Status Survey and Conservation Action Plan for Caprinae

Wild Sheep and Goats and their Relatives

Edited and compiled by David M. Shackleton

IUCN/SSC Caprinae Specialist Group

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Council of Agriculture

Published by: IUCN, Gland, Switzerland and Cambridge, UK

Citation: Shackleton, D.M. (ed.) and the IUCN/SSC Caprinae Specialist Group. 1997. *Wild Sheep and Goats and their Relatives. Status Survey and Conservation Action Plan for Caprinae.* IUCN, Gland, Switzerland and Cambridge, UK. 390 + vii pp.

ISBN: 2-8317-0353-0

Gover photo: Male Apennine Chamois (David M. Shackleton)

Produced by: The Nature Conservation Bureau Limited, Newbury, UK.

Printed by: Information Press, Oxford, UK.

Available from: IUCN Publications Services Unit
219c Huntingdon Road, Cambridge CB2 0DL, United Kingdom
Tel: +44 1223 277894, Fax +44 1223 277175
E-mail: iucn-psu@wcmc.org.uk
WWW: http://www.iucn.org
A catalogue of IUCN publications is also available.

The text of this book is printed on 115gsm Grandeur Pure Velvet, which is rated as 5-star under the Eco-Check system and is made from 100% sustainable fibre sources using chlorine-free processes.

Contents

Foreword

Obviously, no species can survive outside captivity if its habitat is significantly altered or destroyed. Likewise, mismanagement or lack of management can greatly affect its survival. Most Caprinae suffer from these problems. Caprinae (goat-antelopes, wild goats and sheep, muskox and takin) are not only an important component of mountain environments, but are also traditional game species much sought after by hunters. As such, Caprinae have enormous ecological, conservation and economic value that should stimulate efforts to preserve and sustainably manage them. Sound, appropriate, long-term management can only follow the collection of taxon-specific, basic ecological and biological data. Such information should not be anecdotal, but be the result of a sound and documented investigation employing standard methodologies. In some cases, this approach may be difficult, but an effort must always be made to move in this direction, while consciously conserving substantial genetic diversity within viable populations of a taxon in the wild. All other approaches are likely to yield at best, only temporary success.

This Action Plan summarises the present knowledge on the conservation status of wild Caprinae in each country throughout their world-wide distribution. Thus, it should prove an invaluable tool for any government wishing to enact responsible management measures for wild goats, sheep and goat-antelopes. The compilation of this Action Plan has entailed a significant effort to stimulate, to co-ordinate, and to make comparable, status reports for 70 countries written by 111 authors.

David Shackleton has spent some six years in this time (and often nerve) consuming task, for which all conservationists – in a broad sense – should be grateful. His (and my own, as Chairman) goal has been to pull together all available and reliable information related to the conservation of Caprinae, and to present it as clearly and as efficiently as possible. An effort has been made to avoid emotional bias, be it "pro-hunting" or "extreme" protectionism. This should make the Action Plan a unique reference for anyone, government or private, wishing to plan and pursue the management of natural, wild Caprinae populations.

This Caprinae Action Plan is not a final report as might be believed. Quite the contrary, it must be viewed only as the initial step towards implementing conservation measures, or in many cases, the collection of relevant data where information is currently inadequate or non-existent. This will be the duty of national and international political authorities, who are then called on to invest in wildlife management. Later, they are the ones who will be held responsible for the extinction of a population or taxon, or be praised for its survival. Is it such a difficult dilemma?

Kathmandu (Nepal)

Prof. Dr. Sandro Lovari
Chairman, IUCN/SSC Caprinae Specialist Group

Acknowledgements

A significant number of people have contributed in various ways to this report, only a few are mentioned here. Most financial support was provided via IUCN – The World Conservation Union and its Species Survival Commission (SSC), from the Peter Scott IUCN/SSC Action Plan Fund established by the Sultanate of Oman. A grant from this Fund was obtained with the kind help of George Rabb, who was then Chair of the SSC, and his staff. Logistical support was furnished by the Department of Animal Science, University of British Columbia. Dr. Nicholas Franco (Conseil International de la Chasse et de la Conservation du Gibier, CIC Caprini Working Group) and W. Parker (Safari Club International) generously invited me to meetings of the CIC Caprini Working Group in Reno and Beijing, as did Drs. Ulysses Seal (IUCN/SSC Captive Breeding Specialist group), Jim Dolan and Larry Killmar (San Diego Zoological Society) for the Caprinae CAMP session in San Diego.

Besides the authors of the various sections, I wish to express my sincere thanks to all the following for their unfailing help and patience in responding to my interminable requests for information, contacts or reviews: H. Al-Guneid, S. Aulagnier, J. Bauer, K. Braden, K. Bollmann, M. Boyd, D. Bullock, R. Daly, V. Geist, Gong Jien, M.J.B. Green, K. Habibi, R.B. Harris, R. Hoffmann, V. Hrabě, R. Jackson, D. Klein, P.R. Krausman, K. Kutunidisz, T. McCarthy, D. Mallon, J. Matsakis, E. Muhkina, B. Nievergelt, R. Nowak, B.W. O'Gara, S. Pandey, V.E. Prisiadjnuk, G. Rasool, C. Santiapillai, G. Schaller, A.I. Sfougaris, S.I.H. Shah, V. Shakula, E. Sievers, K. de Smet, O. Tsaruk, R.Valdez, D.M. Varisco, P. Winter, R. Wirth, Yu Yuqun, T.M. Zahar, T. Zajac, A. Zatoka; as well as G. Rabb, E. McCance, T. Sullivan and S. Tressler (SSC); S. Stuart, M. Gimenez-Dixon, Jonathan Baillie and S. Edwards (IUCN); CITES-IUCN-SSC-PADU-WCMC staff at Cambridge, especially A. Bräutigam, M.J.B. Green, B. Groombridge, J. Howes, C. Magin and D. Morgan; N. Franco, S. Linn and the late Prince Reuss (Conseil International de la Chasse et de la Conservation du Gibier); J. Schwabland (Safari Club International); J. Dolan and L. Killmar (San Diego Zoological Society); G. Galzi and N. White for translations; D. Casimir and S. Wilson for proofing; R. Shackleton for typing; M. Dépraz and W. Torres of WWF-International's Photolibrary; Joe Fox and Marco Festa-Bianchet for their prompt and invaluable responses; and Elizabeth Saxton and Linette Humphrey of IUCN, and Peter Creed and Joe Little of the Nature Conservation Bureau Limited for their care and input into the final preparation of the manuscript for publication. Lastly, my heartfelt gratitude to my family and graduate students for putting up with the "mess" and lack of attention for so long, and of course to my friend who got me into this, Sandro Lovari.

Others who provided help are acknowledged in the various sections that follow, and for any inadvertently omitted, my sincere apologies. I am probably responsible for many typographical errors or omissions that may have slipped in, and for some decisions when opinion differed.

David Shackleton
Deputy Chairman
IUCN/SSC Caprinae Specialist Group

Executive Summary

D.M. Shackleton

Wild Caprinae are an extremely valuable group of mammals. Most live in mountains but some inhabit desert grasslands, tropical forests or Arctic tundra. They range in size from the 30kg goral to the 350kg muskox, and show a tremendous range of horn shapes and sizes as well as elaborate coat and body coloration. Several species are highly prized by hunters because of their magnificent horns. Domestic sheep and goats, two of the world's most important and numerous species of livestock, also belong to this subfamily. However, despite the importance of their domestic relations, most wild Caprinae are poorly understood and in danger of being lost forever. Over 70% of Caprinae taxa are threatened, with more than 30% endangered or critical. Many live in environments of relatively low productivity and therefore are naturally not very numerous. But today, with increasing human pressure on these areas, wild caprins face three major threats: overharvesting, habitat loss, and resource competition from livestock. Together, these result in reduced Caprinae numbers and increased population fragmentation, raising significantly the risks of extinction.

Necessary conservation legislation is either absent, or more often, ineffectively enforced, while protected areas are generally inadequate in number, size, or both. Many of the most threatened Caprinae face an additional threat because trophy hunters are willing to pay large sums to shoot them. The result is that some governments are tempted to exploit them without adequate biological information or trained personnel to do so sustainably.

Caprinae can be conserved and provide a wide range of sustainable substantial benefits to humans if reliable and accurate data on their demographics and distributions are gathered immediately. Also, adequately trained field and management personnel will be required to oversee their conservation and management. A key factor in the success of any conservation effort, and especially in any sustainable use program, is involvement of local people; both in the decision-making process and in reaping benefits. Besides the caprins, local people are the ones who stand to lose most, because it is their livestock, their energy requirements, and their other resource needs that will be lost if restrictive measures are required to conserve wild Caprinae and their habitat.

While specific conservation actions are contained in each of the Country Reports (**Chapters 4 to 10**) and general actions and their implementations in **Chapter 12,** it is clear that:

1) The overall goal of Caprinae conservation must be maintenance of maximum genetic diversity, not simply preservation of a few populations.
2) Many countries with wild Caprinae will require financial and technical support from international conservation agencies to train staff, carry out population censuses, and develop and implement conservation management plans. The limited use of sustainable hunting programs may be considered where population data indicate it is appropriate and **if** they will create conservation actions that benefit the caprin and its natural habitat.
3) For many Caprinae the number and size of protected areas should be increased, together with significant strengthening of conservation legislation and its enforcement.
4) Effective legislation to control national and international trade in Caprinae requires a workable taxonomy. The taxonomy of Caprinae is in need of revision. It should be the task of the IUCN/SSC Caprinae Specialist Group to establish and co-ordinate a Taxonomy Group comprised of scientists and lay specialists in various disciplines to revise the subfamily's taxonomy.

Success of this Action Plan's conservation recommendations will be significantly higher if closer working relationships are developed among users (locals, hunting organisations), regulators (governments) and professional biologists (government, universities, NGO's). Such co-operation, which will benefit each of these groups, will require networking at an international level to increase the flow of information, and the efficiency of transmission of new ideas and techniques, and to maintain professional standards of wildlife management and conservation. The role of the IUCN/SSC's Caprinae Specialist Group will be central to developing this relationship.

Chapter 1

Objectives, Format, and Limitations of the Caprinae Survey and Action Plan

D.M. Shackleton

The Subfamily Caprinae includes a widespread and diverse group of ungulates (hoofed mammals) that are most frequently associated with steep, and especially mountainous, topography. Wild Caprinae occur naturally in the northern hemisphere on three continents (Map 1.1) and in 70 countries, extending from the arctic to the equator (Table 1.1). Habitats occupied by Caprinae range from tropical forests, through hot and cold deserts, to alpine tundra and Arctic steppe.

Map 1.1. The generalised global distribution of wild Caprinae.

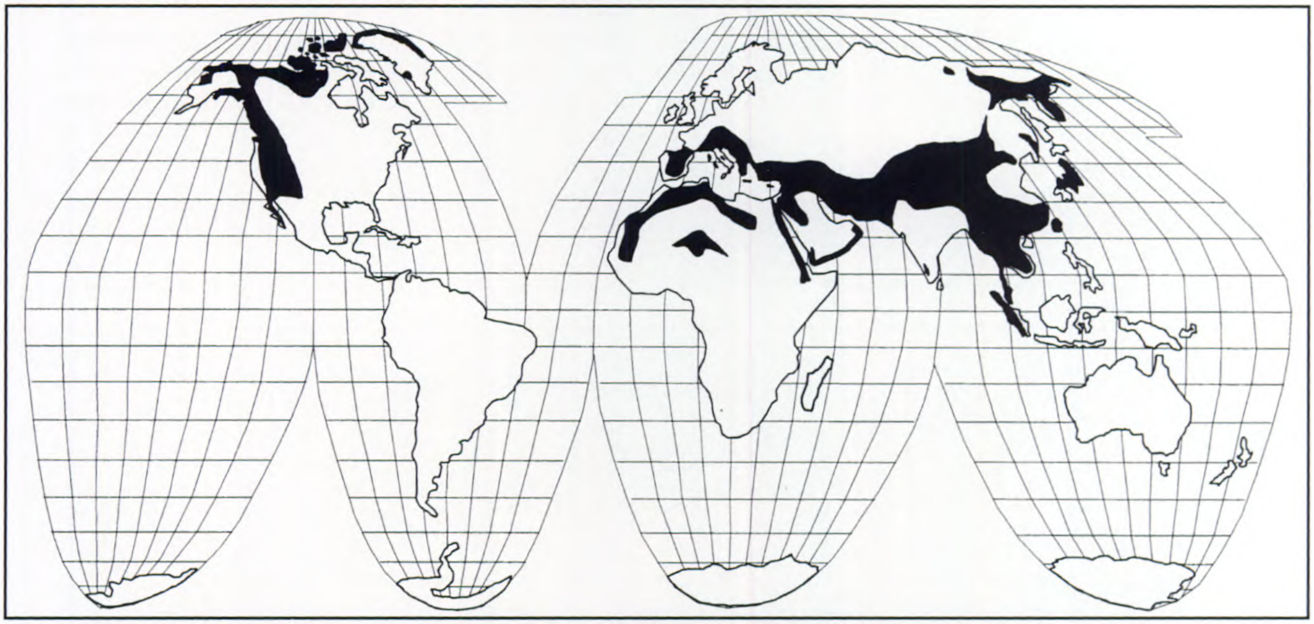


Table 1.1. The 7 regions and their constinuent countries used in the Action Plan.

Africa	Middle East	Europe	China, CIS[1], and Mongolia	Indo-Himalayan Region	Far East	North America
Algeria	Iran	Albania	Armenia*	Afghanistan	Bangladesh	Canada
Chad	Iraq	Austria	Azerbaijan*	Bhutan	Cambodia	Mexico
Egypt	Israel	Bulgaria	China	India	Indonesia	USA
Eritrea	Jordan	Cyprus	Georgia*	Nepal	Japan	
Ethiopia	Lebanon	France	Kazakhstan*	Pakistan	Laos	
Libya	Oman	Germany	Kirgizstan*		Malaysia	
Mali	Saudi Arabia	Greece	Mongolia		Myanmar	
Mauritania	Syria	Greenland	Russia*		North Korea	
Morocco	UAE[2]	Italy	Tadjikistan*		South Korea	
Niger	Yemen	Poland	Turkmenistan*		Taiwan	
Sudan		Romania	Uzbekistan*		Thailand	
Tunisia		Slovakia			Vietnam	
Western Sahara		Spain				
		Switzerland				
		Turkey				
		former Yugoslavia				

[1] Commonwealth of Independent States; * member states.
[2] United Arab Emirates

1.1 Objectives

Although, several Caprinae were known to be threatened to some degree (e.g. 1990 IUCN Red List; WCMC 1990), information on the status and distribution of most taxa prior to this survey was imprecise and mostly out of date. Consequently, the Caprinae Specialist Group had two objectives:

1) Undertake a global survey to assess the conservation status of the wild Caprinae throughout the world; and
2) Propose solutions to conservation problems identified by the survey.

We wanted not only to identify conservation requirements for Caprinae, but also to encourage relevant parties to work together, to focus implementation and support of Caprinae conservation, and to help elicit aid from governments and non-government organisations (NGO's) to carry out the proposed conservation actions. Finally, the Caprinae Specialist Group's overall goal in producing an Action Plan was not simply to maintain or increase numbers of Caprinae throughout their natural habitats, but also to maintain maximum genetic diversity among and **within** taxa.

1.2 Format of the Caprinae Survey

The unique characteristics, vulnerability and value of wild Caprinae are presented in **Chapter 2**, and an introduction to the taxa and the classification of Caprinae used in this survey is given in **Chapter 3**. Survey reports on the status of Caprinae in each of the 70 countries comprise **Chapters 4** to **10**. Conservation priorities are discussed and developed in **Chapter 11** together with an assessment of the global status of each taxon. This is followed by recommendations for broad conservation actions and their implementation in **Chapter 12**. Appendices include a guide to developing biologically sustainable hunting programs, the Caprinae Specialist Group's position statements on wild and feral Caprinae (see also IUCN 1984), the names and addresses of authors of this action plan, and the IUCN 1994 Red List Categories.

The survey information (**Chapters 4** to **10**) is organised at two levels. The first is a broad biogeographic

Caprinae like this 10 year-old male Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*), typically inhabit mountain regions. Banff National Park, Alberta, Canada.

D. Shackleton

division which attempts to group nations into seven regions (Table 1.1) with similar environments and species of Caprinae. Within each of these regions, separate Country Reports are provided. However, it should be recognised that a conservation issue is frequently shared by more than one country, so we have attempted to address shared problems in the **Regional summaries** and in **Chapter 12**.

Individual Country Reports follow a standard format: a brief introduction to the biogeography of the country; an overview of the Caprinae in the country and their conservation status; a summary of general conservation and management measures which have been taken which affect Caprinae; general proposed conservation measures; and finally, individual species accounts that include references to information on basic ecology and behaviour, distributions, population estimates, major threats, the status **within** each country (see below), and specific conservation measures taken and proposed for each taxon.

Although beyond the scope of this volume, we wish to emphasise that the conservation actions for Caprinae cannot be treated in isolation but must be integrated with similar recommendations for other taxa. An example of such integration would be for areas where Caprinae are the principal prey of large, endangered carnivores such as the snow leopard (*Uncia* (*Panthera*) *uncia*).

The IUCN Categories of Threat were revised in 1994 to provide a series of criteria against which the species could be assessed at the global level (see **Appendix 4**). Table 11.1.1. summarises the Caprinae assessed against these new criteria, and this table was the source for listing Caprinae in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). The conservation status of each species according to the new categories is also shown in the Species Accounts, where the listing of these species in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) is shown under Conservation Measures Taken.

Many conservation decisions and actions are made at the national level, and a system for applying these new categories at the national level is currently being developed. Pending completion of this new system, the conservation Status **within** country is given according to the system of categories used in the earlier 1994 IUCN Red List of Threatened Animals (Groombridge 1993) (see box below).

THREATENED SPECIES CATEGORIES (as used in Groombridge 1993:xxix)

EXTINCT (Ex) – Species not definitely located in the wild during the past 50 years (criterion as used by the Convention on International Trade in Endangered Species of Wild Flora and Fauna).

N.B. On a few occasions, the category Ex? has been assigned; this denotes that it is virtually certain that the taxon has become extinct.

ENDANGERED (E) – Taxa in danger of extinction and whose survival is unlikely if causal factors continue operating.

Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that are possibly already extinct but have definitely been seen in the wild in the past 50 years.

VULNERABLE (V) – Taxa likely to move into the 'Endangered' category in the near future if causal factors continue operating.

Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbances; taxa with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.

N.B. In practice, 'Endangered' and 'Vulnerable' categories may include, temporarily, taxa whose populations are beginning to recover as a result of remedial action, but whose recovery is insufficient to justify their transfer to another category.

RARE (R) – Taxa with small populations not at present endangered or vulnerable at present, but at risk.

These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

INDETERMINATE (I) – Taxa *known* to be 'Endangered', 'Vulnerable' or 'Rare', but there is not enough information to say which of the three categories is appropriate.

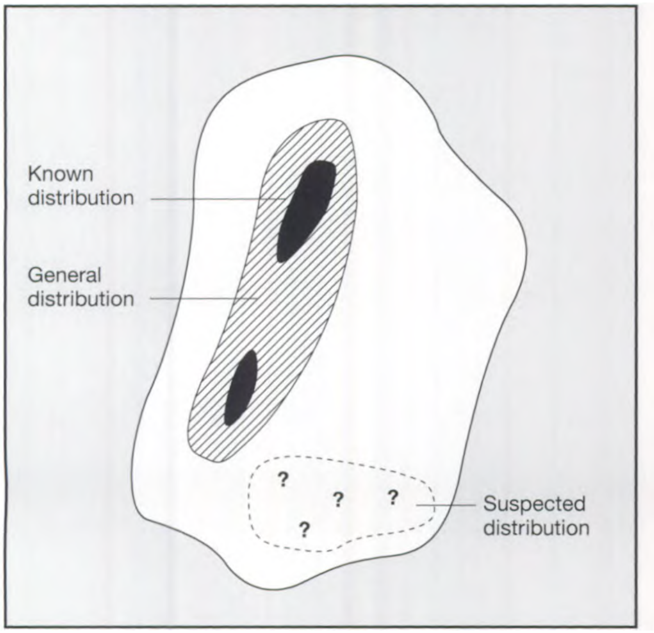
INSUFFICIENTLY KNOWN (K) – Taxa are *suspected* but not definitely known to belong to any of the above categories, because of lack of information.

Also, we have used the term – **Not threatened (S)** – to indicate taxa that appear relatively safe either because there are sufficient numbers in the country, or because adequate conservation measures are in place.

1.3 Distribution maps

Caprinae for the most part are distributed in scattered fragmented populations, often so isolated from each other that interchange may not occur (see **Chapter 2**). Such a distribution pattern is important to recognise for effective conservation to be applied, so we tried to provide the most accurate distribution maps that the current data allowed (Figure 1.3.1). Three levels of confidence are indicated in the distribution maps that follow. For distributions that the authors feel represent the true disposition of a taxon (solid black). For those where separate populations are uncertain, the general distributions of larger units are indicated by hatching. Areas where a taxon is only suspected to occur are suggested by question marks, and suspected distribution borders are indicated by broken lines (Figure 1.3.1).

Figure 1.3.1. Example distribution map illustrating the three levels of confidence used in the Country Reports of Chapters 4 to 10 to show a taxon's range.



1.4 Limitations of the Caprinae Survey

This survey is limited to wild Caprinae; wild taxa introduced in historic times to areas outside their native range are excluded. Concerns about feral Caprinae have been covered elsewhere (IUCN 1984), and the Caprinae Specialist Group's Position Statement on Feral Caprinae is given in **Appendix 2**.

By including 70 countries, this survey cannot hope to present a uniform accuracy of information. Although our goal was to obtain the most recent, reliable information available, sometimes this was not possible due to political and often armed conflicts which occur with unfortunate frequency in countries included in the Caprinae range. From the time the Action Plan first began in 1989, several major international events occurred which hampered data collection (e.g. Gulf War; dissolution of the former Soviet Union, Czechoslovakia and Yugoslavia, etc.). At the time of the Plan's completion, almost 50% of the countries covered in the plan were involved in armed conflicts within their own borders and/or with their neighbours. As a result, information for such countries must be viewed with caution, in fact where conflicts continue, most data are probably optimistic. We were unable to obtain recent information from Iraq, Mynamar, North Korea, Syria, or Yemen.

Particular caution is required with population estimates based on relatively few density estimates extrapolated to larger, often vast, areas. Such estimates are usually the result of severe logistic constraints, and the value of such data are usually severely limited and may overestimate actual numbers. This is especially true where sample estimates are made only in areas known to contain Caprinae, and/or where estimated densities are extremely low (e.g. <<1 animal/km^2); both have very high probabilities of severely over-estimating total numbers. Despite limitations, the data in this survey are sufficient in all cases to provide both a broad overview and a practical starting point for future conservation and management of Caprinae. At the same time, they can be used to identify the most pressing conservation problems facing these animals.

Although this action plan has taken longer to prepare than initially expected, the information has already been used for several conservation actions including the Captive Breeding Specialist Group's Caprinae Conservation Assessment and Management Plan (Killmar *et al.* 1993), CITES decisions on markhor and urial, US Fish and Wildlife Endangered Species Act argali revisions, the 1994 IUCN Red List of Threatened Animals (Groombridge 1993), the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and to evaluate revisions to the IUCN Red List Categories (IUCN 1994).

Chapter 2

Why Caprinae?

D.M. Shackleton

In the following section, the question of why we should be concerned specifically with conservation of wild Caprinae is addressed by considering some of the unique characteristics and values of this ungulate group, and why most are so vulnerable today.

2.1 Uniqueness

The title "Mountain Monarchs" that George Schaller (1977) chose for his book on the wild sheep and goats of the Himalaya, is absolutely appropriate. Even to those who do not study them, most Caprinae are truly majestic creatures. They range from the relatively primitive and little known, forest dwelling goral (*Naemorhedus* spp.) weighing around 30kg, to the muskoxen (*Ovibos moschatus*) of the Arctic tundra which reaches over 350kg.

Characteristic of other bovids, all Caprinae carry horns, although there is strong interspecific and intersexual variation in the size and shape of these weapons. All but the relatively primitive forms (*Naemorhedus*, *Capricornis*, *Oreamnos*) are generally highly social ungulates, with a marked degree of external sexual dimorphism (i.e. the sexes look different from each other). Outside the mating period, most species live in separate male and maternal (females with young and juveniles) groups, and usually exhibit a relatively complex repertoire of social behaviour patterns (Geist 1971; Lovari 1985; Schaller 1977).

All Caprinae are herbivorous ruminants (cud-chewers) that can be grouped roughly into either grazers (feeding primarily on grasses and forbs) or browsers (eating mainly leaves and twigs of shrubs and low growing trees). Grazers are typical of open habitats such as grasslands and alpine regions, while browsers are found in forested habitats. Habitat is also generally correlated with grouping behaviour, so that taxa living in open areas tend to form larger groups than do forest dwelling species. Differences in group behaviour are most likely the result of differences in antipredator behaviour, food distribution and habitat structure. Predators range from large birds of prey that may occasionally take newborn animals, to large cats and even sometimes bears. However, mid to large sized canids and felids, such as coyotes, wolves, and snow leopards, are their most common natural predators.

Breeding occurs only once a year and though in some species twins are common, most Caprinae bear only one young per year. Females usually begin to reproduce in their second or third year and then reproduce each year until death. Males on the other hand may not actively participate in mating until several years later than females, and their reproductive lifespan is shorter. However, the mating system is typically polygynous, so most mature males mate with several females each year. Courtship by male Caprinae is some

Little is known about the behaviour or ecology of Grey long-tailed goral (*Naemorhedus caudatus griseus*), or other Caprinae that inhabit forested mountain slopes. San Diego Wild Animal Park, California, U.S.A.

D. Shackleton

Muskoxen (*Ovibos moschatus*) is one of the few Caprinae not associated with mountain ecosystems. These two adult males at the beginning of the rut (mating season) in the Arctic, are engaged in a "parallel walk" as they display laterally to each other. Banks Island, Canada.

L. Bouckhout

of the most elaborate amongst ungulates, and though most males attempt to guard only one female at a time, some attempt to guard groups of females. Competition for females amongst mature males is intense and together with their need to court females, has lead to the evolution of highly developed weapon and display systems such as the large horns, neck manes and body coloration seen in many taxa. Young are born at the time of year when feeding conditions are beginning to improve. This provides abundant and nutritious forage for lactation and for rapid growth of the young. At this time newborn young are especially vulnerable so they and their mothers stay close to an escape cover (such as steep cliffs) to minimise predation, even if this means avoiding the best grazing conditions.

Subspecies are particularly common within the Caprinae (see also **Chapter 3**), and can be important indicators of the evolutionary history of the Caprinae and should be conserved. More importantly, the range of subspecies represent distinct or unique gene pools which if preserved, serve as a significant and diverse genetic resource adapted to an extremely wide range of ecosystems and often harsh environmental conditions. In keeping with one of the three major objectives of the World Conservation Strategy (IUCN 1980), maintenance of such genetic diversity must be a major overall goal of Caprinae conservation.

2.2 Value of Caprinae

Caprinae have intrinsic value as part of the megafauna of a wide range of distinct ecosystems. Their scientific interest is also great because of their adaptations to the harsh mountain environment. Their evolutionary history is particularly interesting, and though it has attracted considerable attention (e.g. Geist 1971, 1985, 1987), these works have been primarily theoretical and still require testing.

Throughout most of their distribution, Caprinae have great importance for both consumptive (e.g. hunting for food, medicines, or sport) and non-consumptive (e.g. wildlife viewing safaris) uses. As such, with proper conservation schemes, they can be an important source of income or food for local peoples inhabiting areas otherwise unsuitable for agricultural production or with limited alternative economic development potentials. At the same time, development of sustainable-use programs can help ensure the survival of wild caprins.

From a purely anthropocentric perspective, another major value of wild Caprinae is that they were the ancestors of two of the most important species of domestic livestock – domestic sheep (*Ovis aries*) and goats (*Capra hircus*). Present day populations of wild Caprinae represent a potential source of new genetic material which can be used to improve or adapt current domestic breeds to less productive conditions.

A group of wild goats (*Capra aegagrus*) in Kirthar National Park, Pakistan. This species was almost certainly the ancestor of our present day domestic goats (*Capra hircus*).

R. Hess

2.3 Vulnerability

Most Caprinae populations are particularly vulnerable to extinction because of three main factors; genetic isolation, specialised habitat requirements, and a low reproductive rate. However, there are additional factors which interact with these to further complicate conservation aims.

The diversity within the Caprinae represented by many isolated populations may be regarded as positive because it represents potential adaptations to a range of environments (Arctic to tropical). However, for individual populations, this is not necessarily true. When a genetically isolated population falls below a critical size, a loss of genetic diversity within the population can occur, endangering its continued existence due to environmental change (Frankel and Soulé 1981), negative stochastic events, or to inbreeding depression (see also: Berger 1990; FitzSimmons and Buskirk; Nunney and Elam 1994; Schwartz *et al.* 1986)

A major cause of the Caprinae's general vulnerability today is that most species inhabit ecosystems that are classified under the broad heading of "rangelands". Rangelands cover approximately 40% of the world's terrestrial surface. Such areas have limited, often very low, primary production, and are generally unsuitable for growing crops for human consumption; these limitations are especially true in mountains (Poore 1992). To be used for human food production, primary production on rangelands first must be converted by large herbivores, usually domestic livestock, into secondary products such as meat or milk. Non-food products, such as wool or hair, also can be converted through trade or currency into food, or other goods.

With increasing human populations, areas previously considered of little or no agricultural value are now being converted to food production, while grazing pressure from domestic livestock is also increasing significantly. Because of their generally low productivity and the need to involve an intermediate consumer to convert primary production for human use, relatively extensive areas of rangeland are necessary to support even a single human. In addition, the mountain habitats to which Caprinae are so well adapted, are shrinking due to other forms of habitat destruction. Again the major cause is directly related to increasing human numbers, in this case their rising energy demands for fossil fuels, hydroelectric power, and fuelwood.

The consequences of human encroachment into Caprinae habitats are obvious. The wild animals face ever increasing numbers of domestic competitors for the limited, low productive plant resources available. At the same time, their habitat is degraded or lost as forage, or fuelwood is gathered by cutting trees and shrubs which helped stabilise soils and even affect climate. An almost identical problem of similar magnitude faces the forest dwelling Caprinae, except here forests are not only cleared for cultivation but also for their timber resources.

Most Caprinae live in relatively unique ecosystems which may be best exploited through annual altitudinal migrations (Schröder 1985; Shackleton and Bunnell 1987). They are particularly vulnerable to over-harvesting and poaching, especially when access (roads) is developed into their habitats. The problem of increasing access is occurring throughout the world for many reasons, including agriculture, exploration and development of energy resources (Denniston 1995; Foster and Rahs 1983, 1985; Frid 1995; Klein 1984), and recreation (e.g. Cederna and Lovari 1985; Hamr 1988). The detrimental consequences to Caprinae of increased access have been documented even in otherwise well managed regions (e.g. Foster 1977).

Caprinae are particularly susceptible to over-harvesting for several reasons: **1)** low reproductive rate compared to many similar ungulates (Shackleton and Bunnell 1987); **2)** high fidelity to specific home ranges (Geist 1971; Schaller 1977); **3)** frequent use of open habitats (e.g. steppe, alpine for at least part of the year); **4)** most species inhabiting open areas have a conspicuous white rump patch; and they exhibit **5)** a flight response in which they flee to cliffs where they may be safe from most natural predators, but not out of range of modern firearms. Together, these factors make them highly predictable in location from year to year, readily visible, and very vulnerable to hunters and poachers with high-powered rifles.

Conservation problems also arise because many male Caprinae have large, impressive horns that make them highly prized as trophy animals by big game hunters. Many trophy hunters are willing to pay large sums for licences and guide-outfitters' fees, and competition for record heads can be intense. Pressures can be brought to bear on governments and officials to open hunting on threatened taxa without adequate biological data or management plans. It has also led to caprins being introduced into many areas outside their normal ranges. Two problems can result when a species is introduced into, or adjacent to, small populations of indigenous caprins. First, the introduced taxon may interbreed with the autochthones (i.e. native or indigenous taxa), so the native caprin no longer exists. Second, the introduced species (this can be a non-Caprin game species such as deer) competes for scarce resources, often resulting in native caprins suffering. The introduction of Alpine chamois (*Rupicapra rupicapra rupicapra*) to ranges of other subspecies of chamois is well known (Lovari 1984; see also **Chapter 6**) and there are many examples of introductions of other species (Schröder 1985).

A last problem for Caprinae conservation is that mountain ranges frequently serve as international boundaries, so the ranges of many Caprinae populations extend over more than one country. This creates obvious conservation problems because many borders have been, or still are, sites of armed dispute or are otherwise politically sensitive areas. One tragic result of the armed conflicts described earlier, is that in some countries (e.g. Afghanistan, Cambodia) so much unexploded ordnance (e.g. anti-personnel mines, etc.) remains, that it is extremely dangerous for people to travel in certain areas. In the case of Cambodia, it even poses threats to the Caprinae themselves. Under these circumstances, we are faced with at least three conservation problems. The first is that of obtaining biological data in the face of severe access restriction and even danger. Second, caprins often become targets for bored army personnel stationed along the borders. Last, but perhaps most important, conservation efforts are hampered because international agreements essential for their effectiveness are almost impossible to arrange.

These are the general problems facing Caprinae throughout their distribution. Though their relatively inaccessible habitat has provided some measure of protection in the past, as the data in this Survey will show, their continued existence is assured over only a small fraction of their total range.

Chapter 3

Classification Adopted for the Caprinae Survey

D.M. Shackleton and S. Lovari

The Caprinae are a subfamily of the Bovidae, the horned ungulates, that include three tribes, the Rupicaprini or goat-antelopes, the Caprini containing sheep and goats, and the Ovibovini with muskoxen and takin. Caprinae taxonomy developed over a long period with contributions by many authors using different techniques and criteria, and often with extremely few specimens. The result is that today there is a degree of confusion and apparent disagreement amongst scientists.

Also contributing to problems of classifying Caprinae is the Subfamily's recent evolutionary history, its present day distribution, and the generally distinctive qualities of their environment. Being primarily adapted to mountain regions, Caprinae populations tend to be distributed in scattered clumps or "islands" surrounded by habitats that hamper immigration and emigration. Consequently, many populations have been isolated for much of their history, and today many more are becoming fragmented due to the actions of humans.

Isolation played a significant, formative role in the evolution of Caprinae. Most modern caprins evolved during the Pleistocene which in the northern hemisphere was a turbulent 1.6 to 2.0 million years. There were at least 18 major glacial intervals alternating with warm interglacials, and many more intervening glacial stadia and interstadials. This fluctuating climate, with large land areas at times covered in glacial ice, resulted in significant and relatively rapid changes in selection pressure (Geist 1971, 1983, 1985, 1987). Such changes would be particularly felt in the mountain regions inhabited by most Caprinae because they were usually the first and sometimes only areas to be glaciated. Caprin evolution during the Pleistocene was a series of pulses of rapid speciation followed by longer periods of gradual change and adaptation, sometimes accompanied by extinctions (Geist 1971, 1983, 1985, 1987). Today, many subspecies of Caprinae could probably be viewed as incipient species, and for this Subfamily at least, subspecies should be retained as the basic and most useful taxonomic unit. Besides representing potential species, and perhaps more importantly, subspecies can and **must** be recognised as distinct and valuable gene pools, essential for conservation management.

It is not within the scope of this survey to attempt a taxonomic revision of the Caprinae, so we have done our best to take a conservative path. We have followed generally accepted taxa (e.g. Cowan 1940; Cowan and McCrory 1970) and recent revisions which have presented data (Geist 1992; Lovari and Scala 1980, 1984; Masini and Lovari 1988; Nadler *et al.* 1973a, 1973b; Nascetti *et al.* 1985; Pemberton *et al.* 1989; Valdez *et al.* 1978), as well as Schaller's (1977) treatment of Himalayan Caprinae which is almost unique because it is based on living animals in the field. Some recent taxonomic suggestions (e.g. Groves and Grubb 1985) have not been followed because they provide limited justification or no data. Recent studies employing DNA analyses (e.g. Hammer *et al.*, 1995; Hartl, in press; Hartl and Markowski (eds.). 1993; Hartl *et al.* 1990; Hartl *et al.*, in press; Ramey 1995; Randi *et al.* 1990, 1991; Wehausen and Ramey 1993) are beginning to provide new insights. However, results are still somewhat preliminary and hint at future revisions, and such evidence must be combined with other biological criteria (see Avise 1989; Cronin 1993; Lovari 1987; O'Brien and Mayr 1991; Ryder 1986) before taxonomic decisions are made (see also **"Taxonomic uncertainties"** in **6.17 Regional summary** for Europe).

Mouflon and urial sheep require special mention. They are either classified as a single species (*Ovis orientalis*), or as separate species (mouflon (*O. gmelinii*) and urial (*O. vignei*)). Part of the problem revolves around the significance of diploid (2n) chromosome number (i.e. total number of chromosomes) for speciation. In *Ovis*, the number of diploid chromosomes varies from 2n = 54 in mouflon, to 2n = 58 in urial. However, populations with individuals carrying 2n = 55 and 2n = 56 chromosomes are known, and have been considered to be hybrid populations (Valdez *et al.* 1978). An additional factor is the presence (in urials) or absence (in mouflons) of throat bibs, which also vary in these "hybrid populations". Based on these two criteria, Valdez and Nadler (in prep.) suggest that the name *Ovis orientalis* (Blyth 1841) be rejected because the description was based on a specimen from a hybrid population in the Alborz mountains of northern Iran. They also argue that specific epithet *musimon* (Pallas 1817), based on a specimen from Sardinia, should also be rejected because Mediterranean island populations were probably introduced by humans from a wild or early domestic form of unknown origin. Hence they suggest that the oldest name, *gmelinii* (Blyth 1841), should be applied to mouflons (Valdez and Nadler, in prep.). However, although the lack of fossil records supports the view that populations of *Ovis* (and *Capra*) on Mediterranean islands were probably introduced by humans (Corbet 1984), there is little evidence they were early domesticates. Other large mammal species are also believed to be introduced to these islands (e.g. *Cervus elaphus corsicanus, Dama dama, Sus scrofa, Vulpes vulpes*) (Masseti 1993) but none are considered feral. Until these matters are satisfactorily resolved, for the purposes of the Caprinae Action Plan, we retain the single species for both urial and mouflon. It should be noted, however, that the number of trinomials (i.e. subspecies) has not been reduced.

Our approach has been guided primarily by utility, and where possible, the subspecies is used as the basic taxonomic unit of the Survey. The list of subspecies below may differ sometimes from that used in the Caprinae Atlas (CIC, in press) or by others, but this does not reflect disagreement so much as the conservative approach taken

Classification of the Subfamily Caprinae

Family: **Bovidae**

Subfamily: **Caprinae**

Tribe:	Species:	Subspecies:	Common name:	Countries within range:
Rupicaprini				
	Capricornis sumatraensis (Bechstein, 1799)		Serow	
		C. s. maritimus Heude, 1888 (= *annectens*)	Indochinese serow	Cambodia, Laos, Myanmar, Thailand, Vietnam
		C. s. milneedwardsii David 1869 (= *argyrochaetes, montinus*)	Southwest China serow	China (Gansu, Guizhou, Shaanxi, Sichuan, Yunnan)
		C. s. rubidus David, 1869	Red serow	Bangladesh, India (Assam, Meghalaya, Tripura), Myanmar
		C. s. sumatraensis (Bechstein, 1799) (= *swettenhami*)	Sumatran serow	Indonesia (Sumatra), Malaysia
		C. s. thar Hodgson, 1831 (= *humei, jamrachi, rodoni*)	Himalayan serow	Bhutan, China (Tibet), India (Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Sikkim, Uttar Pradesh), Nepal
	Capricornis crispus (Temminck, 1845)		Japanese serow	Japan (Honshu, Shikoku, Kyushu)
	Capricornis [*crispus*] *swinhoei* Gray, 1862		Formosan serow	Taiwan
	Naemorhedus baileyi Pocock, 1914		Red goral	
		N. b. baileyi Pocock, 1914	Tibetan red goral	China (Tibet)
		N. b. cranbrooki Hayman, 1961	Burmese red goral	India (Assam), Myanmar
	Naemorhedus caudatus Milne-Edwards, 1867		Long-tailed goral	
		N. c. caudatus Milne-Edwards, 1867	Chinese long-tailed goral	China (Hebei, Inner Mongolia, Shanxi)
		N. c. evansi Lydekker, 1905	Evans' long-tailed goral	Laos, Myanmar, Thailand
		N. c. griseus Milne-Edwards, 1871 (= *arnouxianus*)	Grey long-tailed goral	China (Anhui, Fujian, Gansu, Guangdon, Guangxi, Guizhou, Hubei, Hunan, Jiangxi, Qinghai, Shaanxi, Sichuan, Yunnan, Zhejiang)
		N. c. raddeanus Heude, 1894	Korean or Amur long-tailed goral	China (Heilongjian, Jilin), North Korea, South Korea, Russia (Primorsky, Khabarovsk)
	Naemorhedus goral Hardwicke, 1825		Himalayan goral	
		N. g. bedfordi Lydekker, 1905 (= "*goral*")	Western Himalayan goral	India (Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh), Pakistan (Azad Jammu and Kashmir, Federal Capital Territory, NWFP)
		N. g. goral Hardwicke, 1825 (= *hodgsoni*)	Eastern Himalayan goral	Bhutan, China (Tibet), India (Arunachal Pradesh, Sikkim), Nepal

in this Survey and to some extent the differing interests of various groups. In most cases of disagreement among sources, the number of subspecies remained the same, so **for conservation purposes the functional taxonomic units are maintained**. Synonyms are indicated where known, and major disputes over specific or subspecific recognition are indicated by square brackets (e.g. *Capra* [*ibex*] *nubiana* indicates some authors recognise it as a species distinct from *C. ibex*, while others recognise it as a subspecies of *C. ibex*). As one of the primary goals of the Action Plan is the conservation of genetic diversity without becoming ensnared in nomenclature issues, the following classification system is presented only as a **working classification** for the purposes of the Survey. A total of 32 extant, autochthonous species with 91 subspecies are considered to occur in 70 countries.

Classification of the Subfamily Caprinae ... continued

Tribe:	Species:	Subspecies:	Common name:	Countries within range:
	Oreamnos americanus (De Blainville, 1816)		Mountain goat	Canada (Alberta, British Columbia, Northwest Territories, Yukon), USA (Alaska, Idaho, Montana, Washington)
	Rupicapra rupicapra Linnaeus, 1758		Northern chamois	
		R. r. asiatica Lydekker, 1908	Turkish chamois	Turkey
		R. r. balcanica Bolkay, 1925	Balkan chamois	Albania, Bulgaria, Greece, former Yugoslavia
		R. r. carpatica Couturier, 1938	Carpathian chamois	Romania
		R. r. cartusiana Couturier, 1938	Chartreuse chamois	France
		R. r. caucasica Lydekker, 1910	Caucasian chamois	Azerbaijan, Georgia, Russia (Daghestan, North Ossetia)
		R. r. rupicapra Linnaeus, 1758	Alpine chamois	Austria, France, Germany, Italy, Switzerland
		R. r. tatrica Blahout, 1972	Tatra chamois	Poland, Slovakia
	Rupicapra pyrenaica Bonaparte, 1845		Southern chamois	
		R. p. ornata Neumann, 1899	Apennine or Abruzzo chamois	Italy
		R. p. pyrenaica Bonaparte, 1845	Pyrenean chamois	France, Spain
		R. p. parva Cabrera, 1911	Cantabrian chamois	Spain
Caprini				
	Ammotragus lervia Pallas, 1777		Barbary sheep	
		A. l. angusi (Rothschild, 1921)	Aïr Barbary sheep	Niger
		A. l. blainei (Rothschild, 1913)	Kordofan Barbary sheep	Libya, Sudan
		A. l. fassini (Lepri, 1930)	Libyan Barbary sheep	Libya, Tunisia
		A. l. lervia (Pallas, 1777)	Atlas Barbary sheep	Algeria, Morocco, north Tunisia (extinct?)
		A. l. ornatus (Audouin, 1829) (= *ornata* – Corbet)	Egyptian Barbary sheep	Egypt (extinct?)
		A. l. sahariensis (Rothschild, 1913)	Saharan Barbary sheep	Chad, Mali, Mauritania Western Sahara
	Pseudois nayaur (Hodgson 1833)		Blue sheep	
		P. n. nayaur (Hodgson, 1833)	Tibetan Blue sheep or Bharal	Bhutan, China (Tibet), India (Arunachal Pradesh, Himachal Pradesh, Jammu and Kashmir, Sikkim, Uttar Pradesh), Nepal, Pakistan (Northern Areas)
		P. n. szechuanensis Rothschild, 1922	Sichuan Blue sheep	China (Gansu, Inner Mongolia, Ningxia, Qinghai, Sichuan, Yunnan)

Classification of the Subfamily Caprinae ... continued

Tribe:	Species:	Subspecies:	Common name:	Countries within range:
	Pseudois [*nayaur*] *schaeferi* (Haltenhorth, 1963)		Dwarf Blue sheep	China (Sichuan, Tibet?, Yunnan?)
	Hemitragus jemlahicus (H. Smith, 1826)		Himalayan tahr	China (Tibet), India (Himachal Pradesh, Jammu and Kashmir, Sikkim, Uttar Pradesh), Nepal
	Hemitragus hylocrius (Ogilby, 1838)		Nilgiri tahr	India (Kerala, Tamil Nadu)
	Hemitragus jayakari Thomas, 1894		Arabian tahr	Oman, United Arab Emirates (extinct?)
	Capra aegagrus Erxleben, 1777		Wild goat	
		C. a. aegagrus Erxleben, 1777	Persian wild goat	Afghanistan, Armenia, Azerbaijan, Georgia, Iran, Lebanon (extinct), Nakhichevan, Russia (Daghestan), Turkey
		C. a. blythi Hume, 1875 (= *turcmenica*?)	Pasang or Sind wild goat	Pakistan (Baluchistan, Sind), Iran, Iraq?, Turkmenistan
		C. a. chialtanensis Lydekker, 1913	Chiltan wild goat	Pakistan (Baluchistan)
		C. a. cretica Schinz, 1838	Cretan wild goat or agrimi	Greece (Crete)
	Capra falconeri Wagner, 1839		Markhor	
		C. f. falconeri Wagner,1839	Flare-horned, Astor, Kashmir or Pir Panjal markhor	India (Jammu and Kashmir), Pakistan (Azad Jammu and Kashmir, Northern Areas, NWFP)
		C. f. heptneri Zalkin, 1945	Tadjik markhor	Afghanistan?, Tadjikistan (Dashtidjum district), Turkmenistan, Uzbekistan
		C. f. megaceros Hutton, 1842	Straight-horned Sulaiman or Kabul markhor	Afghanistan, Pakistan (NWFP)
	Capra ibex ibex Linnaeus, 1758		Alpine ibex	Austria, France, Germany, Italy, Switzerland
	Capra [*ibex*] *nubiana* F. Cuvier, 1825		Nubian ibex	Egypt, Ethiopia, Israel, Jordan, Lebanon (extinct), Oman, Saudi Arabia, Sudan, Syria (extinct), Yemen
	Capra pyrenaica Schinz, 1838		Spanish ibex	
		C. p. hispanica Schimper, 1848	Spanish ibex	Spain
		C. p. lusitanica Schlegel, 1872	Portuguese ibex	extinct
		C. p. pyrenaica Schinz, 1838	Pyrenean ibex	Spain
		C. p. victoriae Cabrera, 1911	Gredos ibex	Spain
	Capra [*ibex*] *sibirica* Pallas, 1776		Asiatic or Siberian ibex	Afghanistan, China (Gansu, Inner Mongolia, Tibet, Xinjiang), India (Himachal Pradesh, Jammu and Kashmir), Kazakhstan, Kirgizstan, Mongolia, Pakistan (Azad Jammu and Kashmir, Northern Areas, NWFP), Russia
	Capra [*ibex*] *walie* Ruppell, 1835		Walia ibex	Ethiopia
	Capra [*ibex*] *caucasica* Guldenstaed and Pallas, 1783		Kuban or West Caucasian tur	Georgia, Russia (Karachai- Circassia)
	Capra cylindricornis Blyth, 1841		Daghestan or East Caucasian tur	Azerbaijan, Georgia, Russia (Daghestan, Chechen- Ingushio, North Ossetia)

Classification of the Subfamily Caprinae ... continued

Tribe:	Species:	Subspecies:	Common name:	Countries within range:
	Ovis orientalis Gmelin, 1774		Mouflons and Urials	
		O. o. arkal Eversmann, 1850	Transcaspian urial	Iran, Kirgizstan, Turkmenistan, Uzbekistan
		O. o. bocharensis Nasonov, 1914	Bukhara urial	Tadjikistan, Turkmenistan, Uzbekistan
		O. o. cycloceros Hutton, 1842 (= *blanfordi*)	Afghan urial	Afghanistan, Iran ?, Pakistan (Baluchistan, NWFP, Sind), Turkmenistan
		O. o. gmelinii Blyth, 1841	Armenian mouflon	Armenia, Azerbaijan, Nakhichevan, Iran, Iraq ?, Turkey
		O. o. isphahanica Nasonov, 1910	Esfahan mouflon	Iran
		O. o. laristanica Nasonov, 1909	Laristan mouflon	Iran
		O. o. musimon Schreber, 1782	European mouflon	France (Corsica), Italy (Sardinia)
		O. o. ophion Blyth, 1841	Cyprian mouflon	Cyprus
		O. o. orientalis Gmelin, 1774	Red sheep	Iran
		O. o. punjabiensis Lydekker, 1913	Punjab or Salt Range urial	Pakistan (Punjab)
		O. o. severtzovi Nasonov, 1914	Severtzov's urial	Uzbekistan
		O. o. vignei Blyth, 1841	Ladakh urial or Shapu	India (Jammu and Kashmir), Pakistan (Northern Areas, NWFP)
	Ovis ammon Linnaeus, 1766		Argali	
		O. a. ammon Linnaeus, 1766	Altai argali	China (Xinjiang), Mongolia, Russia (Altai, Tuva)
		O. a. collium Severtzov 1873	Kazakstan argali	Kazakstan
		O. a. darwini Przewalski, 1883	Mongolian or Gobi argali	China (Xinjiang), Mongolia
		O. a. hodgsonii Blyth, 1840 (= *dalai-lamae, adametzi*)	Tibetan argali	China (Gansu, Qinghai, Sichuan, Tibet, Xinjiang), India (Himachal Pradesh, Jammu and Kashmir, Sikkim), Nepal
		O. a. jubata Peters, 1876	Shansi or Northern Chinese argali	China (Inner Mongolia, Ningxia)
		O. a. karelini Severtzov 1873 (= *littledalei, sairensis*)	Tien Shan argali	China (Xinjiang), Kazakstan, Kirgiziya
		O. a. nigrimontana Severtzov, 1873	Kara Tau argali	Kazakstan
		O. a. polii Blyth, 1841	Marco Polo or Pamir argali	Afghanistan, China (Xinjiang), Pakistan (Northern Areas), Tadjikistan
	Ovis canadensis Shaw, 1804		Bighorn sheep	
		O. c. auduboni Merriam, 1901	Audubon's bighorn sheep	extinct USA (Montana, North Dakota, Nebraska, South Dakota, Wyoming)
		O. c. californiana Douglas, 1829	California bighorn sheep	Canada (British Columbia), USA (California, Idaho, Nevada, Oregon, Washington)
		O. c. canadensis Shaw, 1804	Rocky Mountain bighorn sheep	Canada (Alberta, British Columbia), USA (Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming)
		O. c. cremnobates Elliot, 1903	Peninsular bighorn sheep	Mexico (Baja California), USA (California)
		O. c. mexicana Merriam, 1901	Mexican bighorn sheep	northwestern Mexico, USA (Arizona, Texas)
		O. c. nelsoni Merriam, 1897	Desert bighorn sheep	USA (Arizona, California, Nevada, New Mexico, Utah)
		O. c. weemsi Goldman, 1937	Weems' bighorn sheep	Mexico (Baja California)

Classification of the Subfamily Caprinae ... continued

Tribe:	Species:	Subspecies:	Common name:	Countries within range:
	Ovis dalli Nelson, 1884		Thinhorn sheep	
		O. d. dalli Nelson, 1884	Dall's sheep	Canada (British Columbia, Northwest Territories, Yukon), USA (Alaska)
		O. d. stonei Allen, 1897	Stone's sheep	Canada (British Columbia, Yukon)
	Ovis nivicola Eschscholtz, 1829		Snow sheep	
		O. n. alleni Matschie, 1907 (= *tschukstchorum, koriakorum*)	Okhotsk snow sheep	Russia (Amur, Khabarovsk, Magadan)
		O. n. borealis Severtzov, 1873	Putorean or Norilsk snow sheep	Russia (Krasnoyarsk)
		O. n. lydekkeri Kowarzik, 1913	Yakut snow sheep	Russia (Yakutsk)
		O. n. nivicola Eschscholtz, 1829	Kamchatka snow sheep	Russia (Kamchatka)
Ovibovini				
	Ovibos moschatus (Zimmermann, 1780)		Muskoxen	
		O. m. moschatus (Zimmermann, 1780)	Barrenground muskox	Canada (Northwest Territories), USA (Alaska, extinct)
		O. m. wardi Lydekker, 1900	White-faced muskox	Canada (Northwest Territories), Denmark (Greenland), USA (Alaska, introduced)
	Budorcas taxicolor Hodgson, 1850		Takin	
		B. t. bedfordi Thomas, 1911	Golden takin	China (Shaanxi)
		B. t. taxicolor Hodgson, 1850	Mishmi takin	China (Tibet), India (Assam), Myanmar
		B. t. tibetana Milne-Edwards, 1868	Sichuan takin	China (Gansu, Sichuan)
		B. t. whitei Lydekker, 1907	White's or Bhutan takin	Bhutan, China (Tibet), India (Sikkim)

STATUS AND DISTRIBUTIONS OF CAPRINAE BY REGION

Chapter 4

Africa

4.1 Algeria

K. de Smet

Introduction

The Democratic and Popular Republic of Algeria is the second largest (2,332,164km²) country in Africa. It is formed by a relatively narrow strip of fertile and habitable land, the Tell, along the northern seacoast, and by its Saharan region which covers approximately 85% of its surface. The Tell has a relatively complex physiography formed by a series of east-west running mountain and valley systems. These include two mountain ranges, the Tell Atlas (Atlas Tellien; 1,600–2,300m asl.) and the Saharan Atlas (Atlas Saharien; 1,400–2,300m asl.), between which is the High Plateau (Haut Plateaux) with an overall altitude of more than 1,000m asl. The Saharan region consists of two great depressions, the Great Eastern and the Great Western Ergs, each covered by vast areas of sand dunes. Thrust between them are some major stone plateaux ("regs"), with many canyons around the central M'Zab region. In the desert regions there are also some areas with steep cliffs up to several hundred kilometres long, which form good wildlife habitat. The southern part of the desert is higher and contains three mountain areas. In the southwest, lie the Adrar des Iforas, with most of their mass falling in neighbouring Mali. In the southeast are the Ahaggar and Tassili mountains, whose highest peak, Djebel Tahat, reaches 3,003m asl.

Winter (November to April) is the rainy season with near drought conditions dominating the remainder of the year. The greatest rainfall occurs in the mountains in the extreme northeast near the coast (>1,500mm), and diminishes from this region westward and especially southward. In the northeast and in parts of the Tell Atlas, oak, cedar and pine forests occur, while the drier Haut Plateau is covered only by *Stipa* grasses and herbs, with some shrubs in the hill regions. Some areas at the highest elevations of the Sahara Atlas support pine forests. On the border between the Saharan Atlas and the Great Ergs, rainfall is around 100mm per year and vegetation is becoming extremely sparse and scattered. Further south, rainfall is not only extremely low, but often highly irregular, with some years receiving no rain at all. Under these conditions the available vegetation is not merely scattered but also ephemeral, being totally dependent on a brief, preceding rainfall. Only a few hardy shrubs such as acacias, ethels, and jujube trees may survive in the mountainous regions or along the beds of water courses ("oueds") which have underground water supplies.

Current status of Caprinae

The Atlas Barbary sheep or aoudad (*Ammotragus lervia*) is the only wild caprin present in Algeria, and it is restricted to some of the semi-arid mountain regions of the north and to almost every mountain in the southern part of the Sahara. The species is threatened (vulnerable) especially in the northern mountains due to habitat destruction and poaching. General biological details of the species are reviewed by Gray and Simpson (1980) and by Gray (1985).

Adult male (left) and female (right lying) Barbary sheep (*Ammotragus lervia*) with young of year in background. Hellabrunn Zoo, Munich.

F. Vollmar (WWF)

General conservation measures taken

Following the first conservation legislation in 1921, 14 national parks were established under the French authorities between 1923 and 1947. After a period of lapsed wildlife and forest conservation, a study was initiated in 1979 to develop a legal framework to cover all conservation aspects of natural resources including the creation of protected areas. By 1983, a national faunal conservation strategy was sanctioned (Law No. 83-03) based on a hunting decree passed in 1982. This was followed in 1984 by another decree on the general management of forests. New statutes for the creation and management of protected areas were included in the new decree, together with pollution control and protection of non-domestic species. At the same time, directives were issued to a new hunting council to create hunting reserves and to develop a list of suitable wild species (IUCN 1992a).

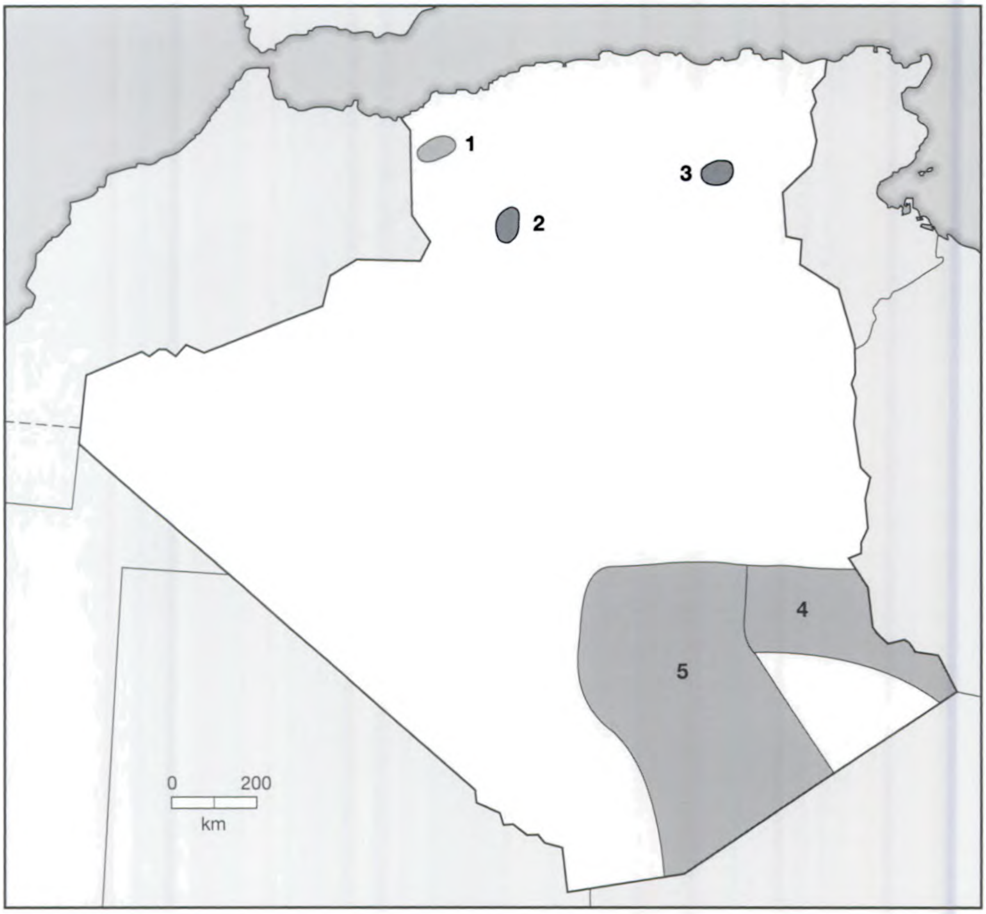
The Ministère de l'Agriculture has overall responsibility for conservation and has several divisions including the Direction des Forèts et des regions naturelles which is concerned with protected areas and the natural environment. Barbary sheep are fully protected by law, and even the possession of a stuffed specimen or its horns is (theoretically) forbidden. Five protected areas contain the species in Algeria, including three national parks (Map 4.1.1). Re-introductions are underway in the Moutas Hunting Reserve near Tlemcen in the Tell Atlas, a very suitable mountain region for Barbary sheep.

Species account

Atlas Barbary sheep (*Ammotragus lervia lervia*)

Distribution: Atlas Barbary sheep occurs in two major areas, in the northern Saharan Atlas Mountains and in the southern Central Sahara Mountains of Tassili n'Ajjer and Ahaggar, and all the surrounding mountainous areas (Map 4.1.2). Populations in the north are small, but in the south the species is widespread and sometimes even very common. Here, they are increasing after two good years and with the establishment of two national parks (de Smet 1989).

Population: No estimates of population size have been made, but overall there are probably several thousand animals in Algeria.



Map 4.1.1. Protected areas in Algeria with Atlas Barbary sheep (*Ammotragus lervia*).

1) Moutas Hunting Reserve (10,000ha; est. 1983); **2)** Djebel Aissa State Forest (70,000ha; est. 1974); **3)** Belezma National Park (8,500ha; est. 1985); **4)** Tassili n'Ajjer National Park (8,000,000ha; est. 1972); **5)** Ahaggar National Park (4,500,000ha; est. 1987).

Threats: They are vulnerable in the northern part of Algeria where a combination of habitat destruction and poaching are the major threats. Populations in the south are more numerous and less threatened.

Conservation measures taken: Listed as Vulnerable (A2cd) in the1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Fully protected by law, but enforcement is a serious problem. Barbary sheep occur in four protected areas: in Belezma, Tassili n'Ajjer, and Ahaggar National Parks; and in Djebel Aissa State Forest. They also occur about 30km from Mergueb Nature Reserve located in the central Algerian Haut Plateau, 80km south of Sour el Ghozlane. A re-introduction is underway for the Moutas Hunting Reserve in the western Tell Atlas Mountains (de Smet 1989).

Status within country: Indeterminate.

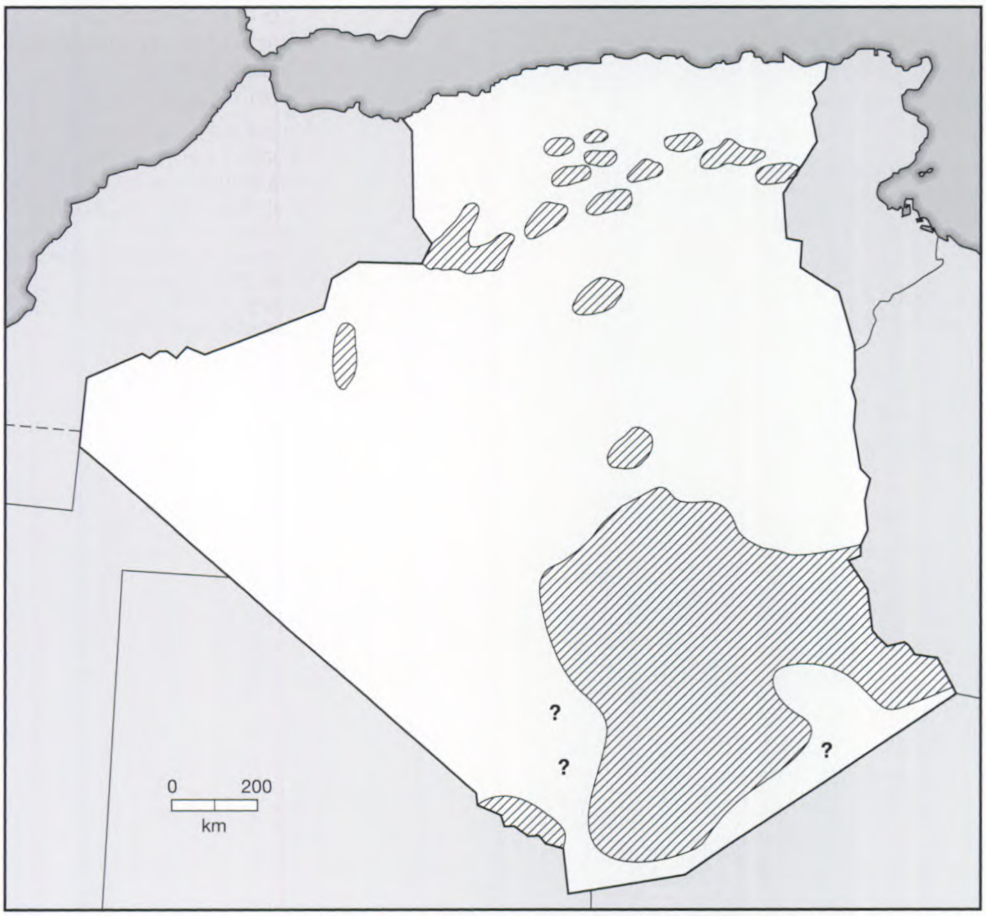
Conservation measures proposed: **1)** Improve enforcement of existing laws. These are still inadequate because poaching is a serious problem in the northern mountains. **2)** Establish more reserves in the north if the species is to survive in the Saharan Atlas range. It may be possible to include such reserves within the framework of the new national park proposed by the Ministry of Culture to protect rock engravings in this area. The two southern national parks should be adequate for their protection in that region. **3)** Reintroduce Barbary sheep into Djelfa Hunting Reserve (20,000ha; est. 1974) located in the Haut Plateau (34°40'N, 3°15'E), and into Tlemcen Hunting Reserve (400ha) in northwest Algeria between Oran and Oujda (34°52'N, 1°15'E).

4.2. Chad

M. Mekonlaou and B-Y. Daboulaye

Introduction

The Republic of Chad covers an area of 1,270,994km² along the south-central border of the Sahelo-Sahara region. The lowest area is on its west central border about 228m asl around Lake Chad and is rimmed all around by higher land. To the northwest, lies the volcanic Tibesti massif which reaches its high point of 3,415m asl on Emi Koussi. The Ennedi plateau, comprised of a



Map 4.1.2. General distribution of Atlas Barbary sheep (*Ammotragus lervia*) in Algeria.

series of often heavily eroded sandstone peaks and plateaux, is to the northeast, while in eastern Chad lie the crystalline rock mountains of Ouaddai (Wadai). To the south is the Oubangai plateau and to the southwest, the Adamawa and Mandara mountains straddling the borders of Cameroon and Nigeria.

Climatic conditions vary widely throughout the country, ranging from wet and dry tropical regions with 800 to 1200mm rainfall per year in the south, through the semi-arid Sahel zone with 300 to 800mm, to the northern hot arid regions where rainfall is irregular and usually less than 25mm annually. Vegetation corresponding to these climatic regions varies from scattered broadleaf forests and tall grasslands, to a parkland savannah in the Sahel zone, and finally a system of bare desert dunes. Permanent vegetation does grow in the Tibesti mountains in the north, and there is a relatively rich Saharo-montane vegetated region with wood and shrub lands, grasslands, and giant heath communities.

Current status of Caprinae

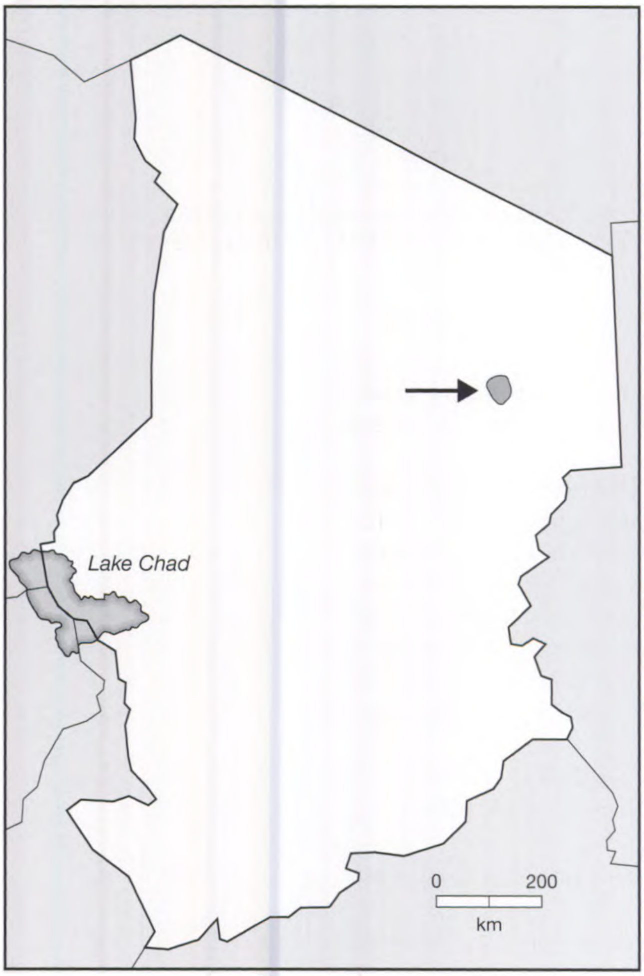
Saharan Barbary sheep (*Ammotragus lervia sahariensis*), known locally as "mouflon à manchettes", is Chad's only wild caprin. It lives in the central and northern regions along the mountains of the south Sahelo-Saharan region. Over the last 10 years, political unrest and the war with Libya have taken their toll on wildlife. No recent censuses have been made, but the Barbary sheep is believed to have declined from several thousand in the late 1960s, to only low numbers today (Newby 1981). The Ennedi mountains are probably the most likely place where it still occurs in any numbers. In part, this is due to the rugged nature of the terrain which is difficult to penetrate, thus providing natural protection for the wildlife. See Gray and Simpson (1980) and Gray (1985) for general information on biology of Barbary sheep.

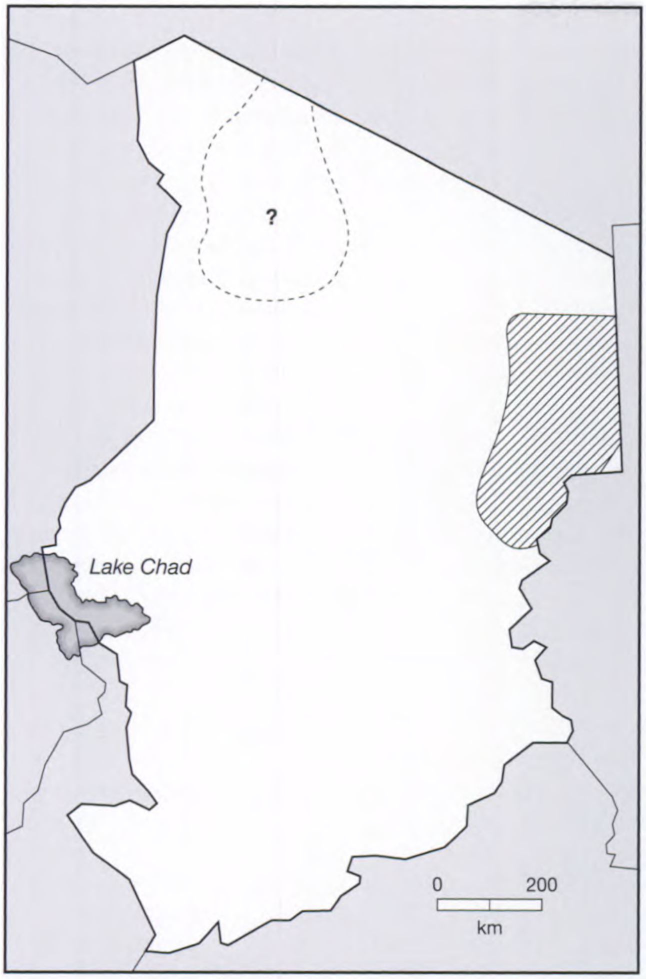
General conservation measures taken

Natural resource conservation in the Republic has been hampered for more than a decade by political instability. The Department of Environment is beginning to restore certain habitats (e.g. Zakouma National Park) and to adopt a suitable wildlife protection policy. A new Forestry Code was adopted by the government on the 4 February 1989, to regulate the protection and use of wild animals. This replaced Ordinance 14/63 (28 March 1963) which concerned hunting and protection of wildlife. Under ordinances in the new forestry code adopted in 1988, Chad became a signatory to international conventions including CITES (Ordinance No. 021/PR/88), RAMSAR (Ordinance No. 020/PR/88), and the Co-operative Accord among Central African States on Conservation of Wildlife, signed in Libreville on 16 April 1983 (Ordinance No. 022/PR/88).

Protected areas are administered by the Directorate of National Parks and Wildlife Reserves within the Secretariat of the State for the Environment, in the Ministry of Rural Development. Chad currently has two national parks and several faunal reserves. One of these contains Barbary sheep; the Fada-Archei Faunal Reserve (La Réserve de Faune de Fada Archei) in northeastern Chad (Map 4.2.1). This was established to preserve Barbary sheep and other desert species in 1967 by Decree No. 232/PREFPC/PNR (IUCN 1987a). About 10 wardens attempt to provide protection in this area. Unfortunately, conditions have been difficult in this region since 1972, as a result of political instability and the conflict with Libya. Poaching in the reserve probably takes place and there are military personnel stationed at the nearby town of Fada.

Map 4.2.1. The location of Fada-Archei Faunal Reserve (La Réserve de Faune de Fada Archei; 211,000ha; est. 1967) which contains Barbary sheep (*Ammotragus lervia*) in Chad.





Map 4.2.2. General and suspected distribution of Saharan Barbary sheep (*Ammotragus lervia sahariensis*) in Chad.

Species account

Saharan Barbary sheep (*Ammotragus lervia sahariensis*)

Distribution: This species originally occurred widely throughout Chad from the Tibestsi mountains in the extreme northwest, on the Jef-Jef Plateau, in the Ennedi mountains towards the northeastern border, and as far as Kapka and Maroone (Map 4.2.2). The northern limit coincides with the Tropic of Cancer, and the southern extent falls between latitudes 140°N and 150°N. Today, most animals are probably restricted to the sandstone massifs in Ennedi.

Population: Animals are difficult to find and there are no estimates of numbers.

Threats: Poaching for meat and for its cape (hide).

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Barbary sheep is totally protected in Chad. It occurs in one protected area, Fada-Archei Faunal Reserve (La réserve de Faune de Fada Archei) in northeastern Chad (Map 4.2.1).

Status within country: Indeterminate.

Conservation measures proposed: 1) Carry out surveys in the Tibesti and Ennedi mountains, and elsewhere to determine current numbers and actual distributions of Barbary sheep. **2)** Consider establishing a protected area, preferably a national park or at least a faunal reserve, in the Tibesti mountains. **3)** Improve the levels of protection, especially anti-poaching efforts, staffing and support for Fada-Archei Faunal Reserve, as with other protected areas in the country (IUCN 1989a). However, it is necessary to recognise the very limited resources of the Directorate of National Parks and Wildlife Reserves. There is also a need for materials/supplies and available operating resources to support these developments. The lack of appropriate surveillance is a handicap for survival of the species in this region. First of all, a suitable conservation management system should be developed together with a practical implementation scheme. Probably three teams, of four wardens each, will be required for adequate surveillance. **4)** Establish a research centre in Fada.

Acknowledgements: J.P. Thomassey and G. Sournia.

4.3 Egypt

M. Amer

Introduction

The Arab Republic of Egypt occupies the northeastern corner of Africa extending over 1,002,270km². As it does in Sudan to the south, the River Nile dissects Egypt into two unequal parts. The relatively narrow, fertile strip of the Nile valley stands in marked contrast to the arid land on either side of it. The Western desert (El Sahra Al Gharbiyah), the larger of the two areas flanking the Nile, is extremely arid and without wadis (water-courses). The Al Gelf Al Kabier Plateau rises in the southwest, ending in the El Uwaynat mountains just over the border into Sudan, where peaks reach almost 2,000m asl. The Eastern desert (El Sahra Al Sharquiyah) is broken extensively by numerous wadis, and is bordered by the rugged Red Sea hills to the east. This range rises to more than 1,800m asl, culminating at 2,187m on Mount Al Shaiyb. In the Sinai peninsula, three physiographic regions can be recognised. Northern Sinai consists of areas of mobile sand dunes, interspersed with mountain ridges including Gabal El Maghara, Gabal

Yelleg and Gabel Halal. Central Sinai extends between Wadi Sudar in the north, south to the Tih ridge, and a limestone area dissected by dry canyons that drain into either the Mediterranean through the Wadi El Arish, or the Gulf of Suez. The Southern region is mountainous with peaks in the Al Ajmah range reaching more than 2,500m asl, including Egypt's highest, Jabal Katrina (2,642 m).

The climate consists of four seasons, winter (November to March), spring (March to May), summer (May to September) and autumn (September to November). Rainfall varies from 175mm on the Mediterranean coast to between 2 and 5mm in southern Egypt, with the Red Sea coastal plain receiving almost none. The Western desert supports almost no vegetation except where some water occurs. The less arid Eastern desert contains some vegetation such as acacia, tamarisk, markh and various species of thorny shrubs, succulents and woody forbs. This vegetation is particularly developed in wadis in the Red Sea hills and in Sinai.

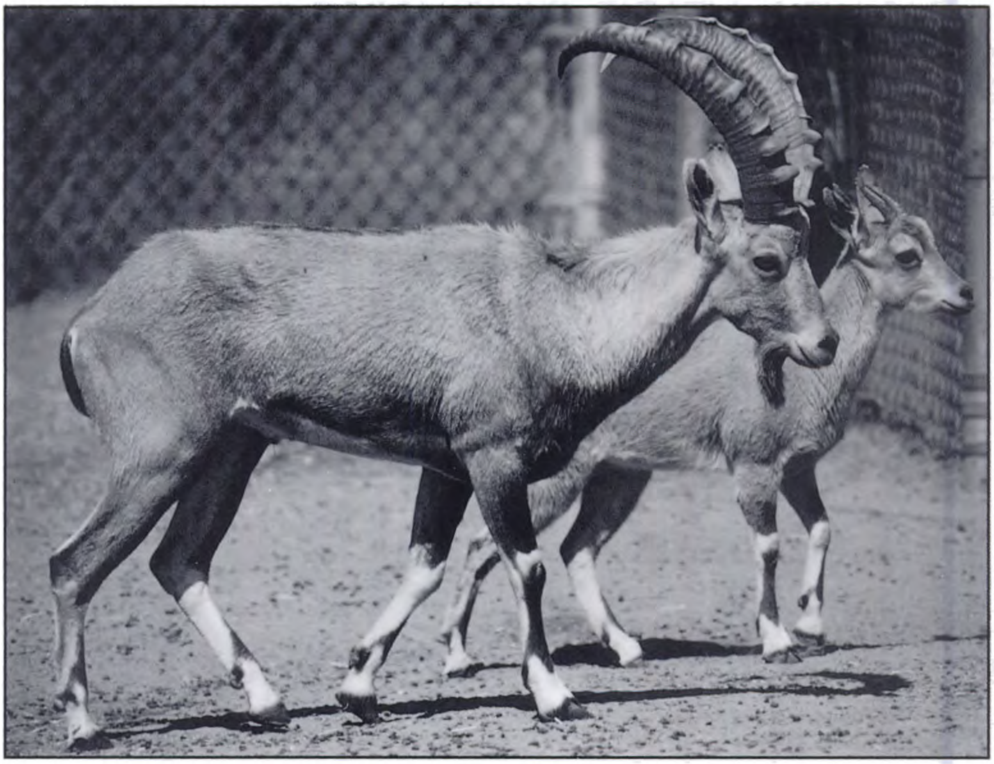
Current status of Caprinae

Two species of Caprinae are present in Egypt, the Egyptian Barbary sheep or aoudad (*Ammotragus lervia ornatus*), and the Nubian ibex (*Capra* [*ibex*] *nubiana*) (Dorst and Dandelot. 1970; Farag and Abou-Terra. 1900; Haltenorth and Diller 1977; Osborn and Helmy 1980). Both species are threatened in Egypt, especially the Barbary sheep which, if it still exists, is probably on the verge of extinction unless serious conservation efforts are made quickly. The Barbary sheep, known locally as "El Kabsh El Arawy" or "Kharouf Al Gabal", was once quite widespread throughout the escarpments of both the Eastern and Western deserts (Gray 1985), but overhunting and habitat destruction have caused its demise.

The Nubian ibex, variously called "El Badan", "El Tital", or "El Maaez El Gabali", occurs only east of the Nile river. It may be surviving best in the mountains of the Sinai peninsula, and also appears to be clinging to survival in the hills along the Red Sea coast at the edge of the Eastern desert.

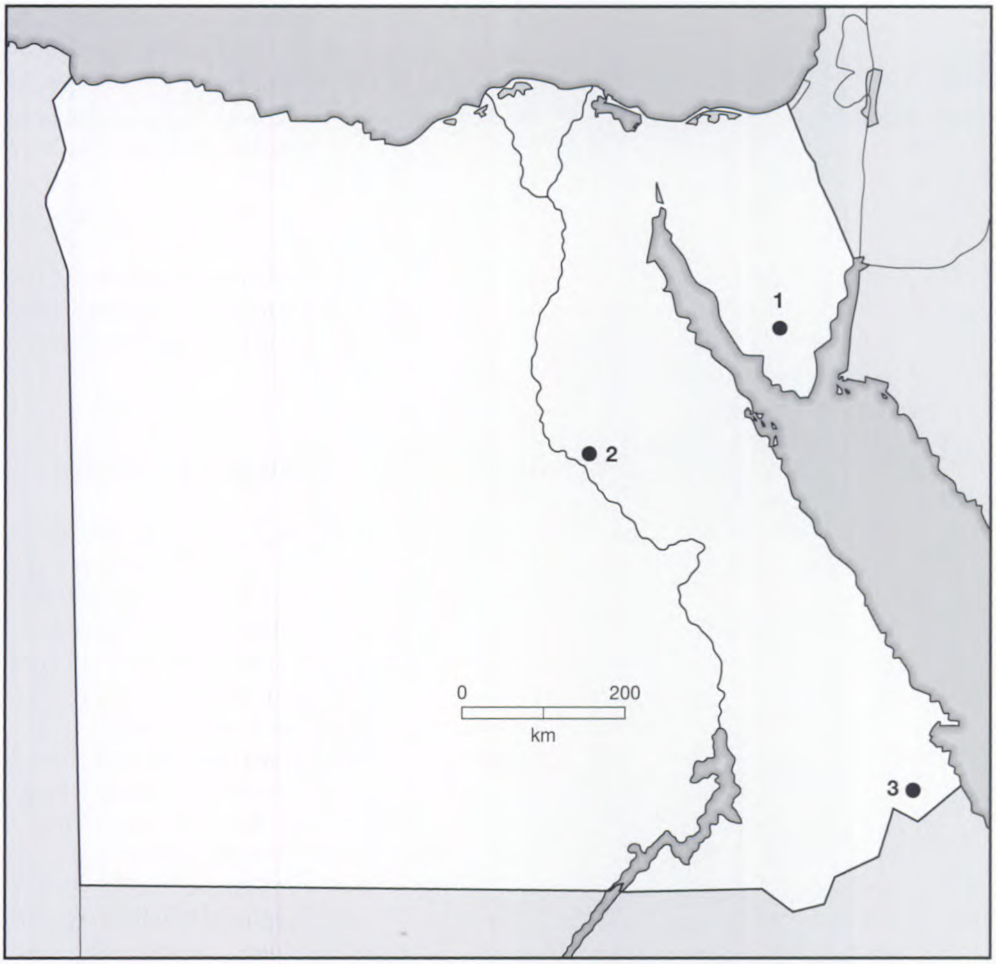
General conservation measures taken

Modern wildlife conservation began with the establishment of a royal desert hunting reserve in 1900, but was not developed further until around 1955 (Drucker *et al.* 1986). The University of Alexandria established the first protected area at El Omayed in 1874, and Israel created a number of protected areas in Sinai during its period of occupation until the territory was returned to Egypt in 1979. In 1980, Law 102 was issued for identifying and protecting threatened species and areas, with the legal framework for this being passed in 1983 (IUCN 1992a). The Egyptian Wildlife Service was established in 1979 under the Ministry of Agriculture as responsible for protected areas and wildlife research. Unfortunately, the Egyptian Wildlife Service is grossly underfunded, and one of its major sources, a grant



D. Shackleton

An adult male Nubian ibex (*Capra* [*ibex*] *nubiana*) in captivity. San Diego Wild Animal Park, California, U.S.A.



Map 4.3.1. Locations of protected areas with Caprinae in Egypt.

1) Gebel Musa (Mt. Sinai) and Jabal Katrina Wildlife Reserve (45,000ha; est. 1977); **2)** Assiut University Protected Area (27°11'N); **3)** Gebel Elba Conservation Area (480,000ha; est. 1986).

from the U.S. Fish and Wildlife Service, has been significantly reduced. The Egyptian Environmental Affairs Agency (EEA) is another governmental agency sharing responsibility for wildlife conservation in Egypt, and also for solving environmental problems.

One area, Gebel Elba Conservation Area (Map 4.3.1), is regarded as a major site for the preservation of North African fauna (Goodman 1985) including Caprinae. However, it falls into the disputed Sudan Government Area in the extreme southeast corner of Egypt, along the border with Sudan. With both Egypt and Sudan claiming the area, any legislation requires the agreement of both parties for it to be realised. Hunting, although banned in the protected area, does take place in at least one part of it because neither government claims authority over this section. Barbary sheep may be extinct in this region, but Nubian ibex are believed to still inhabit it (Goodman 1985).

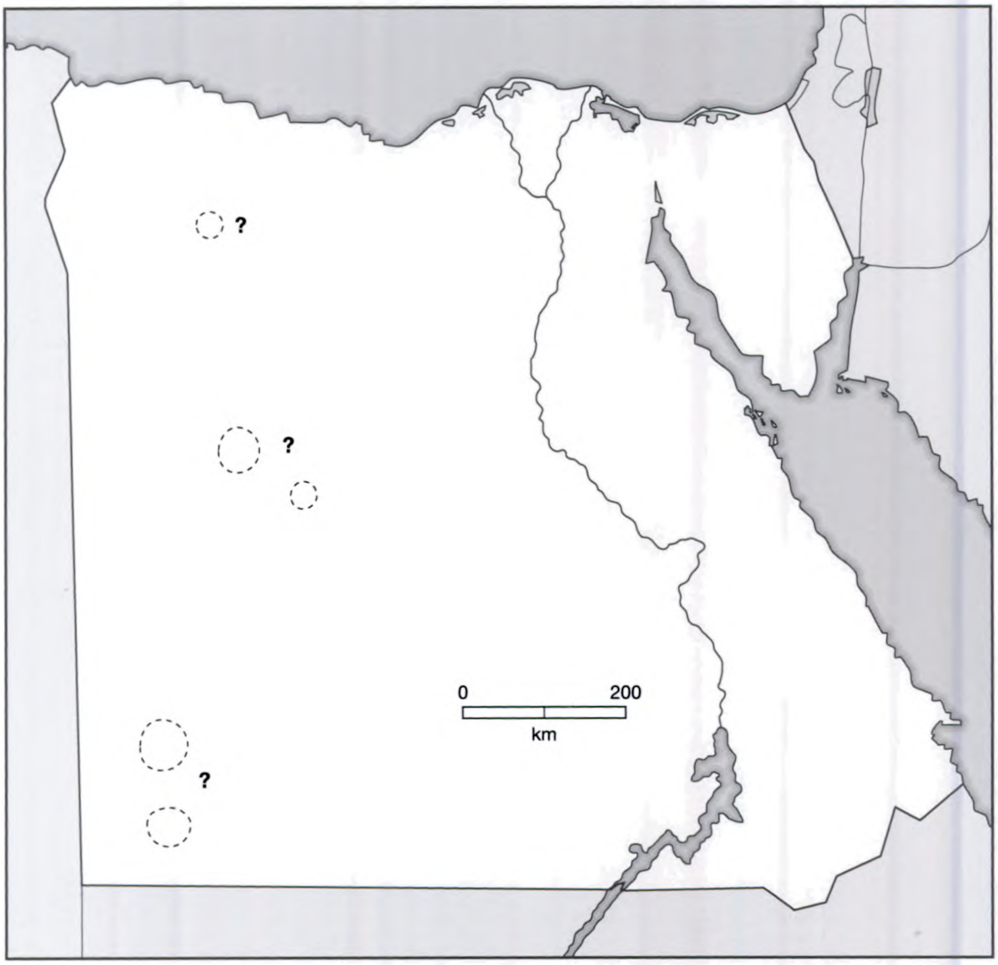
General conservation measures proposed

The success of the specific proposals below requires a serious commitment on the part of Egypt to deal with its wildlife. The Egyptian Wildlife staff have proposed such conservation measures, together with vitally needed public education programs about conservation.

Species accounts

Egyptian Barbary sheep (*Ammotragus lervia ornatus*)

Distribution: Its former distribution was probably most of the hills in the Eastern desert and in some rugged areas in the Western desert, in the hills east of Cairo, and in rugged terrain bordering both sides of the Nile in Upper Egypt (Gray 1985). Its more recent distribution included Wadi El Assiuti and Wadi Mellaha in the Eastern desert, Ain Dalla and Gebel Uweinat in the Western desert, and in the Qattatra depression near Minqar Abu Deweiss (Osborn and Helmy 1980). The most recent (1972) published record of Barbary sheep in Egypt was from near Bir El Obeiyid, northwest of Farafra Oasis (Osborn and Helmy 1980). In the Sudan Government Administration Area in the south, they are apparently extinct in the Gebel Elba Conservation Area, but are reported from the nearby Gebel Garf (Goodman 1985).



Map 4.3.2. **Possible** distribution of **Egyptian** Barbary sheep (*Ammotragus lervia ornatus*) in Egypt (species may be extinct).

Population: No recent systematic surveys; most information comes from casual observations and second-hand reports by guides. It is quite possible that the species is extinct in Egypt (Map 4.3.2).

Threats: Besides hunting and poaching, competition with livestock and feral camels has probably been one of the most significant factors in the Barbary sheep's decline. The availability and distribution of waterholes would likely be a major factor in the condition of populations, and both may fluctuate from year to year.

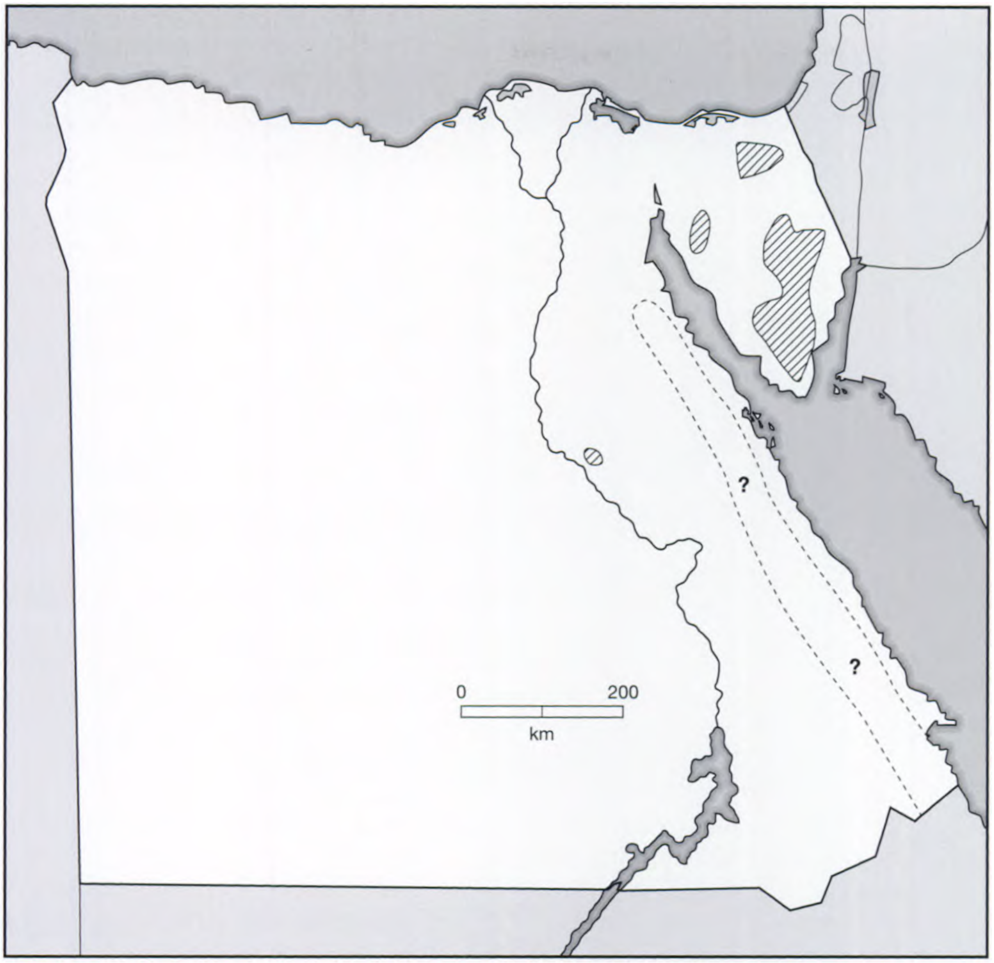
Conservation measures taken: Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals, and in Appendix II of CITES. It may still occur in Gebel Elba Conservation Area (48,000ha; est. 1986), but Goodman (1985) believed it was extinct there. Assiut University Protected Area was originally set aside in the 1930s to protect Barbary sheep, but there are no recent reports of its presence (Drucker *et al.* 1993). Two groups of animals (total 60 animals) are being reared at Giza Zoo for future re-introductions. To this end, the Egyptian Wildlife Service, in co-operation with the Zoo's directorate, has identified some areas for possible re-introductions and as breeding centres in the wild for further re-introductions. Both parties would be interested in working in co-operation with universities or other organizations on the re-introduction program.

Status within country: Extinct (?).

Conservation measures proposed: 1) Survey areas previously known to be inhabited by the species to ascertain if Barbary sheep still survive in Egypt. **2)** At the same time, evaluate the habitat along with the potential for re-introductions.

Nubian ibex (*Capra [ibex] nubiana*)

Distribution: There have been no recent systematic surveys, except for the Sinai Peninsula, so most information comes from casual observations and second-hand reports, often from guides or casual visitors. Ibex have been observed in the Eastern desert on Gebel Ataqa (29°55'N, 32°20'E), Beerdisa, Beermakalla, Wadi Habib (Krausman and Shaw 1986) and the Abrak area; on the northern and southern Galala plateau; and between Quena and Quseir, Quseir



Map 4.3.3. Distribution of Nubian ibex (*Capra [ibex] nubiana*) in Egypt.

and Red Sea hills south of Marsa Alam. They may also occur in the Red Sea hills south of Cairo as far as the Sudan border. They do not occur west of the Nile. Ibex are very limited in their distribution in Sinai, being restricted to the mountainous area of the Gulf of Aqaba, from Dahab to Sharm El Sheikh, and have been observed on Mount Saint Catherine (EWS, unpubl. data, 1982–85). They probably also occur on Gabal Maghara, Gabal Yelleg and Gabal Halal (Map 4.3.3).

Population: On the Sinai Peninsula, between 1977 and 1979, the population in the north has been estimated at around 50 animals, in the central region around 200, and in the south 155 (Baharav and Meiboom 1981). There are no reliable estimates of overall population size in Egypt, but they are thought to be decreasing except in Sinai where numbers possibly may be stable.

Threats: Competition with livestock and feral camels is probably significant. The availability and distribution of waterholes is likely to be a major factor in the condition of populations, and both may fluctuate from year to year. Poaching definitely occurs, but the extent is unknown.

Conservation measures taken: Listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. The Nubian ibex is protected by Agricultural Law No. 53/1966 and amendment 1012 July 1992. Hunting of this species is totally forbidden as mentioned in article 117 of the Agricultural Law. Unfortunately, enforcement of protective measures is inadequate due to staffing shortages, lack of funds and the widely scattered distribution and remoteness of the ibex populations.

Ibex occur in several protected areas: Gebel Elba Conservation Area, where hunting is allowed with little control; in Assiut University Protected Area, where it was rediscovered in 1984 (Krausman and Shaw 1986); and in Jabal (Gebel) Musa and Jabal Katrina Wildlife Reserve in southern Central Sinai. A captive breeding program exists at Giza Zoo with the main objective of eliminating the collection of specimens from the wild. There are no immediate plans to reintroduce animals into the wild.

Status within country: Indeterminate.

Conservation measures proposed: **1)** Survey populations and their habitat immediately to determine its status in

Egypt. **2)** Develop a conservation plan. **3)** Consider government control for Assiut University Protected Area to ensure full protection because it is one of the few remaining areas where Nubian ibex definitely still survive outside the Sinai and Egypt has full control. The site is in the Eastern desert and includes the Wadi El Assiuti and its junction with the Wadi Habib (27°10' to 27°11'N, 31°16' to 31°46'E), 20km east of the Upper Nile Valley and 45km east of the town of Assiut (Asyût). **4)** Re-activate the proposal to make Gebel Elba a National Park in co-operation with the Egyptian and Sudanese governments.

Acknowledgements: A.A. Fouda, M.M. Gayyed, P.R. Krausman, and L.J. Wurfbain.

4.4 Eritrea

J.C. Hillman and H. Yohannes

Introduction

Eritrea is Africa's newest country and covers 124,000km², bordering the Red Sea to the east and Sudan, Ethiopia and Djibouti on its other boundaries. The country comprises three main physical areas. The western lowlands lying around 500m asl along the Sudan border, which are low-lying and well-watered in the wet season, form the main agricultural support area along with the central highlands. The highlands, at around 2,400m asl, are the northernmost extension of the Ethiopian highlands; rugged, rocky, and providing some reasonable agricultural areas to the south, but in the north becoming very arid and unproductive. The eastern lowlands lie at the foot of the escarpment, and border the coast. This region is very arid and desolate, and has very low, unreliable average annual rainfall (<150mm), with salt-laden soils and areas lie more than 130m below sea level in the Dallol depression.

Current status of caprinae

The Nubian ibex (*Capra* [*ibex*] *nubiana*) was believed to be found in scattered, isolated populations in northern Eritrea (Yalden *et al.* 1984). The most likely area being the arid, northern section of the central highlands along the border with Sudan. Little is known of the current status of this species or its status for the last 25 years. However, more detailed, but uncorroborated information suggests that there were two separate Nubian ibex areas in northern Eritrea (J. Bromley, Game Warden, *in litt.* 1968). There are no published studies of Nubian ibex in Eritrea.

General conservation measures taken

Prior to independence, wildlife legislation covering Eritrea came under the Ethiopian Wildlife Conservation Organization of the Ministry of Natural Resources Development and Environmental Protection. People were allowed to live, cultivate crops and graze livestock in Ethiopian protected areas. Hunting was strictly controlled and could take place only under special permit in Controlled Hunting Areas by non-residents; elsewhere outside protected areas residents could also hunt with general hunting permits (IUCN 1987a). Currently, no hunting of wildlife is permitted in Eritrea until the wildlife situation can be accurately assessed.

The Yob Reserve was legally established under the British post-World War II administration in 1959 (Gazetta Eritrea No. 4, p. 31, 16 March 1959), primarily for the conservation of Nubian ibex and other desert wildlife species. No formal development occurred however, and little is known of this area since that time. Old maps indicate an ibex hunting camp was set up in the hills nearby the Reserve, suggesting that there were once sufficient ibex to make hunting them worthwhile. Since then, there have been 30 years of war of liberation which has affected almost the entire country, culminating in the creation of the independent State of Eritrea in May 1993.

The Wildlife Conservation Department, in the Eritrean Ministry of Agriculture, has begun detailed ground surveys of the situation, and has so far covered the Gash-Setit areas (elephant) and the Danakil area (wild ass). The Nubian ibex area is a high priority for the Department for the near future, but it is very isolated with no road or track developments. Nubian ibex were never recorded in either of the other two protected areas established in Eritrea in 1959 – the Nakfa and Gash-Setit Wildlife Reserves.

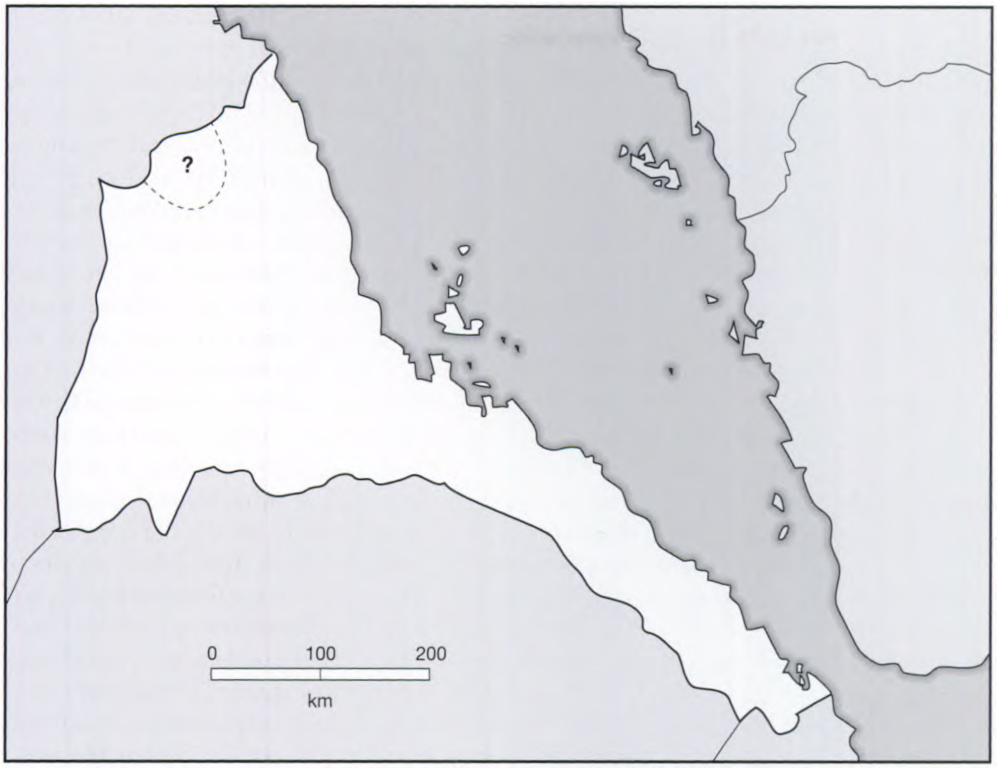
Species account

Nubian ibex (*Capra* [*ibex*] *nubiana*)

Distribution: No surveys have been made and its presence in northern Eritrea (Yalden *et al.* 1984) near the Sudan border (Map 4.4.1) is not confirmed.

Population: No estimate.

Conservation measures taken: Listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). None of the past "Protected Areas" are considered to have any relevance to the present context, although Yob Wildlife Reserve was believed to contain the species. The Nakfa area in particular was the scene of fierce



Map 4.4.1. Suspected distribution of Nubian ibex (*Capra [ibex] nubiana*) in Eritrea. This area is the same as the location of the previous Yob Wildlife Reserve (2,658km²; est. 1959) which was the area Nubian ibex may have been restricted to in Eritrea.

fighting and destruction. The situation is being reviewed in detail and proposals for the conservation of wildlife in the future will be made once the current situation has been assessed.

Status within country: Indeterminate.

Conservation measures proposed: Now that the northern region is safe, **1)** carry out detailed surveys for Nubian ibex in northern Eritrea from the ground and from the air as soon as resources are available. These censuses are needed to estimate numbers and distribution of any populations which are found. **2)** Based on these data, develop a conservation strategy for the species.

4.5 Ethiopia

J.C. Hillman, H. Hurni and B. Nievergelt

Introduction

Ethiopia covers 1,099,600km², and can be divided into three main physiographic regions. The Rift valley runs north-south through the centre of the country at an elevation of around 1,500m asl dissecting the Ethiopian plateau into eastern and western sections. The 40 to 65km wide Valley contains numerous lakes, and in the Danakil plain to the north are several active volcanoes. The Western highlands lie between 2,400 and 3,600m asl. Their northern part is formed by the Tigrean highlands, while in the central region are flat-topped, basaltic tablelands with large extinct volcano systems on top. One of them is the Simen mountains, which includes Ethiopia's highest peak, Ras Dejen at 4,543m asl. The Blue Nile cuts a deep gorge through the Western highlands south of the Simen mountains and on its southern side is the Shewan plateau. This is the largest area of the Western highlands, with an average elevation of more than 2,140m but dropping off to the south. As in the north, this region is cut by numerous deep gorges. The Eastern highlands, like the Western region are mainly basaltic at higher elevations. The highest region forms the steep eastern flanks of the Rift valley, with Mount Tullu Deemtu in the Bale mountains reaching 4,377m asl. In the central region, between the Genale and Wabe Shebele rivers, is the 4,000m plateau of the Bale massif. To the northeast lies the Harerghe plain at about 1,000m asl, which continues southeast into the Ogaden region. To the south of the Eastern highlands is the Borena-Sidamo plain which is at around 1,000m asl.

Ethiopia's climate is influenced by the southwest-northeast Indian Ocean monsoon system, the Atlantic windstreams from the west, and the sheer mass of the Ethiopian highland blocks. As a result of these, the majority of the highlands receive an 8-month long rainy season, from March through October, with a slight decrease in May and June. The surrounding lowlands on the other hand, receive rain in one or two wet seasons, in April–May and October–November. Frosts are a frequent occurrence at higher altitudes in the dryer periods, with extremes of daily temperature fluctuation at the same time in the highest mountains. A range of minus 25°C to +26°C has been recorded in January in the Bale mountains within 24 hours. Snow commonly falls at the highest altitudes, but rarely remains for more than 24 hours.

Current status of Caprinae

Ethiopia is home to the world's only population of Walya or Walia ibex (*Capra* [*ibex*] *walie*), which is one of the members of the unique Simen mountains' fauna (Yalden *et al.* 1984). Although there are small populations outside, most remaining Walia ibex are found within the Simen Mountains National Park (Map 4.5.1). Here they may be receiving adequate but limited protection, and the subspecies is still considered to be endangered due to low numbers and the very restricted area of remaining habitat. Walia ibex is used by the Ethiopian Wildlife Conservation Organization and the Ethiopian Wildlife and Natural History Society as their emblem, and frequently features in other Ethiopian symbolism.

There is an unsubstantiated report of Nubian ibex (*Capra* [*ibex*] *nubiana*) in the Tendaho Estates area, where the Awash river reaches its northernmost point before turning south to Lake Abbé on the Djibouti border.

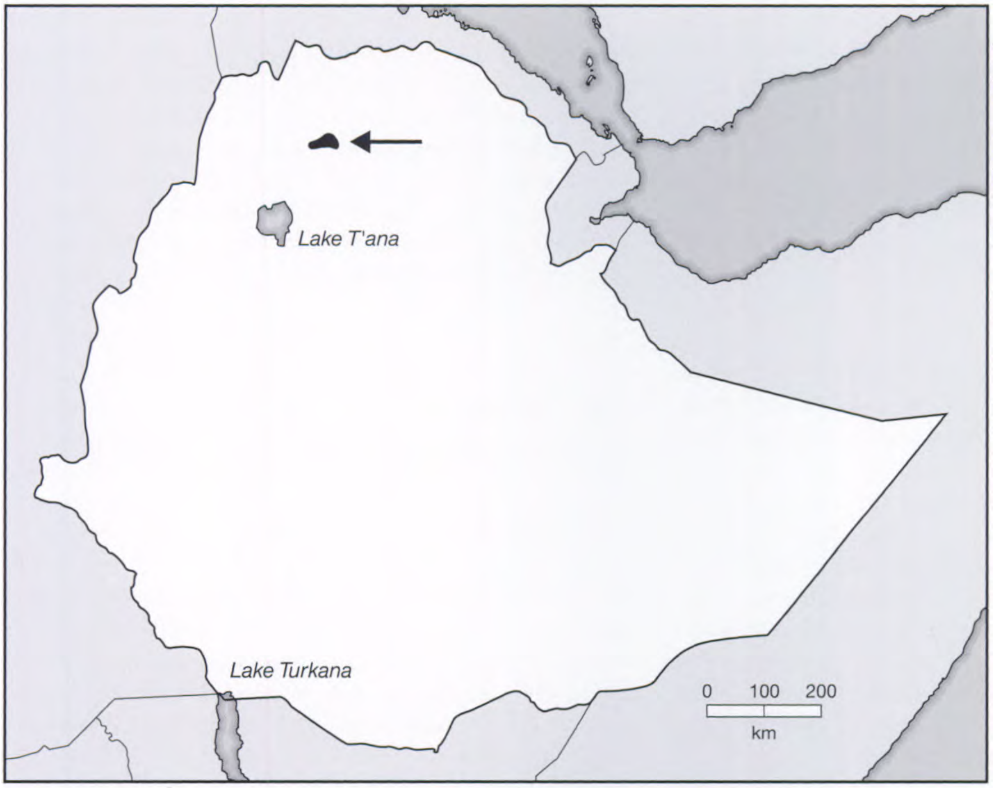
General conservation measures taken

Wildlife conservation in Ethiopia comes under the Ethiopian Wildlife Conservation Organization (EWCO), currently in the Ministry of Natural Resources Development and Environmental Protection. Major conservation legislation is included in the Forest and Wildlife Conservation and Development Proclamation No. 192 (1980), which provides for the conservation and development of forest and wildlife resources, as well as establishment of protected areas. The Organization's Conservation Education Division has the task of increasing the public's role in "development, protection, rational utilization and management of forest and wildlife". Ethiopia has four types of protected areas; National Parks, Wildlife Sanctuaries, Wildlife Reserves, and Controlled Hunting Areas. Wildlife Reserves and Controlled Hunting areas are currently administered by Regional governments. National Parks and Sanctuaries are still administered by the Central Government in theory, but in practice must have close links with their respective regional government administrations. All exploitation of natural resources within National Parks is legally forbidden, except where they are used for development and management. People are permitted to live, cultivate crops and graze livestock in Wildlife Reserves and Controlled Hunting Areas (1996 IUCN 1987a). All hunting was banned in Ethiopia in 1993 for the foreseeable future while the wildlife situation is reviewed.

The Simen Mountains National Park, located in the Gonder Administrative Region of northern Ethiopia (Map 4.5.1), was gazetted by the Simen National Park Order No. 59 (1969) and became a World Heritage Site in 1978. This park provides some protection for its unique endemic flora and fauna, and is vital for Walia ibex as it contains the majority of the world population of this species. The Park, while providing a core conservation area, must be considered in terms of a much larger environmental unit. It is essential to maintain wildlife corridors between the

B. Nievergelt

Adult male Walia ibex (*Capra* [*ibex*] *walie*) in Siemen Mountains National Park, Ethiopia.



Map 4.5.1. Location of Simen Mountains National Park (19,000ha, est. 1969; World Heritage Site 1978) which contains Walia ibex (*Capra [ibex] walie*) in Ethiopia.

Park and surrounding areas of the Simen mountains. A detailed management plan for the Park and surrounding areas was developed after a 20-year inter-disciplinary research program (Hurni 1986). It deals not only with the Walia ibex but all the area's unique wildlife, as well as the needs of the rural human population. Although some funds do exist for the plan's implementation, progress has been halted by the recently concluded civil war in the country. Implementation can take place when conditions have improved (EWCO 1991).

Species account

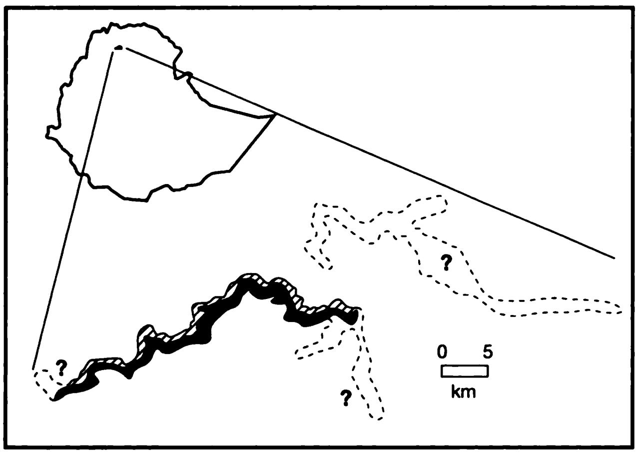
Studies of the ecology and behaviour of Walia ibex have been published (Dunbar 1978; Dunbar and Dunbar 1981; Nievergelt 1974, 1981).

Walya or Walia ibex (*Capra [ibex] walie*)

Distribution: Currently found only in the Lemalimo to Walia Kend-Silki sectors of the Simen mountains, in the Gonder Administrative District of north-central Ethiopia (Map 4.5.2). Formerly more widespread in the Simen Mountains, the greatest concentration now occurs within Simen Mountains National Park, mainly along 25km of the northern escarpment between Adarmaz Camp and Chennek Camp. There are also four small populations outside the protected area: north of Werk Amba west of the park; between Silki and Walka northeast of the park; between Bwahit and Mesarerya; and just north of Weynobar along the Ras Dejen escarpment to the north.

Population: The total population appears to have increased slightly since the park was created, and at the time of the most recent survey (1989) was estimated to be ≤400 animals (Nievergelt, unpubl. data).

Map 4.5.2. Known and suspected distribution of Walia ibex (*Capra [ibex] walie*) in Ethiopia. Note that Walia ibex are restricted to Simen Mountains National Park and its immediate environs.



Threats: The population appears to have survived the civil war relatively unscathed. Until 1989, numbers were believed to have remained stable (Hurni, pers. obs.). The most recent reports (EWCO 1991; Hillman 1991) indicate that ibex are still present in the park, but a current estimate of numbers is not available. The main conservation problem is that the remaining natural habitat is extremely limited. In addition, threats come from hunting and habitat destruction caused by human encroachment, even though most of the villagers who lived in the Park have been re-settled outside.

Conservation measures taken: Listed as Critical (C2b) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and listed in Class A of the 1969 African Convention. The Walia ibex is protected by Ethiopian law and cannot be hunted except under a Special Permit for Hunting Game Animals for Scientific Purposes. The majority of Walia ibex live in the Simen Mountains National Park. Although villagers from the lowland areas of the Park were removed from the Park in 1978, the human population growth rate is such that there will be further pressure on the Park. Some people still live in the Park, and it is suspected that all those resettled outside have returned to the Park over the past decade. The remoteness of the area makes legislation difficult to enforce. Since 1985, the Park has been inaccessible due to the civil war, but the most recent information indicates that although the Park's buildings and equipment have been destroyed, the wildlife and environment may still be in good condition.

Status within country: Endangered.

Conservation measures proposed: 1) Establish the 400km² buffer zone proposed in the 1986 Management Plan (Hurni 1986) for Simen Mountains National Park. This would increase the effective area of Simen Mountains National Park to 590km² and serve two main functions. a) It will provide an ecologically stable and socially secure region for rural inhabitants so that they are no longer dependent on the Park's natural resources. In conjunction with this, and in accord with the Government's national parks policy, every effort should be made to relocate the Park's remaining local human population, followed by reclamation of areas they and previous farmers occupied. All hunting within the Park must cease and regulations effectively enforced. b) Development of buffer zones must include provision for natural movement corridors along the escarpment ranges that are vital for allowing the ibex and other wildlife to disperse in and out of the park. **2)** Although no hybrids of domestic goats with Walia ibex have been reported, they are not inconceivable. Free-ranging domestic goats must be eliminated from the Park and around other ibex populations to exclude the possibility of hybridization occurring at some future date. **3)** With no Walia ibex in captivity anywhere in the world, a captive breeding program should be developed, a small number should be captured to form the nucleus of a captive breeding group in a closely managed and protected location in Ethiopia, and for a captive breeding population outside the country. Such a program would provide insurance against natural disasters and furnish animals for re-introductions into other parts of the Simen Mountains, as well as for other suitable areas such as the Wofwasha-Ankober area, northeast of Addis Ababa.

4.6 Libya

D.M. Shackleton and K. de Smet

Introduction

The People's Socialist Libyan Arab Jamahiriya borders the Mediterranean and covers ca. 1,748,700km². The Jabal Nafusah range and the associated Gefara plains lie in the northwest. The plains rise from sea level to about 300m at the foot of the Jabal Nafusah. This latter is a limestone range reaching 610 to 915m asl and stretching for approximately 350km. Another limestone mountain range, the al-Jabal al-Akhdar, runs for about 160km along the coast in the northeast, between 600 and 915m asl. Between these and to the south lies the vast Saharan plateau, covering almost 99% of the country. This includes two high plateaux, the al-Hammadah al-Hamra in the northwest, and the al-Haruj al-Haswad in the centre, and the Tibesti mountains rising to almost 2,300 m, along southern Libyan-Chad border.

Rainfall is highest along the coast (average between 254 to 380mm) not only decreasing inland but also becoming highly irregular. The world's highest degree of aridity was recorded at Sabhah in the east-central region. Areas with less than 150mm annual precipitation are semi-desert with sparse vegetation. Annual grasses grow only for a short period after rains. Rainfall is sufficient for forests of juniper and lentisk to grow on the slopes of the al-Jabal al-Akhdar, but grasslands predominate in the drier Jabul Nafusah.

Current status of Caprinae

The only species of Caprinae in Libya, the Barbary sheep or aoudad (*Ammotragus lervia*) is represented by two subspecies (*fassini* and *sahariensis*), although *A. l. blainei* was reported by Shaw (1933, cited in WCMC 1986). Barbary sheep appear to always have been rare in Libya, but heavy hunting pressure appears to have reduced it to dangerously low numbers in recent years (Essghaier 1980). Only general biological information is available on the species (Gray and Simpson 1980; Gray 1985).

General conservation measures taken

Legislation affecting Barbary sheep is known only regarding protected areas. Forest reserves and national parks are two forms of protected areas in Libya. Some forest reserves meet UN criteria for managed nature reserves. The first national park was established in 1978, and three types were originally considered (wildlife park, natural sanctuary, multipurpose reserve). National parks fall under the Secretariat of Agriculture, and are administered by the Forests and Range Management and National Resources Department. The Arab Centre for the studies of Arid Zones and Drylands, also is involved in national parks. One of the goals of the national parks' system is restoring native wild animals in protected areas (IUCN 1992a).

Species account

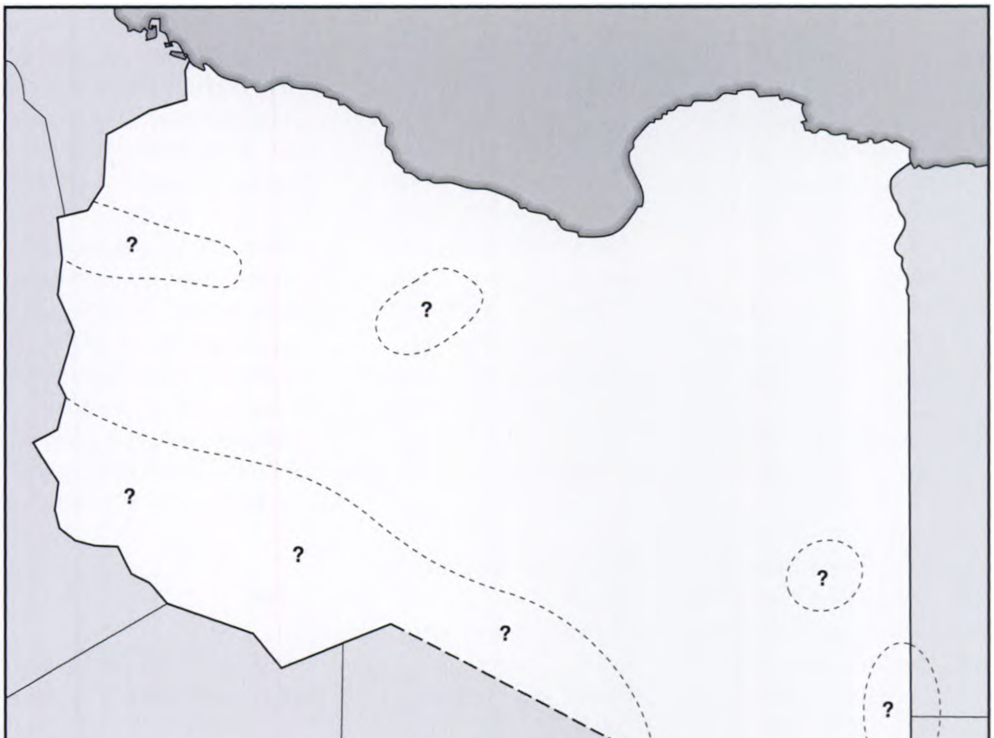
Barbary sheep (*Ammotragus lervia*)

Distribution: The species was reported to occur between Murzuq and Socna in the west-central region of the country (Harper 1945, cited in Munton 1987). Libyan Barbary sheep (*A. l. fassini*) inhabited the Hamada el Homra, the region south of Gatroun in the Fezzan, near Socna, Uaddan and Murzuq, and some around Ghadames and Kufra (Hufnagel 1972). Kordofan Barbary sheep *A. l. sahariensis* was reported in Arkenu, Gebel Uwainat, and Dalloni at Tierko and Tousside in the Tibesti (Hufnagl 1972). No recent information on distributions is available (Map 4.6.1).

Population: No estimates.

Threats: Reported as rare in 1945 (Harper 1945, cited by Munton 1987), Hufnagl (1972) suggested that 20 years ago they were not intensively hunted and were not threatened. However, more recently, Essghaier (1980) suggested that the species was probably highly endangered due to overhunting. Livestock over-grazing is a threat to other wildlife, but whether this affects Barbary sheep is not known, though probable.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. It is not known whether Barbary sheep are protected by law. The species was introduced into Tripoli Nature Reserve (870ha; est. 1978), located between Tripoli and the Tripoli International



Map 4.6.1. Suspected distribution of Barbary sheep (*Ammotragus lervia*) in Libya.

Airport (32°49'N, 13°12'E). It may also occur in Jabel Nefhusa Nature Reserve (20,000ha; est. 1978) in northern Libya in the Jebel Tarabulus range of the Jebel Nefhusa mountains (Tripolitania Region 32°N, 12°50'E). A recommendation was made to fence the entire area, and then release Barbary sheep and *Gazella dorcas* (Drucker *et al.* 1993). However, this reserve does not appear to fall within the suspected distribution of the species shown in Map 4.6.1.

Status within country: Indeterminate.

Conservation measures proposed: Conduct population surveys to determine current distributions and status in Libya.

4.7 Mali

B. Lamarche

Introduction

The Republique du Mali is one of the largest countries in Africa covering 1,240,192km². The country is generally flat with only localised highland regions. In the south and southwest are sandstone plateaus lying between 300 and 600m asl, and cut by the Senegal and Niger river systems. The southeastern and eastern plateaus consist of broken hills ranging around 300m high. All these plateaus are extensions of the Guinea highlands and form part of the Sahel. Central Mali is formed by the alluvial plains of Mrréyé and Azzawad, of the Niger river basin. The Tanezrouft and Taoudenni plains, in the northern part of the country, are covered by vast areas of sand dunes or ergs, southern extensions of the Sahara. The main highland region, the Adrar des Iforas, is found in the northwest corner along the border with Algeria. This eroded sandstone plateau is the southwestern extension of Hoggar mountain region of the Sahara. Here, elevations run between 400 and 500m asl.

Mali, in the inter-tropical zone, has a hot, dry climate, with two main seasons and three climatic zones. The rainy season runs between June and October, with the rest of the year being a dry season. The Sudanic climate zone, covering about 33% of the country from the southern border north to 15°N, has an annual rainfall of 500 to 1300mm and average temperatures of 24° to 30°C. In this zone, forests occur along rivers and the border with Guinea, while elsewhere the area is predominantly savannah. The Sahel climatic zone borders the Sahara and receives between 200 to 500mm rain per year and temperatures between 23° and 36°C. A steppe vegetation characterises the Sahel region, with drought resistant trees such as baobab, doum palms, and palmyra in the south and even more arid adapted species such as acacia, mimosa and cramcram nearer the Sahara. In the third climatic zone, the Sahara in the north, rainfall is irregular and usually less than 180mm per year. Here perennial vegetation is rare, and the area is generally desert to semi-desert.

Current status of Caprinae

Barbary sheep (*Ammotragus lervia*) is the single wild caprin occurring in Mali. The subspecies is probably *A. l. sahariensis.* It is believed to be limited in numbers and restricted to the mountains of the Adrar des Iforas which are located in the northeastern part of the country.

General conservation measures taken

Following independence, Law No. 68-8/AN-RN (1968) setting out the Forestry Code and Ordinance No. 68-8/CMLN (1969) which covers the Hunting Code, superseded their equivalent decrees of the previous French colonial administration. The Hunting code has since been replaced by the Wildlife Management Code (Law No. 86-43/AN-RM) in 1986 (IUCN 1992a). The National Parks Department (Direction des parcs nationaux) is supervised by the Department of Water and Forests (Direction generale des eaux et forêts) of the Ministry of Natural Resources and Animal Husbandry (Ministère des resources naturelles de l'èlevage) (IUCN 1987a). Definitions of protected areas are generally based on the 1968 African Convention (IUCN 1989a). The Service des Eaux et Forêts is responsible for wildlife management in Mali. The Barbary sheep receives no protection nor occurs in any protected areas in Mali.

Mali is party to the African Convention on the Conservation of Nature and Natural Resources (1968) and the World Heritage Convention. It is also a participant in the UNESCO MAB Programme, and acceded to the Convention on Wetlands of International Importance (RAMSAR Convention) in 1987 (IUCN 1989a).

Species account

Barbary sheep (*Ammotragus lervia*)

Distribution: Believed to occur only in the Adrar des Iforas (Map 4.7.1) of northeastern Mali, where it was considered rare (Newby 1981).

Population: No population data available.

Threats: Poaching, and food and habitat loss due to fuelwood gathering.

Map 4.7.1. Suspected distribution of Barbary sheep (*Ammotragus lervia*) in Mali.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Barbary sheep occurs in no protected areas in Mali.

Status within country: Indeterminate.

Conservation measures proposed: **1)** Conduct censuses and surveys to determine population composition, numbers, and distribution of Barbary sheep within the Adrar des Iforas. From these data, **2)** develop conservation strategies and **3)** consider the feasibility of establishing a protected area for Barbary sheep in this region.

4.8 Mauritania

B. Lamarche

Introduction

The Islamic Republic of Mauritania begins at the Atlantic coast and covers 1,030,700km² forming part of the western Sahara. Physiographically the country is characteristically a flat region, beginning with the low coastal plain and the lower Senegal River valley which runs along the border with Senegal, where the elevation is less than 45m asl. Continuing inland to the interior plains, the land rises to 180 to 230m asl in the form of numerous tablelands joined by long gentle slopes. The gently sloping topography is broken by cliffs and faulted scarps, some of which may be 270m high, and by inselbergs, the highest of which, Kediet Ijill, reaches 916m asl. Dunes cover almost 50% of the country.

Mauritania's arid climate is due to the drying effect of the northeast trade winds. Aridity increases from south to north, ranging from around 640mm to 25mm rainfall per year. In the south, the Sudanic savannah, a grassy parkland, with baobab and palmyra palm trees is replaced by Sahel vegetation dominated by acacias. With further decreases in precipitation towards the interior, desert conditions increasingly prevail.

Current status of Caprinae

The Barbary sheep (*Ammotragus lervia*) is the only wild caprin found in Mauritania; the subspecies is probably the Saharan Barbary sheep (*A. l. sahariensis*). Though no estimate of its numbers is available, the species is believed to be decreasing due primarily to hunting.

General conservation measures taken

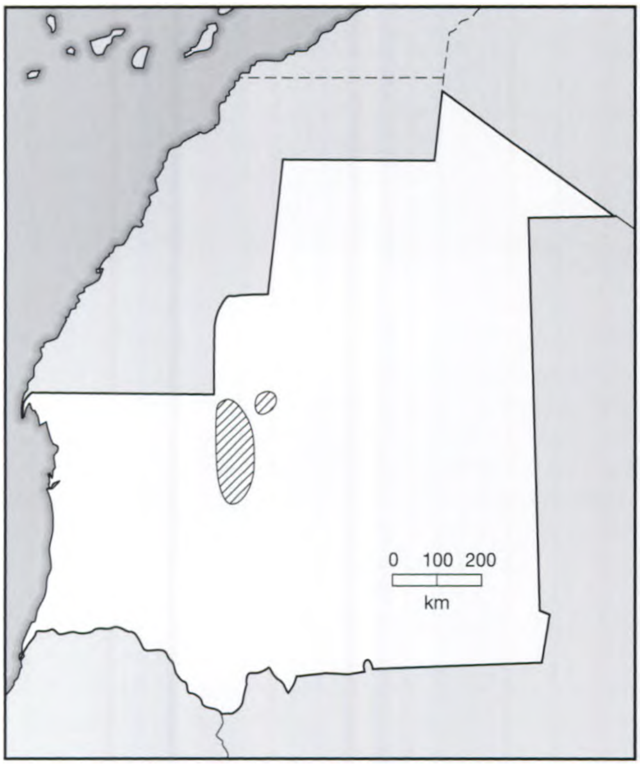
The Hunting and Wildlife Protection Act (1975) deals with the creation of national parks and faunal reserves. Protected areas are the responsibility of the Department of Conservation of Nature, Ministry of Rural Development (IUCN 1989a). Mauritania ratified the Convention for World Heritage Sites in 1981, and its only national park, Banc d'Arguin, was inscribed as a World Heritage site in 1989 (IUCN 1987a). Barbary sheep occur in one protected area (Map 4.8.1).

Species account

Saharan Barbary sheep (*Ammotragus lervia sahariensis*)

Distribution: Barbary sheep were recorded in l'Adrar de Mauritanie (Dhar Adrar) as recently as 1986 (Alados and Vericad 1993).

Map 4.8.1. General distribution of Saharan Barbary sheep (*Ammotragus lervia sahariensis*) in Mauritania. This area also includes the Adrar Mouflon Partial Faunal Reserve, the only protected area in Mauritania with Barbary sheep.



Population: There are no population estimates available but Newby (1981) stated that it was very rare, while Verschuren (1985) reported it to "live in fairly large numbers" in the Adrar mountains (Map 4.8.1). At this time numbers appear to be very low and decreasing.

Barbary sheep is probably endangered in Mauritania.

Threats: The main threat to the species is hunting, although livestock grazing, fuelwood gathering and desertification have negative additive effects by causing loss of habitat and food.

Status within country: Indeterminate.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Barbary sheep receives partial protection only in Adrar Mouflon Partial Faunal Reserve (Map 4.8.1).

Conservation measures proposed: **1)** Carry out censuses to determine numbers and distributions. **2)** Develop protection measures based on these data. **3)** Conservation actions must involve the co-operation of local people whose help will be essential in censusing Barbary sheep. Involving local people directly in any protection measures and employing them as game wardens will help ensure the success of any program.

4.9 Morocco (including Western Sahara)

S. Aulagnier and M. Thévenot

Introduction

Located in the northwestern corner of Africa, Morocco (including Western Sahara) extends over an area of 720,850km² from latitude 21° to 36°N. It is the most mountainous country of North Africa. The limestone Rif mountains run along the north coast rising abruptly from the Mediterranean to 2,456m asl (Jbel Tidighine). The Atlas mountains divide the Eastern plateaus, pre-desertic and Saharan Hamadas from Atlantic Morocco. The northern chain, extending southwest-northeast, is the Middle Atlas rising to 3,340m (Jbel Bou Nasser). The largest mountains are the High Atlas, which extend east from the Atlantic coast for more than 650km to reach more than 3,500m asl, including Jbel Toubkal (4,167m asl), North Africa's highest peak. The Anti-Atlas run south-westward from the High Atlas towards the Atlantic Ocean. The pre-desertic Eastern plateaus and Hamadas lie to the east and south of the

Atlas mountains, more than 1,000m asl. Atlantic Morocco consists of the coastal plains (Rharb, Chaouia, Doukkala, Souss), the Central plateau, and the arid central plains (Tadla, Haouz).

The Moroccan climate is hot-temperate with two main seasons; a dry, hot summer, and a mild winter with heavy precipitation. Rainfall is most abundant in the northern regions, where it exceeds 1,000mm per year in the Rif and some parts of the middle Atlas. East and south of the Atlas mountains and in the central plains, the average is between 200 and 400mm, decreasing below 200mm in western Sahara. In northern Morocco, vegetation tends to be typical western Mediterranean with evergreen oak, (*Quercus ilex*), predominating. Forests of cedar (*Cedrus libani*), juniper (*Juniperus thurifera*), and fir (*Abies pinsapo*), occur in the mountains, while cork oak (*Q. suber*), juniper (*J. phoenica*), thuya (*Tetraclinis articulata*), pines (*Pinus halepensis*, *P. pinaster*) and oleaster (*Olea europea*), grow in the Atlantic plains and plateaus. Here, agriculture and pastoralism allow the persistence of woods and at least matorral vegetation types typical of the Mediterranean. The eastern plateaus are covered by the alpha (*Stipa tenacissima*) grasslands, and in southern Morocco, after some sparse forests of argan (*Argania spinosa*), pre-Saharan and Saharan regions are covered with sagebrush (*Artemesia herba-alba*) and jujube (*Ziziphus*) steppe, with acacias (*Acacia gumifera*, *A. raddiana*).

Current status of Caprinae

Caprinae are represented in Morocco by a single species the Barbary sheep (*Ammotragus lervia*), known variously as "aoudad" (Berber), "arrui" (Arabic) or "mouflon à manchettes" (French). The subspecies occupying Morocco is the Atlas Barbary sheep *A. l. lervia* according to Ansell (1971); however, the southern limit of this taxon is unknown. The subspecific identification of animals from Western Sahara remains in doubt, although Harper (1945) provisionally referred to them as Saharan Barbary sheep (*A. l. sahariensis*). Some specimens from Rio de Oro were brought to Estaciõn Experimental de Zonas Aridas (Almeria, Spain) and bred in captivity, and by 1986 they numbered 40 individuals (14 males, 26 females) (Alados *et al.* 1988). Barbary sheep occur in small, widely scattered populations throughout the main mountain regions of the country (except the Rif Mountains), but occasionally in flat areas where human activity is low. They are usually observed in small groups, although formerly larger herds were relatively common. General details of the biology of Barbary sheep in Africa are given by Gray and Simpson (1980) and Simpson (1980). Major problems still threatening the survival of most populations are similar for all large mammals, and include overgrazing by domestic livestock (even in protected areas), deforestation, human disturbance and poaching (Aulagnier and Thévenot 1986a; Loggers *et al.* 1992).

General conservation measures taken

The legal basis for wildlife conservation in Morocco includes texts related to the status of protected areas and habitat management, and texts on hunting rules (Moroccan legislation refers also to Western Sahara). The Ministry of Agriculture has administrative responsibility for protected areas, while the Direction des Eaux et Forêts is responsible for general management and activity co-ordination. And at a lower level, the Division de la Pêche, de la Chasse et de la Protection de la Nature, deals with the day to day activities in protected areas and game preserves. Also in the Ministry of Agriculture, the Direction de l'Elevage, deals with pastoralism and the Direction de Recherche et d'Exploitation Forestière with preservation of forests and reforestation.

The Ministerial Order of 21 May 1921, regulates the use and rights to common pasture in state forests. The Royal Decree or Dahir of 11 September 1934, established national parks as protected areas while maintaining the use-rights established earlier. This Dahir requires ministerial decrees for the establishment of parks. For example, Toubkal National Park (50km south of Marrakech), the first of the two national parks, was established on 19 January 1942. Ministerial decrees in 1962 and 1978, authorised the establishment of reserve areas that are to receive complete protection from commercial exploitation, grazing, building and hunting. Currently there are 13 nature and wildlife reserves (mainly wetlands), but unfortunately none meet international standards.

Utilization of wildlife is scheduled by the Dahir of 21 July 1923, which specifies which species can be hunted and during which period of the year. A ministerial order of 3 November 1962, gives rules for the preservation of endangered species, restricting the destruction of prejudicial species (Chapuis 1973). Hunting is prohibited permanently in the 80 permanent preserves (grazing and cultivating are allowed), while the ban is temporary in the biennial reserves. Biennial reserves are areas of the public domain which are closed for hunting on a 2-year rotational basis. Every two years, approximately one third of the public domain is classed as biennial reserve and closed to hunting. The goal of this management system is to maintain numerous game populations. In addition to the biennial reserves, there are 10 hunting reserves managed by private hunting societies (e.g. Sochatour), Royal Reserves (four of which are hunted each year), and reserved areas for dune repair, reforestation, control of soil erosion and protection forestry posts. The areas surrounding marabouts and other religious areas are also protected *de facto*.

Map 4.9.1. Locations of protected areas with Barbary sheep (*Ammotragus lervia*) in Morocco.

1) Ida ou Tanane (proposed national park, which includes existing game reserve SE of Tamanar); **2)** Tirardine Hunting Preserve (10,000ha; est. 1983); **3)** Takherkhort Nature Reserve (1,230ha; est. 1967); **4)** Toubkal National Park (36,000ha; est. 1934); **5)** Eastern High Atlas (proposed national park which includes an existing game reserve near Tounfite, SW of Midelt).

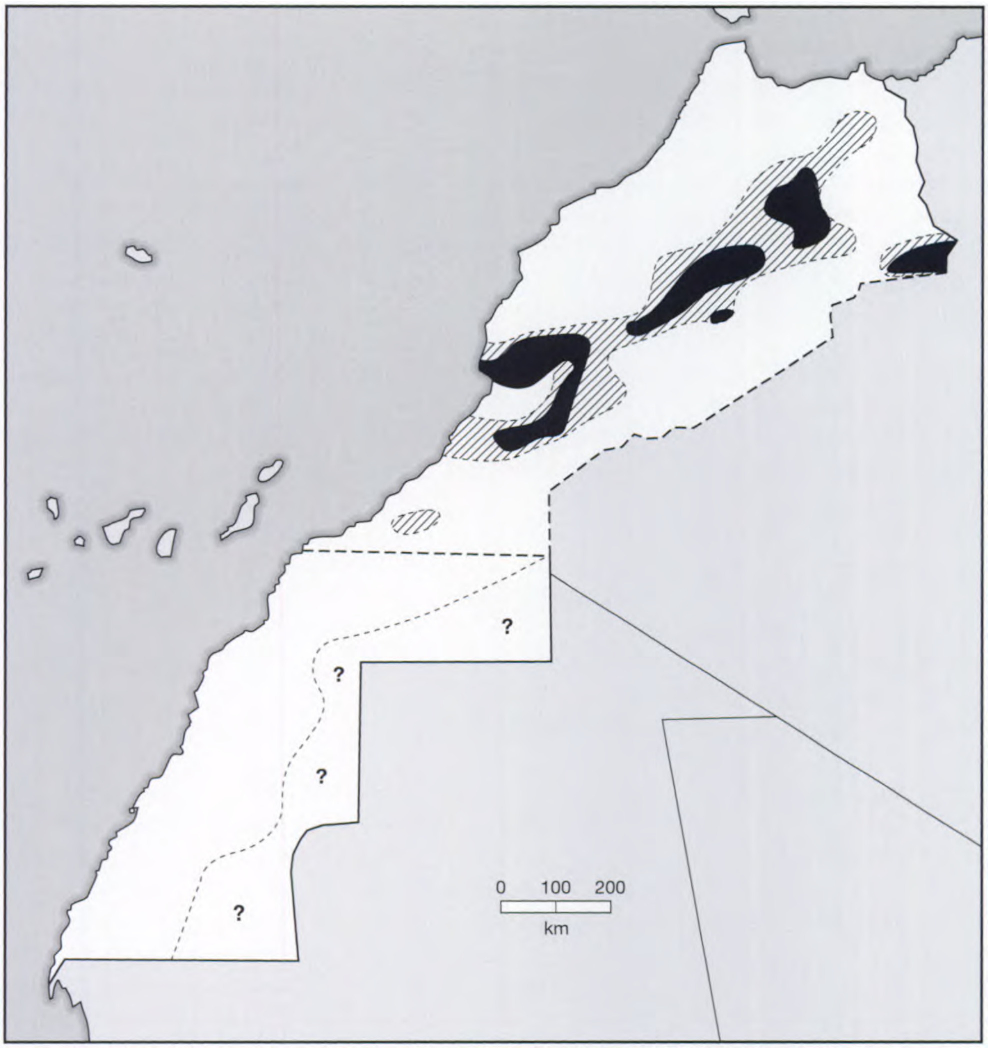
Each year, 1,600,000ha of reserved areas, 600,000ha of permanent hunting preserves, and 10,000,000ha of biennial reserves are protected in Morocco. Despite this, the current system of reserve and park management has only limited success in protecting large mammals from overgrazing by domestic sheep and goats which can quickly destroy natural habitats.

Economic constraints are so important that only supported programs with obvious and quick benefits are considered. In this way, the Ministry of Tourism became interested in national parks, and together with the Ministry of Agriculture, is studying ways to develop a tourist industry based on nature and wildlife. Barbary sheep occurs in four protected areas, all in Morocco (Map 4.9.1). While awareness is slowly growing in urban centres, an education program to explain the need to conserve the environment is urgently required for the rural population. The Société Marocaine du Droit de l'Environment (SOMADE) and the Association Marocaine de Protection de l'Environment (ASMAPE) are two non-government associations established to further conservation of natural resources. The reserve managed by the private organization, Sochatour, is planned to be developed for tours for foreign hunters.

General conservation measures proposed

Existing wildlife management strategies are currently unable to protect the wildlife resources of Morocco. Significant legislative and institutional changes are necessary. Most conservation legislation dates from the 1920s and is not adapted to the current demographic expansion and economic conditions. Existing wildlife conservation laws require updating, especially with regard to restriction of the use of public resources by rural inhabitants. It is also necessary to address the problem of law enforcement which will include better training and support for wildlife guards.

At the national level, the various administrative units should work co-operatively around the main authority of the Interior Ministry, and with the help of research institutions (e.g. Institut Scientifique, Institut Agronomique



Map 4.9.2. Distribution of Barbary sheep (*Ammotragus lervia*) in Morocco, including Western Sahara.

et Vétérinaire Hassan II, I.N.R.A., etc.). Locally, a single managing organization, collaborating with local and regional representative leaders and the main authorities in rural communes, should be mandated to manage and enforce rules and regulations. They should also be able to advise all activities inside and around each protected area.

Lastly, there is a clear need for a long-term education program to develop in the public an understanding of the need for wildlife conservation. Environmental education is essentially non-existent at the moment and it is vital that people come to realise that natural resources are not endless. This program should be addressed both to the urban and rural populations.

Species account

Barbary sheep (*Ammotragus lervia*)

Distribution: Found scattered throughout most main mountain regions except the Rif (Map 4.9.2). Barbary sheep occurs in small dispersed populations in the ranges of the Middle Atlas (Jbel Bou Nasser, Jbel Taghioult and Jbel Bou Iblane) and in the Figuig region (Jbel Grouz and Jbel Maiz). The highest densities occur in the eastern High Atlas around Jbel Ayachi south to Todgha gorges, and in the western High Atlas at Takherkhort near Jbel Toubkal. Small populations still survive in the central High Atlas and in the Haha region at the extreme west of this range (Aulagnier and Thévenot 1986b). In the Anti Atlas, some animals are reported from Jbel Siroua and small herds have been observed quite frequently near Igherm and Anezi (Lamsalli, *in litt.* 1988; Mellado 1989). There have been no reliable reports from Western Sahara since the surveys of Morales Agacino (1949) and Valverde (1957), but the species is probably still extant in the Oued El Dahab according to soldiers stationed there.

Population: The total population in Morocco is estimated to be between 800 and 1,000 animals. No estimates are available for Western Sahara.

Threats: Barbary sheep was quite abundant and widespread at the beginning of this century (Panouse, 1957), but has since declined due to overhunting with modern firearms, poaching, feral dog predation in the recent past, and especially today, to habitat destruction. The expanding human population's needs for more timber and food reduce available habitat, as logging, crops and grazing ascend into mountainous areas. In the Western Sahara, hunting by soldiers is a serious threat, and here the species may already be extinct (Valverde 1968).

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Since 1958, the annual ministerial order regulating hunting has severely restricted taking Barbary sheep. For example, in 1961 the species could be hunted for only three days, and only one day in 1966. Since 1966, the species is fully and permanently protected.

Barbary sheep occur in four protected areas in Morocco (Map 4.9.1). Takherkhort Hunting Reserve was established in 1967 to preserve the species. This reserve of 1,230ha is situated in the western High Atlas mountains and is adjacent to Toubkal National Park. Although around 350 to 400 animals occupy the hunting reserve, grazing by livestock is a serious threat. Animals from the reserve have been used for re-introductions to other areas. One of these areas was Sochatour's Tiradine Hunting Reserve in the western High Atlas near Amizmiz. The native vegetation is evergreen oak forest, and the Barbary sheep is reported to be reproducing and numbered around 70 animals in 1990. Barbary sheep also inhabit a number of other hunting reserves, most of which are so small that they are occupied only seasonally and have little significance for conservation of the species. It also occurs in Toubkal National Park but at low density. In 1986, the Moroccan Ministry of Tourism and the U.S. National Parks Service Joint Evaluation Team reported that the park was of international importance for the protection of Barbary sheep habitat along with other flora and fauna. Environmental education programs are planned within the park, but more staff are required to control livestock grazing within its boundaries. Before creation of the proposed Eastern High Atlas National Park, the provincial authority of Er Rachidia supported the protection of Barbary sheep within its jurisdiction, by establishing a network of guards in 1987. Recent reports indicate the population of just less than 100 individuals is reproducing and increasing in numbers.

Status within country: Vulnerable in Morocco; Indeterminate in Western Sahara.

Conservation measures proposed: 1) Survey to determine status and distributions in Western Sahara. **2)** Increase the number of protected areas. The project of an Ida-ou-Tanane National Park (Guillaume and Bons 1975) unfortunately failed, but it is to be hoped that the more recent project of the Eastern High Atlas National Park (created for the conservation of Barbary sheep) will succeed. Among the most valuable and interesting natural places where Barbary sheep need protection, three or four national parks or permanent reserves can be proposed: Jbel Grouz and Jbel Maiz (arid hills near Figuig), Jbel Bou Iblane or Jbel Bou Nasser (eastern Middle Atlas), and some area of rocky argan bush in the Anti-Atlas (between Igherm and Tata). One national park could be also of great value in the central part of Western Sahara (Oued Ed Dahab Province). **3)** Hunting and grazing should be strictly forbidden in protected areas. **4)** Employ a sufficient number of wildlife guards to enforce regulations effectively.

4.10 Niger

C.D. Magin and J. Newby

Introduction

The Republic of Niger is one of the largest countries in western Africa encompassing approximately 1,200,000km^2. Its topography is dominated by arid highlands, and by desert which covers approximately 60% of the country. In the northeast are a series of high plateaus, the Plateaux du Djado, de Magueni and du Tchigai, which link the Ahaggart mountains of Algeria with the Tibesti mountains of Chad. In the north central part of the country, the Massif de l'Aïr rises to around 1,800m asl with its highest point Mount Greboun at 2000m. To either side of the Massif is the Nigerian Sahara, and to the south extending along the Niger river and the border with Nigeria are lower plateaus, ending at the Lake Chad basin in the extreme southeast corner of the country. The rainy season in the south occurs between June and October and an average of 560mm falls each year. Only about 30% of Niger is savannah, and in the rest of the country desert conditions prevail. The Niger river basin in the southwest corner of Niger is the only really fertile region.

Current status of Caprinae

The single species of Caprinae in Niger is the Aïr Barbary sheep (*Ammotragus lervia angusi*). The species is confined to the desert mountains and hills north of the 100mm isohyet in the region defined geographically as the climatic Sahara. In the Aïr mountains, the Barbary sheep occupies two habitat types: the rocky foothills between 600 and 800m asl, and the rugged mountain massifs 600 and 2,100m asl. The Barbary sheep is well adapted to the inhospitable environment it occupies, but because of human activities it is now considered Vulnerable, particularly outside the one protected area it inhabits.

General conservation measures taken

All hunting in Niger has been banned since 1964, although it has not been widely enforced. The agency responsible for wildlife conservation and management of protected areas is the Direction Faune, Pêche et Pisciculture of the Ministère de l'Hydraulique et de l'Environnement.

The Barbary sheep only occurs in one protected area in Niger, in the vast Réserve Naturelle Nationale de L'Aïr et du Ténéré, in north-central Niger (Map 4.10.1). Created in January 1988, the reserve covers 7,737,000ha of Saharan desert and Sahara-montane habitat. The reserve may harbour as much as 70% of the total population of Barbary sheep in Niger and theoretically should be adequate to ensure conservation of this species in Aïr. The management of the reserve was supported by a joint WWF/IUCN conservation and development project until 1992, when guerrilla action by Tuareg rebels forced its suspension. Since government personnel withdrew, local people under tribal leaders formed a Provisional Committee to assume responsibility for its management (Hislaire 1994). Populations of Barbary sheep elsewhere in Niger are not adequately protected however, and further measures are required.

Two recently formed Nigerien non-government organizations, the Organisation Nigerienne des Voluntaires pour la Protection de l'Environnement (ONVPE) and the Alliance Niger Vert (ANV), are concerned with all aspects of environmental protection including wildlife. In the future, these NGO's could support Caprinae conservation by raising public awareness.

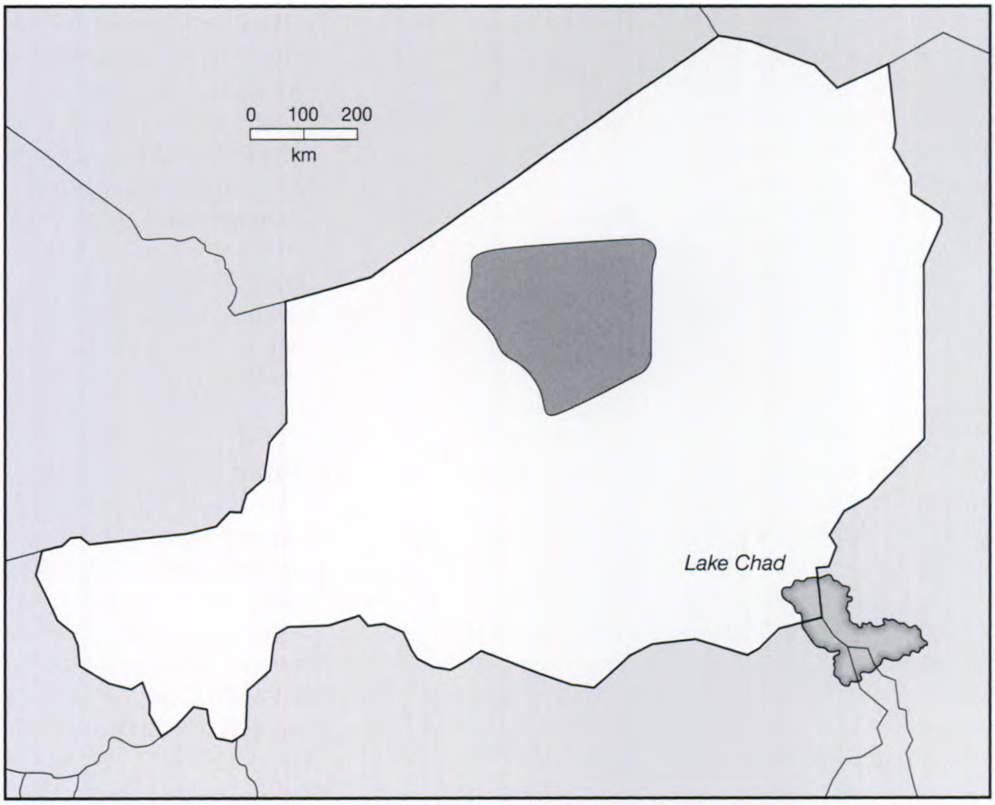
Species account

There are two reports on the ecology of Barbary sheep in Niger (Magin 1990b; Watkins and Watkins 1986), while general information is summarised by Gray and Simpson (1980) and Gray (1985).

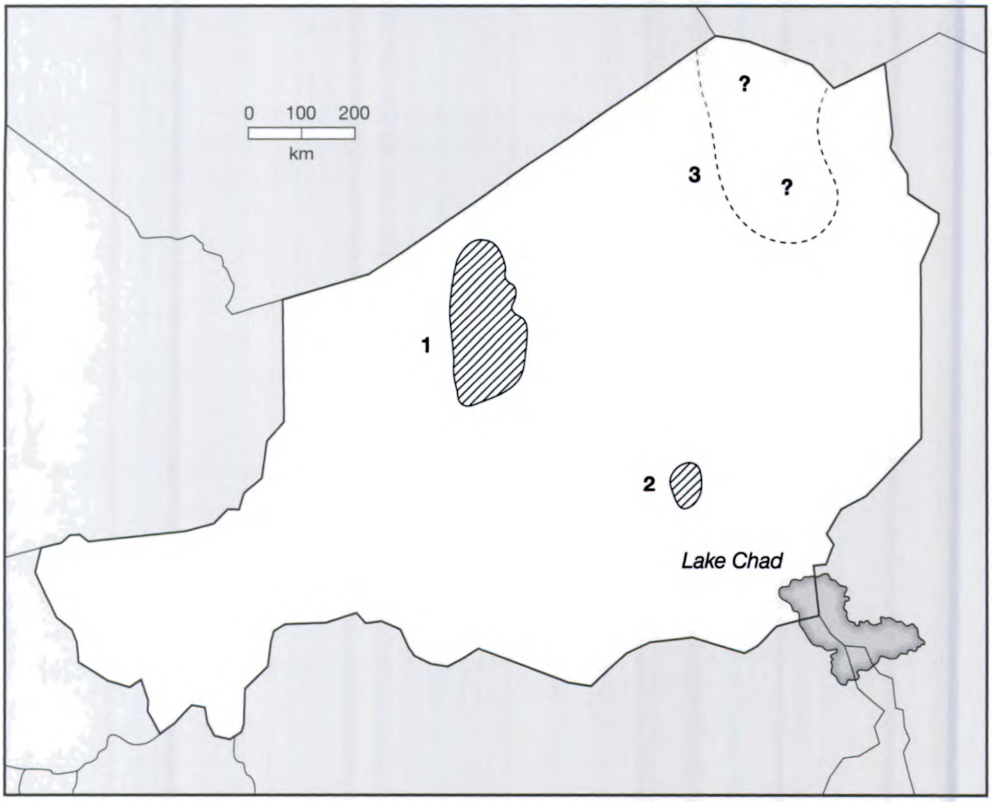
Aïr Barbary sheep (*Ammotragus lervia angusi*)

Distribution: Occupies all the massifs of the Aïr mountains between approximately 8° and 10°30'E, and 17° and 20°30'N, except for Adrar Madet (10°30'E, 18°40'N). Also found on the isolated Massif of Termit (11°20'E, 16°N), and though not confirmed, it probably occurs on the Djado plateau in the northeast of the country (Map 4.10.2).

Population: No censuses have been made and only approximate estimates (Magin 1990a) are available for the Aïr and Ténéré National Nature Reserve (3,500 animals) and outside the reserve (700). Populations in protected areas in the Aïr mountains appear to be increasing, but for the country as a whole the population trend is overall downward.



Map 4.10.1. Location of the Aïr and Ténéré National Nature Reserve (7,737,000ha; est. 1988), the only protected area in Niger with Aïr Barbary sheep (*Ammotragus lervia angusi*).



Map 4.10.2. General and suspected distribution of Aïr Barbary sheep (*Ammotragus lervia angusi*) in Niger.

1) Aïr mountains; **2)** Massif de Termit; **3)** Plateau du Djado.

Threats: Drought poses the major threat to the species in Niger, but there are also problems posed by low-level subsistence hunting by local Tuareg, poaching by military personnel, and disturbance caused by tourists.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. All hunting has been banned since 1964 and though this law is enforced by the Nigerien Forest Service, the vast range occupied by the Barbary sheep, together with manpower limitations and political unrest, limit the effectiveness of anti-poaching efforts. Approximately 70% of the total population in Niger inhabits the Aïr and Ténéré National Nature Reserve.

Status within country: Vulnerable.

Conservation measures proposed: Once hostilities have ceased in the area, the first need will be **1)** to reassess the status of Barbary sheep in the Réserve Naturelle Nationale de L'Aïr et du Ténéré. After this has been determined, four areas will require developing if Barbary sheep conservation is to be improved. **2)** Provide additional support to the Forest Service in terms of manpower and equipment so that it can fulfil its role of enforcing anti-poaching laws. **3)** Provide support for the conservation education program aimed at the pastoral Tuareg populations in the Aïr region, that is carried out by extension workers and via publication of an environmental education bulletin. **4)** Extend the Protected Areas System to include the Massif de Termit in the southwest of Niger. **5)** Carry out a population census and survey of conditions on the Plateau du Djado as soon as possible to complete and update our knowledge of the status of Barbary sheep in Niger.

4.11 Sudan

M.B. Nimir

Introduction

The Democratic Republic of the Sudan is the largest African country, covering 2,503,890km^2 or more than 8% of the continent. It consists of an immense plain dissected into two unequal parts by the River Nile which runs the entire length of the country from south to north, a distance of 2,258km. The river's headwaters fill southwestern Sudan, and the whole of the central and southern region is a clay plain whose centre is comprised of a vast swamp, the as-Sudd. The as-Sudd is the most important interior wetland in all of Africa with a permanently flooded area of approximately 16,500km^2, which can increase seasonally by an additional 15,500km^2 (IUCN 1989a). The central region also contains isolated mountains or inselbergs which rise abruptly from the plain, the largest group of which form the Nuba mountains (Jibal an-Nubah). Along the southern border with Uganda, the Imatong mountains rise more than 3,000m asl. The Dafur highlands in the centre of Sudan form the western border of the plain, from which rise the volcanic Jabal Marrah, reaching altitudes of between 900 and 3,000m asl. The northern and western extensions of the plain are covered by vast areas of sand dunes and broken, flat-topped, sandstone plateaus ranging around 1,400m asl. They include the Erdi plateau in the northwest and the Jabal Abyad plateau in the north. The Nubian desert lies to the east of the River Nile in northeastern Sudan. It is separated from the narrow coastal plain by the rugged Red Sea hills, an uplifted escarpment with an average elevation of around 2,000m.

The climate ranges from a tropical continental type in the northern desert region to an equatorial one in the south. Rainfall varies from less than 25mm in the desert to more than 1,500mm per year in the extreme south, and falls primarily between April and November. There are five main vegetation zones which correspond to the distribution of rainfall. The northern desert regions form about 25% of Sudan, followed by semi-desert, low and high rainfall savannah grasslands with inland floodplains, and finally mountain vegetation.

Current status of Caprinae

Both indigenous species of Caprinae are threatened in the Sudan. The Kordofan Barbary sheep (*Ammotragus lervia blainei*) is also known in the country by the Arabic names "El Kabsh El Wahshi" and "Kabsh Mai", and as "Al Nakar" in the Heidandwa language of eastern Sudan. This species used to be relatively widespread from western Sudan to the Red Sea coast. They existed in considerable number in the Sabaluka hills which lie about 100km north of Khartoum on the western bank of the Nile. However, this population was completely annihilated by Mahmoud Wad Ahmed's troops during the Mahdist Revolution in 1898. Forbes (1949) reported that seven Barbary sheep were reintroduced into the Sabaluka hills around 1920, and estimated their numbers to have reached 100 by 1949. Recent surveys in the area could find no evidence of their presence. Today, it is endangered, and may still exist within the Red Sea hills of eastern Sudan. Even as recently as the 1970s, the species was more widely distributed, occurring in the Meidob hills of Northern Dafur, in the hill region west of Dongola in the Northern Province, and in the Sablouka area in the Nile Province.

The Nubian ibex (*Capra [ibex] nubiana*), called "Al Aio" in Heidandwa, still occurs in several locations within the Red Sea hills, from the Sudanese-Eritrean border in the south, to the Sudanese-Egyptian border in the north. Some of these areas may still contain viable populations, but overall the species' status is Indeterminate.

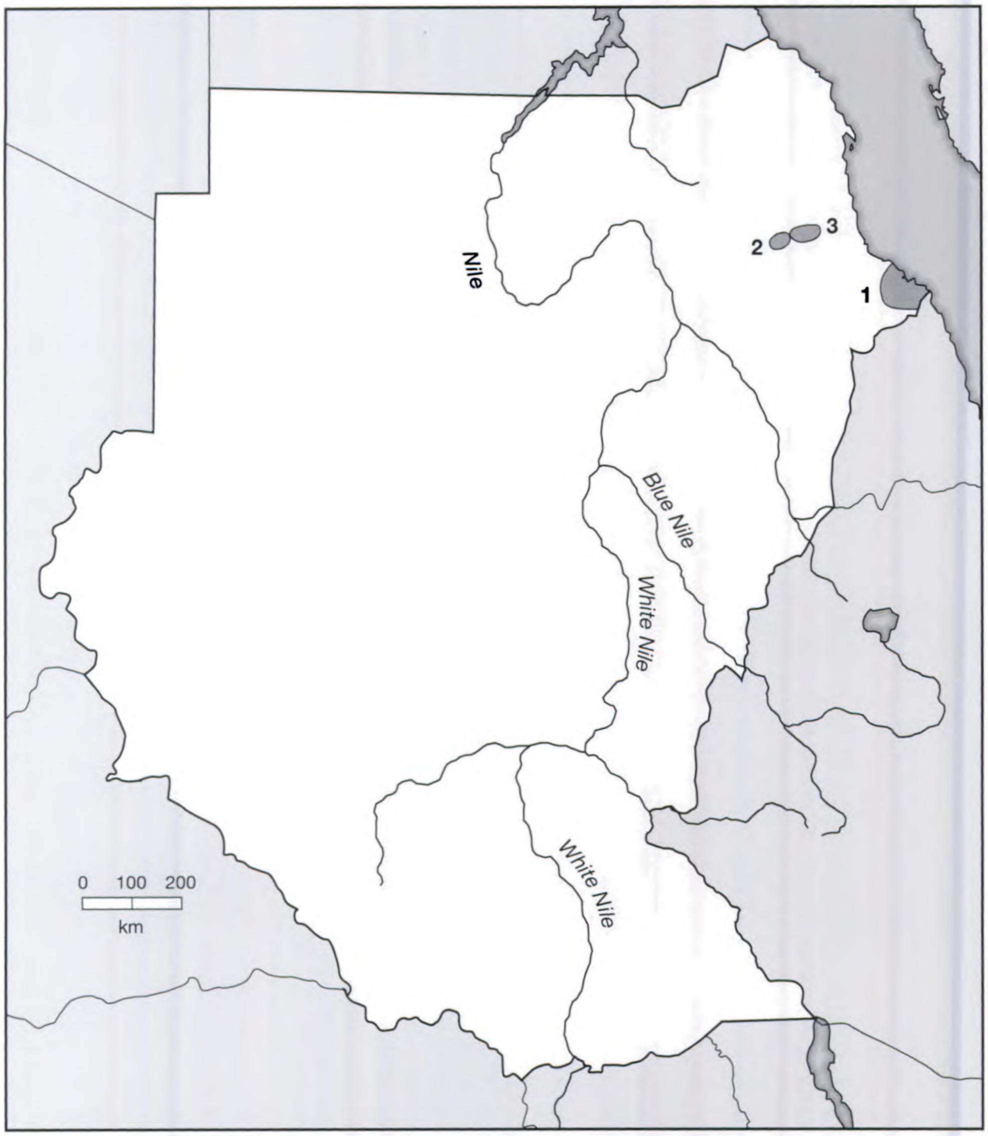
General conservation measures taken

The Wildlife Conservation Act of 1939, as amended in 1985, includes articles for the protection of animals, hunting laws, trade in wild animals and their parts, and protected areas. Animals listed in Schedule I of this Act are strictly protected (no hunting or capture allowed except for scientific purposes), while species included in Schedule II (which includes both species of Caprinae) could be hunted under special licence. Species in Schedule III can be hunted with an ordinary hunting licence. A hunting ban imposed in the Sudan in 1989 and extended until December 1991, was lifted in January 1992. The exact number of animals killed since the ban was lifted is not known, but believed to be low.

The Wildlife Administration (WA), previously known as the Wildlife Conservation Forces (WCF) of the Ministry of Interior, is the governmental agency entrusted with wildlife conservation in the Sudan. It was originally conceived as a licensing and policing body and had been staffed as such. The amended Ordinance for the Protection of Wild Animals enables the WA to establish national parks, game sanctuaries and game reserves. Access to protected areas is restricted to holders of entry permits issued by the Minister of Interior or the Director of the Wildlife Administration. Hunting is prohibited in national parks and in game sanctuaries, but may be permitted in game reserves only under the authority of a special permit issued by the Director of the WA. Residence, cultivation of crops, and pasturing domestic animals is only allowed in game reserves with permission of the Director. However, enforcement of laws governing protected areas is a serious problem.

Protected areas cover approximately 3.7% of the Sudan, but unfortunately most of them are in the southern part of the country where Caprinae do not occur. The Sabaluka Game Reserve (29,000ha) was established in 1923 in the Nile Province primarily for the protection of Barbary sheep, and although the reserve still exists, the species no longer occurs in it. Nubian ibex does still occur in at least three protected areas (Map 4.11.1). The Wildlife Research Centre (WRC) of the Ministry of Agriculture, had been involved in surveys and in suggesting conservation measures to the WA. Reports by the Centre form the basis of this report (WRC 1989, 1990).

Between 1980 to 1985, from 10 to 44 hunting licences were issued annually for hunters to kill Nubian ibex in the Red Sea region. Licences continued to be issued until 1989, despite a 3-year hunting ban introduced in 1988. Due to prior commitments with foreign hunters, hunting Nubian ibex was excepted from the ban in 1989. Neither the number of licences issued, nor the areas open for hunting, were based on any scientific surveys to determine if hunting could



Map 4.11.1. Locations of Protected areas with Nubian ibex (*Capra [ibex] nubiana*) in the Sudan.

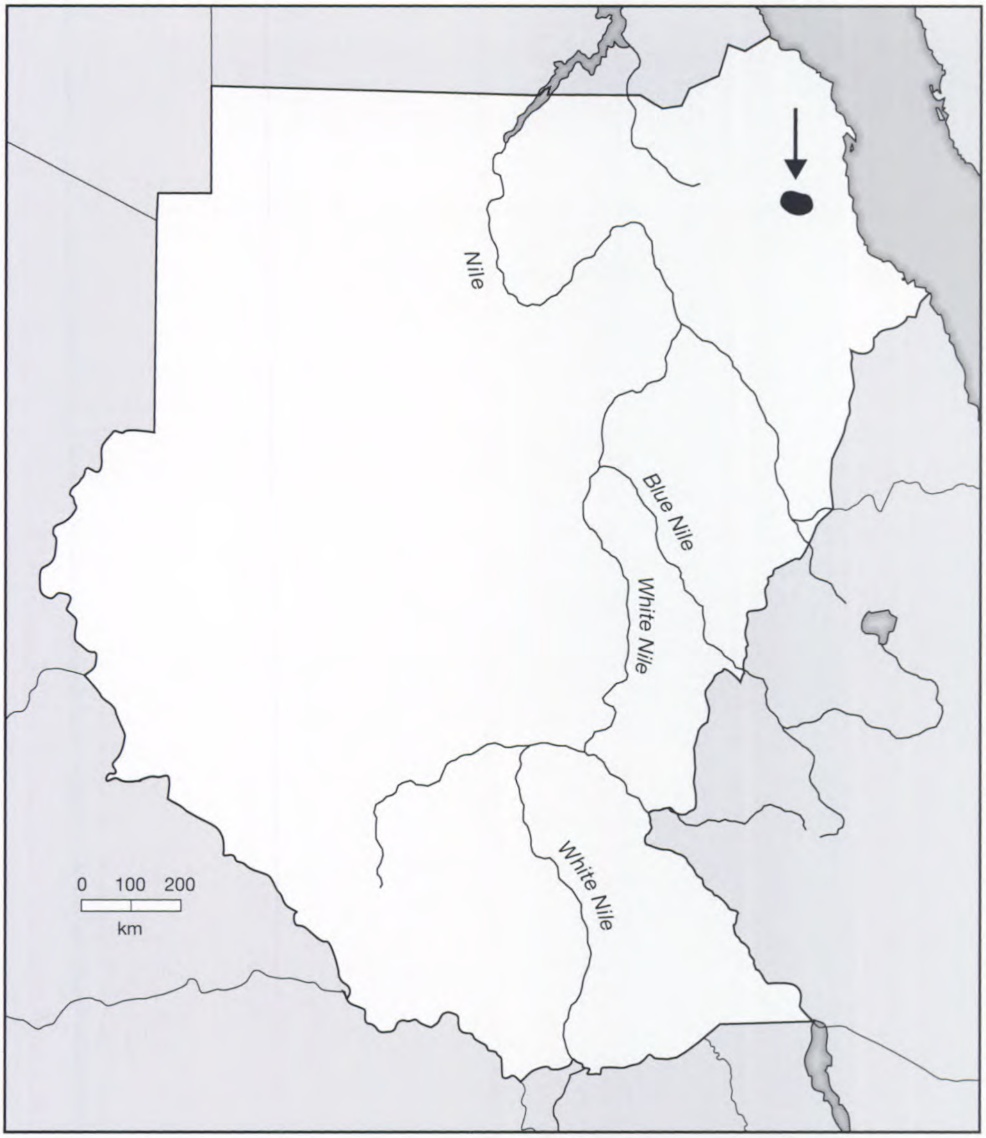
1) Tokar Game Reserve (725,200ha; est. 1939);
2) Sinkat-Erkawit Game Sanctuary (23,000ha: est. 1939);
3) Erkawit Game Sanctuary (81,300ha; est. 1939).

be sustained by the populations. Poaching is also practised by nomads who hunt with dogs and traditional weapons. According to the Wildlife Laws, both sheep and ibex can be hunted with an ordinary hunting licence. Since January 1992, both ibex and Barbary sheep can be legally hunted again with a special hunting permit.

One area, Gebel Elba Conservation Area, is regarded as a major site for the preservation of North African fauna (Goodman 1985). However, it falls into the disputed Sudan Government Administration Area along the border between the extreme southeast corner of Egypt and the northeast part of the Sudan. The Sudan and Egypt are currently negotiating the future of this area, and settlement of this dispute will be required before any form of legislation is realised. Hunting, although banned in the protected area, does take place in at least one section of this region because neither government claims authority over it. Barbary sheep may be extinct in this region but Nubian ibex are believed to still inhabit it (Goodman 1985).

General conservation measures proposed

The Wildlife Administration (WA) was originally established and operated as a licensing and policing body, but today it would be more appropriate if it were to develop into a technical, natural resources conservation management agency. As such it should become responsible and actively concerned with the management of habitats and animal populations. Currently, the WA, with its limited manpower, expertise, funds and working facilities, concentrates its efforts in the country's national parks, and, as in other protected areas, is able to keep only a minimal presence in the three with Caprinae in the Red Sea Province. Conservation in these three areas is consequently unsatisfactory. For example, the WA has been unable to enforce conservation in Tokar Game Reserve and as a result the area has experienced drastic destruction of habitats and wildlife (Hashim and Nimir 1978). Dasmann (1972) stated that the most serious



Map 4.11.2. Distribution of Kordofan Barbary sheep (*Ammotragus lervia blainei*) in the Sudan.

limitations of game reserves in the Sudan were that they were open to human settlement, cultivation and heavy use by livestock. Like Tokar Game Reserve, the Erkawit and Sinkat-Erkawit Game Sanctuaries were seldom patrolled and were subjected to overgrazing and destruction of shrubs. A new leadership of WA was appointed in 1991, and a new policy was declared which could improve the status of conservation management in the country. However, current internal conflicts offer little hope that this will occur soon.

Species account

Kordofan Barbary sheep (*Ammotragus lervia blainei*)

Distribution: Goodman (1985) reported the presence of Barbary sheep in the hills around Beja north of Atbare, the hills west of the Musmar station, the hills of North Kordofan and North Dafur, near Jebel Meidob and Sabaluka. Although all areas reported by Goodman (1985) used to be inhabited by sheep, there have been no recent sightings. Today, the species is probably restricted to the Red Sea hills of eastern Sudan. The only recent, reliable sightings have been made in the scrub area near Jebel Egrim, at about 19°N and 35°E. Surveys made in 1990 in Sablouka, found no sheep left even in the game reserve. No other recent surveys have been made in other areas that until the 1970s still contained some of the animals (Map 4.11.2).

Population: There are no population estimates available, but the species is generally regarded as very rare (Newby 1981) and almost certainly declining.

Threats: Major threats include poaching, and destruction or loss of habitat from livestock grazing and from drought and desertification.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Barbary sheep fall under Schedule II as a protected species, though up to two can be shot by anyone with a class A or D licence (Gray 1985). None occur in any protected area in the Sudan, but until 1992, two adult females and one adult male were kept in Khartoum Zoological Gardens. In 1992, the male and one female died of contagious pleuro-pneumonia, and the remaining female together with her twins were transferred to San Diego Zoological Park (U.S.A.). It is not known whether any Barbary sheep are kept in Medani Zoo Park.

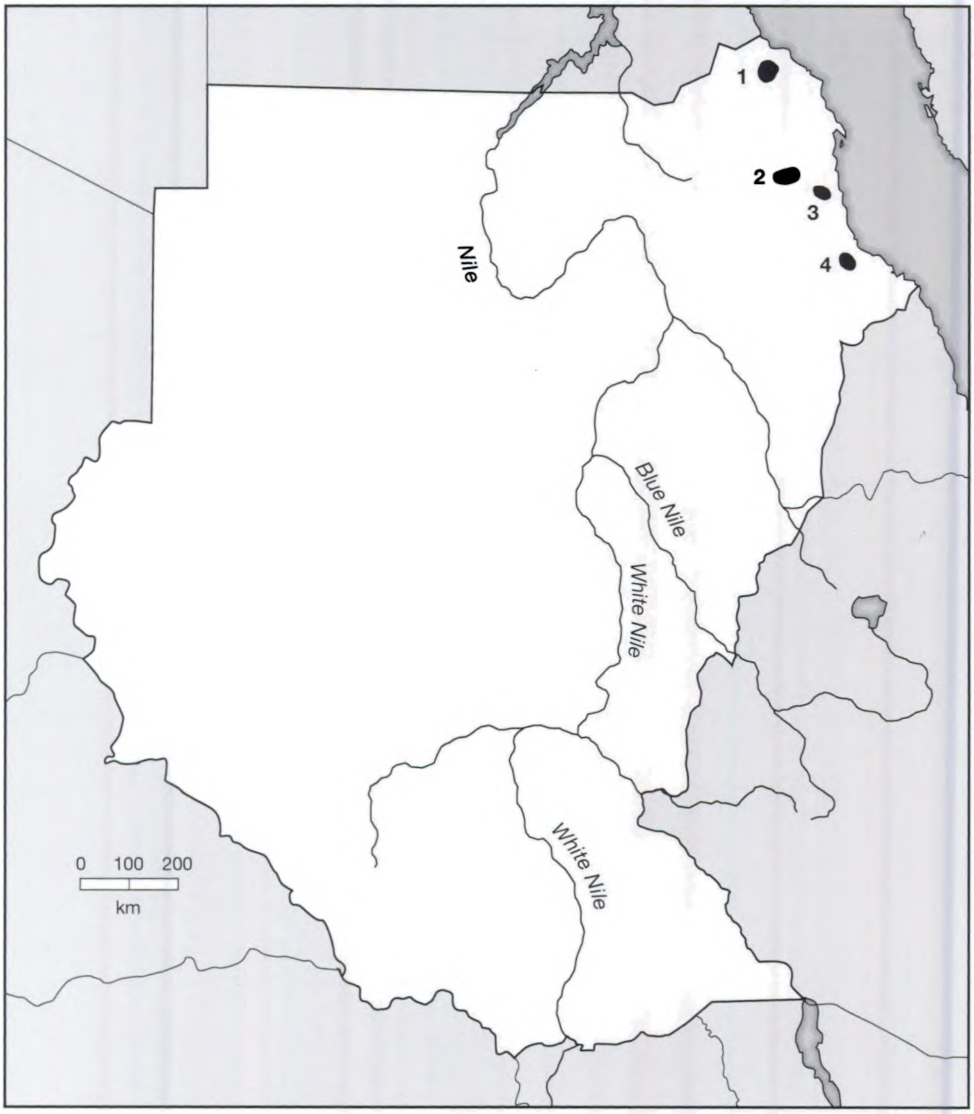
Status within country: Endangered.

Conservation measures proposed: 1) Move Barbary sheep to Schedule I so that it is completely protected; this is urgent. **2)** Make surveys to determine current distribution together with population censuses before future conservation plans can be drawn up. **3)** These plans should include the re-introduction of Barbary sheep to remaining areas and habitats which are suitable.

Nubian ibex (*Capra* [*ibex*] *nubiana*)

Distribution: The most recent surveys (January–February 1990) located small ibex populations in several areas within the Red Sea hills. These included the Erkawit hills, Jebel Ashet southwest of Suakin, and Sherik Jebel southwest of Tokar. Recent reliable reports indicate they may also occur in the hills further north as far as the Jebel Elba area on the border with Egypt (Map 4.11.3).

Population: No population estimates are available, but the populations are considered to be generally declining.



Map 4.11.3. Distribution of Nubian ibex (*Capra* [*ibex*] *nubiana*) in the Sudan.

1) Jebel Elba; **2)** Erkawit; **3)** Jebel Ashet; **4)** Jebel Sherik.

Threats: Threats include poaching and to a lesser extent habitat loss.

Conservation measures taken: Nubian ibex is listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and is included as a Schedule II species under the Wildlife Conservation Act; however, enforcement is not very effective. It occurs in three protected areas along the Red Sea coast: in the Erkawit and Sinkat Sanctuaries, and in the Tokar Game Reserve (Map 4.11.1). Ibex hunting was permitted prior to 1989, before being banned. In January 1992, the ban was lifted and they can now be hunted under special licence.

A total of six Nubian ibex used to be kept in Khartoum Zoological Gardens, together with a Walie ibex (*Capra* [*ibex*] *walie*). The Walie ibex together with two male and two female Nubian ibex were recently shipped to San Diego Zoo. The remaining two adult males and one adult female all died, but two sibling offspring have survived, one male and one female who is now pregnant. Medani Zoo Park holds six Nubian ibex in captivity.

Status within country: Indeterminate.
Probably Vulnerable.

Conservation measures proposed: 1) Increase protection to effective levels, especially in the protected areas. **2)** Place the species in Schedule I to ensure its full legal protection. **3)** Carry out the Sudan Government's proposed population estimate and ecological studies, so that a comprehensive conservation management plan for Nubian ibex can be developed.

4.12 Tunisia

K. de Smet

Introduction

The Republic of Tunisia occupies 154,530km² on the Mediterranean coast between Algeria and Libya. In the extreme northwest, lie the sandstone Kroumirie mountains, with the Mogods along the north coastline. Below these and separated by the fertile Majardah (Medjerdja) valley, run the Dorsale, the northeast extensions of both the Atlas Saharien (Tell Atlas) and Haut Atlas mountain ranges from Algeria. Here, peaks range up to a maximum of 1,544m on Jabal as-Shanabi (Djebel Chambi) on the border with Algeria. South of the Dorsale is a high steppe between 180 to 458m asl, traversed north-south by lower mountain ranges. The steppe extends further south at lower elevations, followed by a region of salty lakes or "shatt", and finally the southern part, which is desert.

Annual rainfall varies considerably from 1,000mm in the northwest to less than 50mm in the extreme south. On average, northern Tunisia receives about 400mm of rain, while the steppe region gets between 150 and 406mm; most of the rain falls between mid-autumn to mid-spring. Cork oak forests grow on the slopes of the Kroumirie mountains, and grasslands with typical grasses (*Lygeum, Aristida* and *Stipa*) grow on the steppes.

Current status of Caprinae

The Barbary sheep or aoudad (*Ammotragus lervia*) is the sole representative of the Caprinae in Tunisia. It used to occur throughout the Atlas mountains (Gouttenoire 1954); there the Barbary sheep in Tunisia is classed as Endangered, although the species is fully protected and is found in three protected areas (Map 4.12.1).

Map 4.12.1. Protected areas with Barbary sheep (*Ammotragus lervia*) in Tunisia.

1) Djebel Chambi National Park (6,723ha; est. 1980), **2)** Djebel Bou Hedma National Park (16,488ha, with 4,000ha fully protected; est. 1980); **3)** the proposed Dghoumes National Park.

General conservation measures taken

Conservation legislation in Tunisia began in 1884 in order to regulate hunting. Current legislation is based on the forestry code (code forestièr) Law No. 66-60. Protected areas are the technical and administrative responsibility of the National Parks Service and the Direction de l'Environment, both in the Ministère de l'Agriculture, and include national parks and permanent reserves. National parks are based on internationally recognised criteria. They are established by Presidential decree, following recommendations by the Ministry of Agriculture. Legislation regarding permanent reserves is covered under Law No. 66-60, and the purpose of this type of protected areas is to provide strict protection for game species in natural habitats. There are at least five different types of permanent reserves: Réserve Naturelle Intégrale, Réserve de Chasse Permanence, Réserve à Gazelle, Enclos à Cerf, and Enclos à Reproduction. Species can be released to stock reserves, some of which are fenced. Hunting can take place in Réserves de Chasse with written permission. Legislation for reserves is in need of revision, but their management is effective and well controlled. By contrast, the effectiveness of national parks is sometimes hampered by intensive settlement, by heavy grazing pressure and by fuelwood gathering, despite being illegal. The Forestry Department is fencing some of the national parks in an attempt to deal with these problems (IUCN 1992a).

There are several Tunisian non-government organizations actively involved in wildlife research and conservation. These include the Association Tunisienne pour la Nature et de l'Environment, the Association des Amis des Oiseux, Fédération Nationale des Associations de Chasseurs, Conseil Supérieur de la Chasse, the Institut de Recherches Scientifiques et Techniques of the University of Tunis, and the Institut National de Recherches Forestières

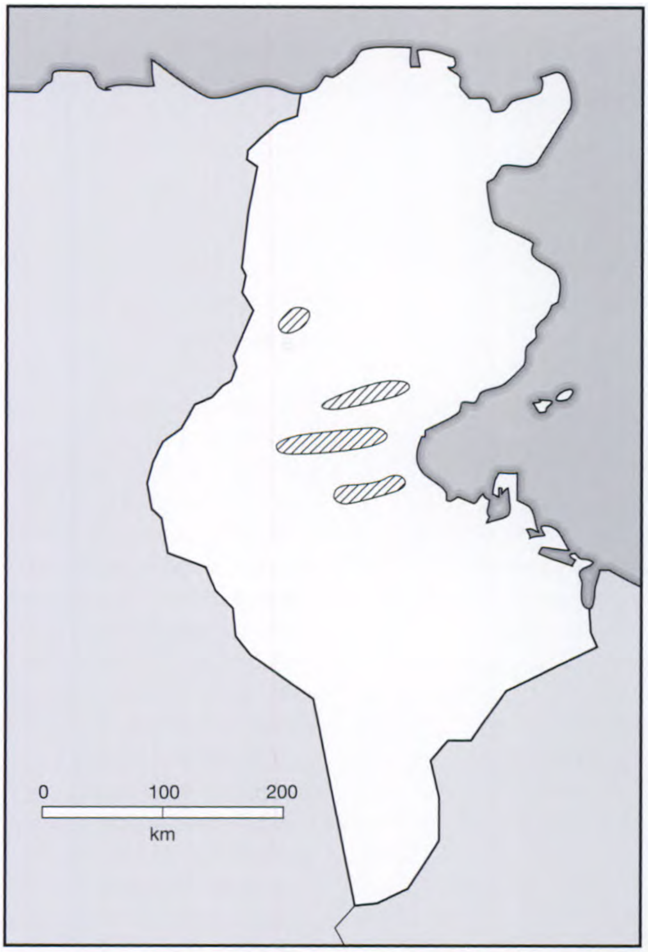
Species account

Barbary sheep (*Ammotragus lervia*)

Distribution: Previously found throughout the Atlas mountains and foothills, today probably all but wiped out from central Tunisia. Atlas Barbary sheep (*A. l. lervia*) may still existed in small numbers at Foum El Khanga near Tamerza, and at the border with Algeria near Tebessa. In 1994, de Smet (1994, pers. obs.) confirmed their presence in the mountains between Djebel Orbata (Gafsa) and Djebel Bou Hedma, and in the mountains north of Chott El Djerid and Chott El Fedjadj, while Forest Service personnel at Kebili (1994, pers. comm. to K. de Smet) also reported Barbary sheep still surviving in the Djebel Tebaga, just south of Chott El Fedjadj. The subspecies to which the latter population belongs is not clear. In southern Tunisia, the Libyan Barbary sheep (*A. l. fassini*) was formerly found near Foum Tatahouine. Its distribution starts 100km further south, in the mountains south of Remada, and runs at least as far south as Bordj Bourgiba, with small herds in Djebel Segdel and Merbah Safsaf (Map 4.12.2). Barbary sheep may be better

K. de Smet

Libyan Barbary sheep (*Ammotragus lervia fassini*) in captivity at Djebel Bou Hedma National Park, Tunisia. The large neck ruff and leg chaps of these adult males give rise to the Barbary sheep's French name of "mouflon à manchettes".



Map 4.12.2. General distribution of Barbary sheep (*Ammotragus lervia*) in Tunisia.

off in this southern region because they were hunted less frequently there (Gray 1985).

Population: There are no recent, reliable estimates available for population numbers or trends.

Threats: Poaching, and loss of forage and habitat due to domestic animal grazing.

Conservation measures taken: Barbary sheep has been protected by law since 1966. It is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. The Direction des Forêts is involved in a re-introduction program for the larger species of endangered animals, including Barbary sheep. This program has the technical assistance of the WWF and various European zoological organizations (IUCN 1992a). A re-introduction of Barbary sheep into the Djebel Chambi National Park (Map 4.12.1) began in 1987, when 10 animals, originally from Kasserine, were released into a 1ha enclosure for later release into the rest of the park. Some of these animals escaped in 1988. Three males, five females, and juveniles belonging to *A. l. lervia* from Foum Tatahouine are held in captivity in the Djebel Bou Hedma National Park (Map 4.12.1), in the Bou Hedma ranges of the Atlas Saharien. In 1994, three animals (one male, one female and one young), originally from the Tunis Zoo, escaped from their pen into the surrounding area of Bou Hedma National Park. Animals are also believed to occur in the proposed Dghoumes National Park (Map 4.12.1).

Status within country: Endangered.

Conservation measures proposed: 1) Prohibit all hunting of Barbary sheep, and **2)** control overgrazing by livestock in mountain regions. **3)** Conduct systematic population surveys throughout the Barbary sheep's range in Tunisia, with perhaps the status of the population south of Foum Tatahouine a first priority. **4)** Ensure establishment of the new desert national park 50km east of Tozeur at Dghoumes (Map 4.12.1). This area and the rest of the mountain chain north of the Chott El Fedjadj and Chott El Djerid, are considered good Barbary sheep habitat. **5)** Reconsider the suggestion to release Barbary sheep into Sidi Toui National Park because the topography is probably too flat to be suitable for them.

4.13 Regional summary

C. Alados and D.M. Shackleton

Caprinae distribution and abundance

Of the three Caprinae found in Africa, the Barbary sheep (*Ammotragus lervia*) is the most widespread, being scattered throughout the various mountain ranges north of 15° latitude. Of the other two, Nubian ibex (*Capra* [*ibex*] *nubiana*) is found only in a few scattered populations, primarily in the southern Sinai peninsula but also along the hills of the Red Sea coast at the edge of the Eastern desert of Egypt and along the northwestern coastal mountains of Egypt and Sudan. It may also occur in Eritrea but its status there is uncertain. Walia ibex (*Capra*[*ibex*] *walie*) is restricted to the Simen mountains of Ethiopia. All three taxa are threatened to some degree, but there are no recent estimates of numbers for any country (Table 4.13.1).

Conservation problems

All three species of Caprinae are threatened by the need for land and natural resources by the continent's own growing human population, and from the world-wide demand for resources. Overall, the two major threats are habitat

Table 4.13.1. Summary of conservation status (category of threat[1]) of Caprinae within countries in the African Region.

Taxon	Algeria	Chad	Egypt	Eritrea	Ethiopia	Libya	Mali	Mauritania	Morocco	W Sahara	Niger	Sudan	Tunisia	1996 IUCN Red List[2]
Aoudad or Barbary Sheep *Ammotragus lervia* Ssp.	I	I	Ex[3]	I		I	I	I	V	I	V	E	E	VU A2cd Ex[3]
Nubian ibex *Capra [ibex] nubiana*	-	-	I	I	-	-	-	-	-	-	-	I	-	EN C2a
Walia ibex *Capra [ibex] walie*	-	-	-	-	E	-	-	-	-	-	-	-	-	CR C2b

[1] Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List of Threatened Animals (Groombridge 1993).
[2] Global category of threat listed in 1996 IUCN Red List of Threatened Animals (IUCN 1996); CITES: I = Appendix I.
[3] **Ex** refers to Egyptian Barbary Sheep (*Ammotragus lervia ornatus*) in Egypt.

destruction and poaching. Habitat destruction is primarily the direct outcome of overgrazing by domestic sheep and goats, that increases desertification by reducing vegetation cover, increasing soil erosion, and hence resulting in the loss of the natural habitat. Fuel-wood gathering, which removes shrubs and trees, is also another important cause of habitat and forage destruction.

Although hunting is supposedly regulated in many areas, it is often difficult to enforce either because of logistical problems associated with travel in the usually arid regions occupied by African Caprinae, by lack of funds, or by both. The same problems beset poaching controls which form an additional and significant threat to Caprinae throughout much of the continent, as well as maintenance of protected areas. Added to these problems are armed conflicts between some neighbouring countries, and political instability and guerrilla action within the countries, all of which make many protection actions in western and central Sahara difficult if not impossible.

Conservation solutions

There is a basic problem of an almost complete lack of information on population numbers or demographics and in some cases, inadequate data on distributions. Obtaining better basic distribution data and population estimates of each of the three species of Caprinae in Africa is a first essential step.

Recommended action:

1) Census for numbers and at least current distributions of Barbary sheep throughout their range.
3) Census for numbers and distribution of Nubian ibex in Africa.
2) Census for numbers and distribution of Walie ibex in Ethiopia.

There are probably few areas in which joint international conservation actions would be especially valuable. The main problem in many of the countries with Caprinae is the lack of resources including trained personnel, to carry out effective conservation or even census. In light of this restriction, two approaches may be useful; developing co-operation with local people, and personnel training in conservation and population census techniques.

Conservation in remote, often marginally productive regions, will require the co-operation of the local human population if it is to have any hope of success. Resources will be required to provide environmental education, to work with and to train local people. The probability of success can be higher with rural than with urban people because the former often have a greater appreciation of habitat deterioration. The feasibility of projects involving benefits for both Caprinae conservation and local people need to be explored and developed (e.g. tourism, sustainable hunting – see **Chapter 11** and **Appendix 1**).

Training personnel may be achieved most efficiently by workshops held at central areas to which government employees can be sent from different countries. It may be useful to consider inviting attendees responsible for similar mountain areas (e.g. the Saharan Atlas mountains – Morocco, Algeria and Tunisia; central Sahara – southern Algeria, Mali, Niger, Chad and southern Libya; Adrar des Iforas – Algeria and Mauritania; Gebel Elba – Egypt and Sudan) because they will share many common conservation problems, require similar solutions, and in some instances, need international co-operation. Financial funds for training personal and education programs will have to be provided by international agencies as well as from local governments. (For Nubian ibex, see also **Chapter 5. Regional summary**)

Recommended action:

1) Run an international workshop(s) to train personnel in census techniques for Caprinae.

Chapter 5

Middle East

5.1 Iran

H. Ziaie

Introduction

The Islamic Republic of Iran covers about 1,648,500km² between the Caspian Sea in the north and the Persian Gulf in the south. Iran's topography is dominated by a large central plateau characterised by vast salt deserts lying over 460m asl. This interior plateau is surrounded on almost all sides by mountains that account for more than 16% of the country and reach heights of over 2,000m asl. Along the northern edge of the plateau are the volcanic peaks of the Elburz mountains (Reshteh-ye Kuhha-ye Alborz), including Iran's highest, Mount Demavend (Qolleh-ye Damavand) at 5,604m. The Khorsasan border ranges in the east, together with the southern Baluchistan ranges, form the eastern edge of the interior plateau. The plateau's western edge is defined by the Zagros mountains running from the Turkish border in the north, southwest to the Makran mountains and the Persian Gulf in the south, before turning east into Baluchistan. Along the south coast, the land drops from the plateau at 600m, backed by an 1,800m escarpment, to meet the Persian Gulf and the Gulf of Oman.

Only the narrow, northern coastal strip along the Caspian Sea receives >1,000mm of rainfall per year, while the interior salt deserts receive <100mm annual precipitation. About 10% of the country is forested with most occurring in the Caspian region where rainfall is sufficiently high. Here, besides some evergreen forests, are deciduous forests composed of oaks (*Quercus*), beech (*Fagus*), elm (*Ulmus*), ash (*Fraxinus*) and hornbeam (*Parottia*). The Zagros mountains are also forested by a semi-humid oak forest, along with elm, maple (*Acer*), hackberry (*Celtis*), walnut (*Juglans*), pear (*Malus*) and pistachio (*Pistachia*) trees, and with willows (*Salix* spp.), poplars (*Populus*), and plane (*Platanus*) in riparian areas. To date, ca. 152 species of mammals and 495 species of birds have been recorded in Iran.

Current status of Caprinae

Caprinae are widely distributed in Iran from the cold heights of the Alborz and Zagros mountains, with elevations up to ca. 4000m asl and temperatures <20°C in winter, through the low mountain ranges of the central deserts with their arid, hot climate, to the rocky seashore of the Persian Gulf as low as 3m asl and with summer temperatures up to 45°C. These areas are home to at least two species of wild Caprinae; Persian wild goat (*Capra aegagrus aegagrus*), widespread throughout most of the country, and wild sheep (*Ovis orientalis*). Populations of wild goat in southeastern Iran may belong to *C. a. blythi*.

Wild sheep in Iran are particularly interesting because their taxonomy is complex and controversial (Corbet and Hill 1980; Valdez 1982; Valdez and Nadler, in prep.). In this report four subspecies are recognised. The Laristan (*O. o. laristanica*) and the Esfahan (*O. o. isphahanica*) sheep are found only in Iran, and though the Armenian mouflon (*O. o. gmelinii*) is also found in Turkey, Iran probably harbours the majority of the

Adult male Armenian mouflon (*Ovis orientalis gmelinii*) in captivity. Azerbaijan, Iran.

E. Firouz (WWF)

world's population. Similarly, most of the world's Transcaspian mouflon (*O. o. arkal*) are found in Iran, with only remnant populations in neighbouring Afghanistan and Turkmenistan. Some authors (Valdez and Nadler, in press) consider urial and mouflon as separate species and recognise two hybrid populations in Iran: Alborz red sheep (*O. gmelinii gmelinii* × *O. vignei arkal*), and Kerman mouflon (*O. g. laristanica* × *O. v. blanfordi*) (see **Chapter 3**).

Immediately following the 1978 Islamic Revolution, most protected areas, including those with Caprinae, were heavily utilised by domestic livestock and poaching was considerable. In Golestan in 1979, drought decreased water resources and disease led to further declines in Caprinae. For example, in the summer of 1980 in Golestan, the author saw only 17 wild sheep and five wild goats during three days, compared to over 15,000 Caprinae (including up to 11,000 wild sheep and 4,000 wild goats) observed in this park in 1977 (Kiabi 1978). Most protected areas suffered the same problems. Overall, Caprinae numbers have declined drastically throughout the country, both in and outside protected areas. Unfortunately it is not possible to give an accurate estimate of wild sheep numbers at the present time.

[Editor's note – Recent informal reports suggest that Caprinae numbers in Iran have not recovered and are greatly reduced. This is due to a lack of conservation controls that have resulted in increased hunting (legal and illegal) and competition from domestic livestock. There is also interest in developing cash-producing, foreign trophy hunting programs, and these have already started. There is a large-scale national hunting lobby and the number of hunting clubs is increasing (J. Howes, pers. comm. 1994).]

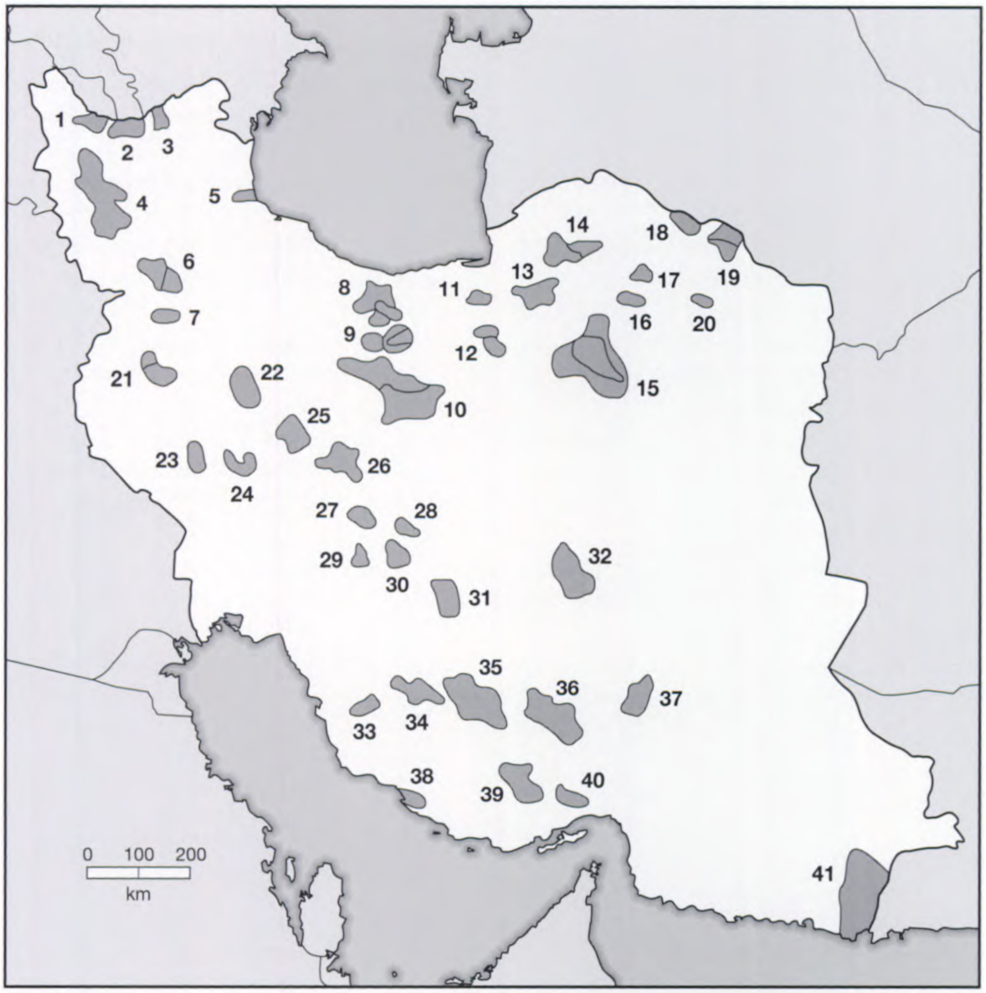
General conservation measures taken

The first wildlife protected areas were established in 1890 as Royal Game Reserves. The first conservation law was passed in 1956, including the creation of the Game Council of Iran. The Council's policy was to control hunting and to establish protected regions within which grazing, woodcutting, hunting and other forms of exploitation were restricted. The Game and Fish Department was created in 1967, along with two important laws, the Game and Fish Law (Khordad 1346/1967; amended in 1975) and the Law of Protection and Exploitation of Forest and Range (Khordad 1346/1967). Until 1971, the Game and Fish Department was the main management and administrative body responsible for hunting, freshwater fisheries, and the protection of wildlife and the natural environment. This department was incorporated into the Department of Environment, created in 1972, and was responsible for the conservation of all wildlife in Iran. The Environmental Protection and Enhancement Act of 1974, the main conservation law, superseded all previous

Table 5.1.1. Protected areas with Caprinae in Iran (see also Map 5.1.1).

Protected Area[1]	Size (ha)	Date est.	Species[2]
National Parks			
14) Golestan	91,895	1957	w,t
4) Uromiyeh Lake	463,600	1967	a
34) Bamou	47,440	1962	w,(l)
10) Kavir	420,00	1964	w,a*
19) Tandoreh	53,780	1968	w,t
9) Khogir	11,570	1982	w,a*
9) Sorkheh Hesar	9,380	1982	w,a*
Wildlife Refuges			
6) Angoran	28,600	1971	w,a
35) Bakhtagan	310,438	1968	w
21) Bisoton	31,250	1975	w,a
15) Touran	431,250	1972	w,t
37) Khabr-va-Rochon	169,200	1971	w,l*
13) Koshyeylag	154,400	?	w,t
12) Dodangeh	6,700	1974	w,a*
27) Gamishlo	37,000	1971	w,e
28) Kolahgazy	50,000	1964	w,e
2) Kiamaky	84,400	1974	w,a
16) Miandasht	52,000	1974	w,t
Protected Areas			
33) Arjan	65,750	1972	w
3) Arasbaran	38,320	1971	w,a
24) Oshtrankoh	93,950	1970	w,a
8) Alborz-e -Markazy	399,000	1961	w,a*
6) Angoran	96,130	1971	w,a
36) Bahramgoor	385,000	1973	w
7) Bijar	31,250	1970	w,a
21) Bisoton	50,850	1968	w,a
12) Parvar	37,937	1962	w
15) Touran	431,250	1972	w
19) Tondoreh	6,900	1971	w
29) Tangsayad	27,000	1971	w
31) Jajrud	51,650	1982	w,a*
11) Jahannama	30,600	1974	w
20) Sarigol	28,00	1974	w,t
17) Salok	16,000	1973	w
18) Serany	17,800	1971	w,t
10) Kavir	250,000	1976	w
41) Gando	382,430	1971	w
40) Geno	27,500	1972	w,l
14) Gorkhod	34,000	1971	w,t
8) Lar River	28,00	1976	w,a*
5) Lisar	33,500	1970	w,a
1) Marakan	92,715	1966	w,a
26) Mooteh	163,250	1964	w
8) Varjim	28,000	1982	w,a*
39) Hormod	151,284	1976	w,l
25) Haftadgoleh	82,000	1970	w,a
38) Nayband	195,000	1978	w
23) Sefidkoh	69,500	1991	w,a
32) Kalmand	17,500	1991	w
31) Dena	86,500	1991	w
30) Sabzkook	60,870	1991	w
22) Lashgardar	16,000	1991	w,a

[1] Numbers refer to Map 5.1.1.
[2] Species present: w = wild goat; a = Armenian mouflon; e = Esfahan sheep; l = Laristan sheep; t = Transcaspian urial; * possible hybrid population (see text).



Map 5.1.1. Locations of protected areas with wild Caprinae in Iran (see also Table 5.1.1).

1) Marakan PA; **2)** Kiamaky WR; **3)** Arasbaran PA; **4)** Uromiyeh Lake NP; **5)** Lisar PA; **6)** Angoran WR and Angoran PA; **7)** Bijar PA; **8)** Alborz-e-Markazy PA, Lar River PA and Varjim PA; **9)** Khogir NP and Sorkheh Hesar NP; **10)** Kavir NP and Kavir PA; **11)** Jahannama PA; **12)** Dodangeh WR and Parvar PA; **13)** Koshyeylag WR; **14)** Golestan NP and Gorkhod PA; **15)** Touran WR and Touran PA; **16)** Miandasht WR; **17)** Salok PA; **18)** Serany PA; **19)** Tandoreh NP and Tondoreh PA; **20)** Sarigol PA; **21)** Bisoton WR and Bisoton PA; **22)** Lashgardar PA; **23)** Sefidkoh PA; **24)** Oshtrankoh PA; **25)** Haftadgoleh PA; **26)** Mooteh PA; **27)** Gamishlo WR; **28)** Kolahgazy WR; **29)** Tangsayad PA; **30)** Sabzkook PA; **31)** Dena PA and Jajrud PA; **32)** Kalmand PA; **33)** Arjan PA; **34)** Bamou NP; **35)** Bakhtagan WR; **36)** Bahramgoor PA; **37)** Khabr-va-Rochon WR; **38)** Nayband PA; **39)** Hormod PA; **40)** Geno PA; **41)** Gando PA.
NP = National Park;
WR = Wildlife Refuge;
PA = Protected Area.

enabling legislation (IUCN 1992a). Following the Islamic Revolution in 1979, the Department continued to hold the same responsibilities with the same laws for environmental preservation, and with a long-term program for the conservation of wildlife and natural areas. After the country was proclaimed the Islamic Republic, Constitution Act No. 50 was legislated under which all citizens were obligated to respect the conservation of nature and natural resources.

There are four categories of protected areas in Iran; national parks, wildlife refuges, protected areas and national nature monuments. There are also other kinds of wildlife protected areas called Hunting Prohibited Areas. Altogether there are 77 protected areas in Iran, including seven National Parks, four National Nature Monuments, 22 Wildlife Refuges, and 44 Protected Areas. A total of 52 of them contain wild Caprinae (Table 5.1.1, Map 5.1.1).

Caprinae are the only game mammals that can be hunted under licences issued by the Department of the Environment. Other large mammals such as cheetah (*Acinonyx jubatus*), Persian fallow deer (*Dama dama mesopotamicus*), roe deer (*Capreolus capreolus*), red deer (*Cervus elaphus*), gazelles (*Gazella bennetti*) and wild ass (*Equus hemionus*), are protected species and hunting them is prohibited except under special licence. The hunting season for Caprinae lasts four months beginning each year in September, but each licence is valid only for five days from its date of issue. Hunters with non-automatic and semi-automatic weapons (all weapons with a calibre of <6mm and all shot guns are prohibited) can obtain a licence and are permitted to shoot a wild sheep or a wild goat. Each hunter can obtain up to four licences per hunting season, and may shoot three males and one female. Unfortunately the exact numbers of Caprinae shot each year by hunters are not available. According to recent data, between 2,200 and 3,200 licences were issued each hunting season, and a rough estimate of the number Caprinae legally shot each year would be between 2,000 to 3,000 animals. However, more than twice this number are estimated to be killed by poachers annually. Hunting is permitted in protected areas but requires a special licence. Because Caprinae populations are not harvestable in most areas, licences are almost never issued for protected areas except for Kabudan island, located within Lake Uromiyeh. Here, the Department of the Environment staff harvest between 200 and 500 Armenian mouflon annually.

General conservation measures proposed

During recent years, conservation management has begun to be practised again. Many protected areas are once more under control and most hunters are licensed, but though the illegal kill has consequently been reduced, poaching is still common. In some protected areas, numbers are responding, for example in Golestan National Park where recent estimates are 3,500 urial and 2,500 wild goat. Despite this, more management and law enforcement is required to return populations to viable levels, particularly mouflon. Continued efforts should be made to control poaching, both in and outside protected areas.

One of the first actions which must be taken is to make surveys to determine the present distribution and numbers of all wild Caprinae. The censuses should be made in conjunction with surveys for other wildlife species. There are also major taxonomic questions about wild sheep in Iran which need settling. Both these actions are necessary before constructive conservation programs can be developed for the country.

Species accounts

For descriptions of general biology and ecology of Caprinae in Iran, see Schaller (1977) and Valdez (1982).

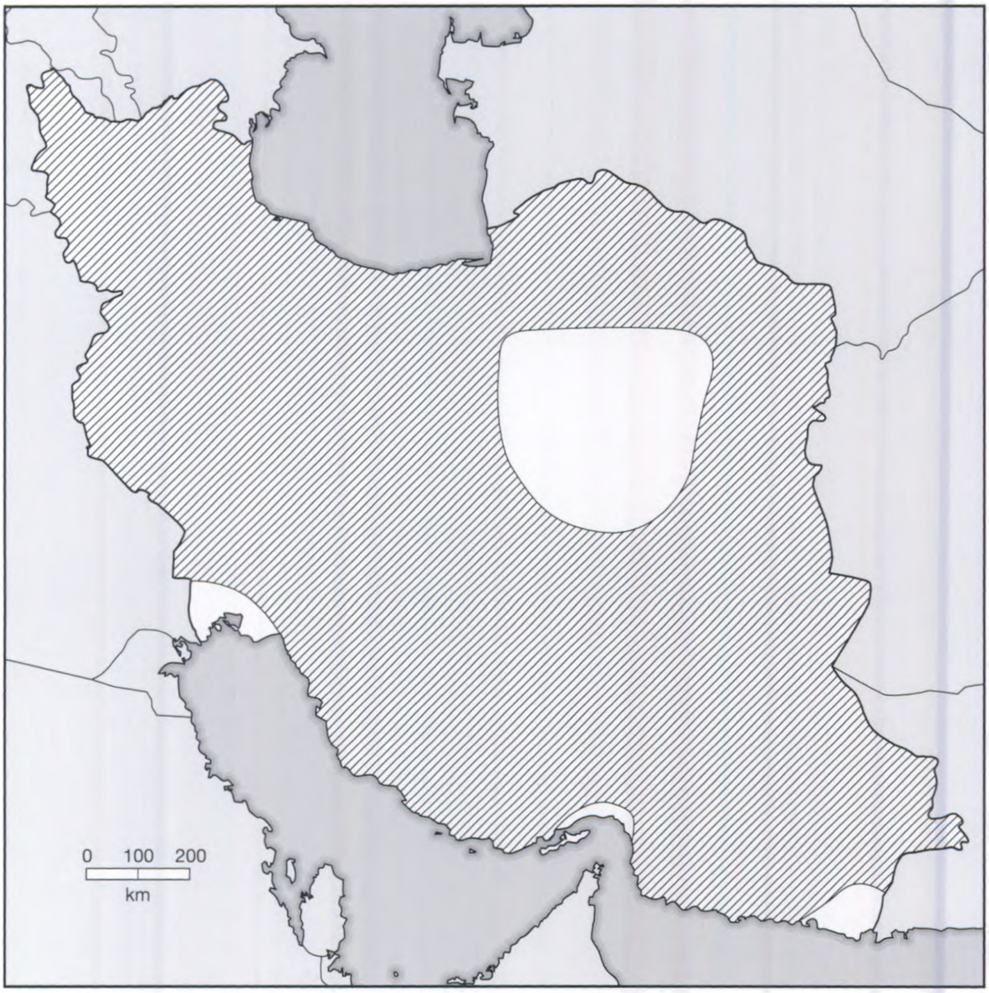
Persian wild goat (*Capra aegagrus aegagrus*)

Distribution: Wild goat is widely distributed throughout Iran wherever large areas of rocky terrain are available (Map 5.1.2). This includes not only mountainous areas, but also cliffs along the seashore, in deciduous forested areas of the north, and in areas of the central desert.

Population: No estimates of total numbers are currently available. However, 1991 estimates are available for Golestan National Park – 2,500, and for Alborz-Markazy Protected Area – 4,000.

Threats: Poaching and competition with livestock.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN



Map 5.1.2. General distribution of wild goat (*Capra aegagrus*) in Iran.

1996). Wild goat occurs in several protected areas where hunting is prohibited and livestock grazing is strictly controlled. Wild goat was found in seven National Parks, 11 Wildlife Refuges, and 34 Protected Areas throughout the country (Table 5.1.1, Map 5.1.1). They can be hunted under licence outside protected areas between September and February each year.

Status within country: Insufficiently Known.

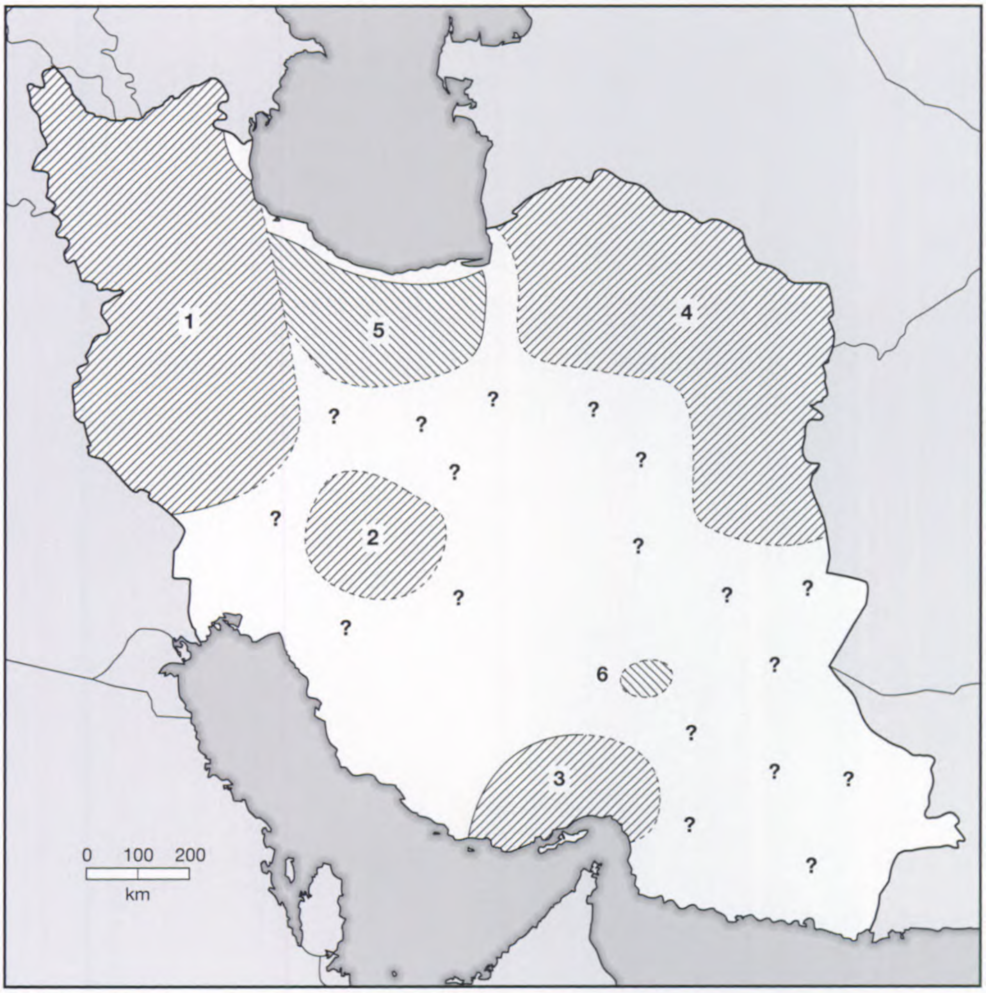
Armenian mouflon (*Ovis orientalis gmelinii*)

Distribution: This sheep, with a small black neck ruff is a resident of the mountain foothills and rolling steppe of northwest and southwest of Iran (Map 5.1.3). In the recent past, its range extended eastward from northwestern Iran to central Alborz and Zagros. The purest Armenian sheep are found in Marakan, Kiamaky, Arasbaran, Uromiyeh lake (Kabodan Island), Angoran and Bijar. Armenian sheep also occur in Oshtorankoh and Haftad Goleh. The purported hybrid population, Alborz red sheep (*Ovis gmelinii gmelinii* × *Ovis vignei arkal*) (Valdez and Nadler, in prep.), occurs in north-central Iran in the Alborz mountains near Tehran, east to the Parvar Wildlife Reserve and south into the Kavir Desert (Siah Kuh range) (Map 5.1.3). The exact western, eastern and southern limits of its distribution are undetermined.

Population: No current total population estimate is available for *O. o. gmelinii*. The population on Kabodan Island, on Uromiyeh Lake, is probably the largest and the current estimate for this is around 2,250 sheep. An estimate of numbers for the hybrid is not available.

Threats: Habitat loss and competition from domestic livestock, together with poaching.

Conservation measures taken: Armenian mouflon is listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). In Iran, it is found in Uromiyeh Lake National Park, three Wildlife Reserves, and 10 Protected Areas (Table 5.1.1, Map 5.1.1). The contentious hybrid populations occur in Kavir,



Map 5.1.3. General and suspected distribution of wild sheep (*Ovis orientalis*) in Iran.

1) Armenian mouflon (*Ovis orientalis gmelinii*); **2)** Esfahan sheep (*Ovis orientalis isphahanica*); **3)** Laristan sheep (*Ovis orientalis laristanica*); **4)** Transcaspian urial (*Ovis orientalis arkal*). Zones of purported hybrid populations of **5)** Alborz red sheep (*Ovis gmelinii gmelinii* × *Ovis vignei arkali*), and **6)** Kerman sheep (*Ovis gmelinii laristanica* × *Ovis vignei blanfordi*).

Khogir and Sorkheh Hesar National Parks; in Dodangeh Wildlife Reserve; and in Alborz-e-Markazy, Lar River, Varjim and Jajrud Protected Areas (Table 5.1.1, Map 5.1.1). Hunting is allowed under permit outside the protected areas between September and February each year, while within them, domestic livestock grazing is strictly controlled.

The population on Kabudan Island, which lies within Uromiyeh Lake National Park, was introduced 90 years ago. In recent years the Kabudan Island population built up to over 3,000 sheep and vegetation was badly damaged. Two leopards (*Panthera pardus*) were released in an attempt to control the sheep population, and after a few years numbers decreased and stabilised at around 1,000 sheep. The leopards reportedly produced at least one young, but no more sightings or signs were recorded after 1984. The population of wild sheep has since increased and control of the sheep population has been initiated, with Department of Environment staff removing 200 to 500 animals per year.

Status within country: Indeterminate.

Esfahan sheep (*Ovis orientalis isphahanica*)

Distribution: Restricted to a very small area directly southwest of Esfahan in east-central Iran (Map 5.1.3).

Population: No recent population estimates.

Threats: Poaching and competition with livestock.

Conservation measures taken: This subspecies is listed as vulnerable (A2c) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and is found in Gamishlo and Kolahgazy Wildlife Refuges, and in Tangsayad Protected Area (Table 5.1.1, Map 5.1.1).

Status within country: Insufficiently Known.

Laristan sheep (*Ovis orientalis laristanica*)

Distribution: This sheep is a resident of southern and southeastern Iran (Map 5.1.3). The purest Laristan sheep are found in Hormod Protected Area, while those east of 55°E in the Khabr and Baft mountains in Kerman Province have been suggested to be hybrid populations – Kerman sheep (*Ovis vignei blanfordi* × *Ovis gmelinii laristanica*).

Population: No estimates of total numbers are available.

Threats: Poaching and competition with livestock.

Conservation measures taken: Laristan sheep are listed as Vulnerable (A2c) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It is known to occur in Khabr-va-Rochon Wildlife Refuge and in Geno and Hormod Protected Areas (Table 5.1.1, Map 5.1.3). Some authors believe that Laristan sheep also inhabit Bamou National Park (estimated number 1,150) (Valdez and DeForge 1985).

Status within country: Insufficiently Known.

H. Ziaie

A group of Laristan sheep (*Ovis orientalis laristanica*) at a waterhole in Bamou National Park, Iran.

Transcaspian urial (*Ovis orientalis [vignei] arkal*)

Distribution: This urial occurs on rolling hills and on gentle mountain slopes in northeast Iran (Map 5.1.3). The purest form of this urial is found in Golestan, Gorkhod, Serany and Tandoreh Protected Areas (see also **Armenian mouflon *Ovis orientalis gmelinii*** above). The population was estimated to be at least 20,000 animals in the mid-1970s (Valdez and DeForge 1985), of which around 15,000 were estimated to inhabit Golestan National Park alone (Kiabi 1978).

Population: No recent estimates.

Threats: Habitat destruction, poaching and competition from livestock.

Conservation measures taken: This subspecies of urial is listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix I of CITES. It occurs in two National Parks, three Wildlife Refuges, and three Protected Areas (Table 5.1.1, Map 5.1.1). Hunting in all these areas is prohibited and domestic animals are under control. Hunting under licence is allowed from September to February outside these areas.

Status within country: Insufficiently Known.

Acknowledgements: R. Valdez

5.2 Iraq

D.M. Shackleton

Introduction

Located at the northwest end of the Persian gulf, Iraq covers approximately 437,393km^2. There are four main physiographic divisions with the most dominant feature being the twin river valleys of the Tigris and Euphrates. Between the Persian gulf and Baghdad, are lowland regions where the rivers meander and large marshlands have formed, starting in the Hawr as-Suwayqiyah depression and becoming most extensive in the vast reed swamp, Hawr al-Hammar. Further upstream the two river valleys are separated in the north by undulating steppe and low ranges of al-Jazirah, and while the Euphrates generally runs through a wide, flat and terraced valley, the Tigris river has cut an irregular winding path through ridges and low foothills. The northeastern part of the country, rising in steps eastward from the Tigris, is an upland region. The first step is the Jabal Hamrin and behind this is an undulating area of river basins, rolling plateaux and irregular hills which further east merge with the Zagros range in Iran. North and west of this region is the area sometimes referred to as Iraqi Kurdistan, a mountainous region of high, northwest-southeast running ridges and river basins. The mountains average around 2,440m asl with peaks over 3,000m, including Iraq's highest mountain, Rawanduz (3,658m asl). Finally, lying to the west of the Euphrates river valley and covering most of western and southwestern Iraq is a vast desert area, Badiyat ash-Sham (the Syrian desert) in the west, and Sahra al-Hijarah in the southwest.

There are two climatic regions, the hot arid lowland and the moister northeast. In the mountain regions, winters can be quite severe, and frost can occur throughout most of the country. The persistent, dry north-westerly wind ("shamal") is a major climatic feature over most of the country from the beginning of May onwards, and average temperatures are around 33°C in July and August around Baghdad. As much as 760 to 1,000mm of rain can fall each year on the high mountains in the northeast, and between 380 and 640mm on their foothills. A steppe vegetation predominates in the north and east regions including perennial bushes and low shrubs such as *Artemesia* and *Chenopodiaceae*, and various grass species. To the south and west, the dry conditions result in thorn scrub primarily of tamarisk with *Haloxylon*, and salt resistant forbs and shrubs. Open oak forests used to grow between 600 and 1830m asl on the Zagros Mountains, but these have been greatly reduced due to grazing and cutting for forage and fuel. At higher elevations, alpine communities similar to European conditions prevail.

Current status of Caprinae

Two species of Caprinae may still inhabit Iraq, the wild goat (*Capra aegagrus*) and the Armenian mouflon (*Ovis orientalis gmelinii*) (Mahdi and Georg 1969). Nothing is known of either their current distributions or their status. The possible effects of the Iran-Iraq and the Persian Gulf Wars on these Caprinae are also unknown.

General conservation measures taken

Caprinae are affected by Law No. 40 (1958) which concerns the protection and hunting of terrestrial animals. The Fauna Section of the Department of Agricultural Research Projects is concerned with wildlife in the country. There are no national parks in Iraq; however, there are a number of Wildlife Breeding Stations (WBS) operated by the Forest Department of the Ministry of Agriculture and Agricultural Reform. These Stations are often fenced and are divided into two types: those with native flora used for breeding native wildlife, and those with planted habitats and used to breed imported wild animals. Both types are primarily concerned with breeding ungulates (Mahir abu Ja'fer 1984). Stations concerned with breeding native species include: Saba al-Nisan WBS (21.3ha; est. 1978); Rawdat al-Maha WBS (50ha); Zawayta/Dahuk WBS (110ha; est. 1980); and Sanjar/Ninwa WBS (90ha; est. 1981). Stations concerned with imported species include: Kusaybah WBS (25ha); Hajran/Arbili WBS (90ha; est. 1980); Days/al-Ta'mim (Karkuk) WBS (80ha; est. 1980); and Darr Bander Bazyan/al-Sulaymaniyah WBS (75ha; est. 1980). It is not known whether there any other protected areas with wild goats or sheep in Iraq.

General conservation measures proposed

There were plans to expand Saba al-Nisan Wildlife Breeding Station to 170ha, and to establish 12 more breeding stations or reserves to include all the provinces by 1982. It is not known whether any of these plans were executed.

Species accounts

Wild goat (*Capra aegagrus*)

Distribution: If it still occurs in Iraq, it would most likely be found in the Zagros mountains in the extreme north and along the northeastern border with Iran. Nothing is known of current distributions.

Population: No estimate.

Conservation measures taken: If the subspecies is *blythi* then it is listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It is not known whether this species was in any Wildlife Breeding Station; however, it is possible that the Zawayta/Dahuk Wildlife Breeding Station has either wild goats or Nubian ibex (*Capra* [*ibex*] *nubiana*).

Status within country: Insufficiently Known.

Conservation measures proposed: Surveys to determine status and distribution.

Armenian mouflon
Ovis orientalis gmelinii

Distribution: Populations occurred in the extreme northern region in the Zagros mountains and along the northeastern border with Iran. Nothing known of current distributions

Population: No estimate.

Conservation measures taken: This mouflon is listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It is not known if the species was held in any Wildlife Breeding Station.

Status within country: Insufficiently Known.

Conservation measures proposed: Surveys to determine status and distribution.

5.3 Israel

P.U. Alkon

Introduction

The State of Israel, located on the eastern rim of the Mediterranean sea, was founded as a parliamentary democracy in 1948. The total area within the pre-1967 boundaries is approximately 20,800km^2 and is 28,000km^2 including the territories (Judea, Samaria, Gaza and Golan) administered since the June 1967 war. Israel is 420km long and up to 115km wide, with a varied topography comprising three major physiographic divisions. The Mediterranean coastal plain is a 115km long strip, up to 32km wide, running along the country's western margin. Further inland is a hill region that extends from Galilee in the north, through Judea and Samaria in the central region (and including the Jordean desert), and south to the Negev desert highlands and the Elat mountains. Finally, extending along the eastern margin, is the Great Rift depression that includes the Jordan Valley, the Dead sea (401m below sea level), and the Arava valley to the Gulf of Elat (Gulf of Aqaba). The Negev is Israel's largest political region, and comprises most of the southern half of the country.

Israel has a Mediterranean climate regime (cool, wet winters and hot, dry summers), and steep north-to-south and west-to-east gradients in rainfall, temperature and other meteorological variables. The southern and eastern half of the country (including the Negev and Judean deserts) is arid to extremely arid and receives on average ≤200mm rainfall annually, but with as little as 30mm average rainfall in the Elat region. In the northern and western parts, climates range from semi-arid to mesic Mediterranean, with an average of ≤1,000mm annual rainfall in the Upper Galilee (Central Bureau of Statistics 1989). Despite its small size, Israel is characterised by substantial ecological and species diversity. It owes this diversity to steep north-south and east-west climatic gradients, varied topography and land use, and its location near the confluence of three continents (Europe, Asia and Africa) and four plant geographic territories (Mediterranean, Iran-Turanian steppe, Saharo-Sindian desert, and Sudao-Deccanian intrusions from sub-tropical Africa) (Danin 1983; Yom-tov and Tchernov 1988). The country also is situated along a major bird migration flyway connecting Eurasia and Africa.

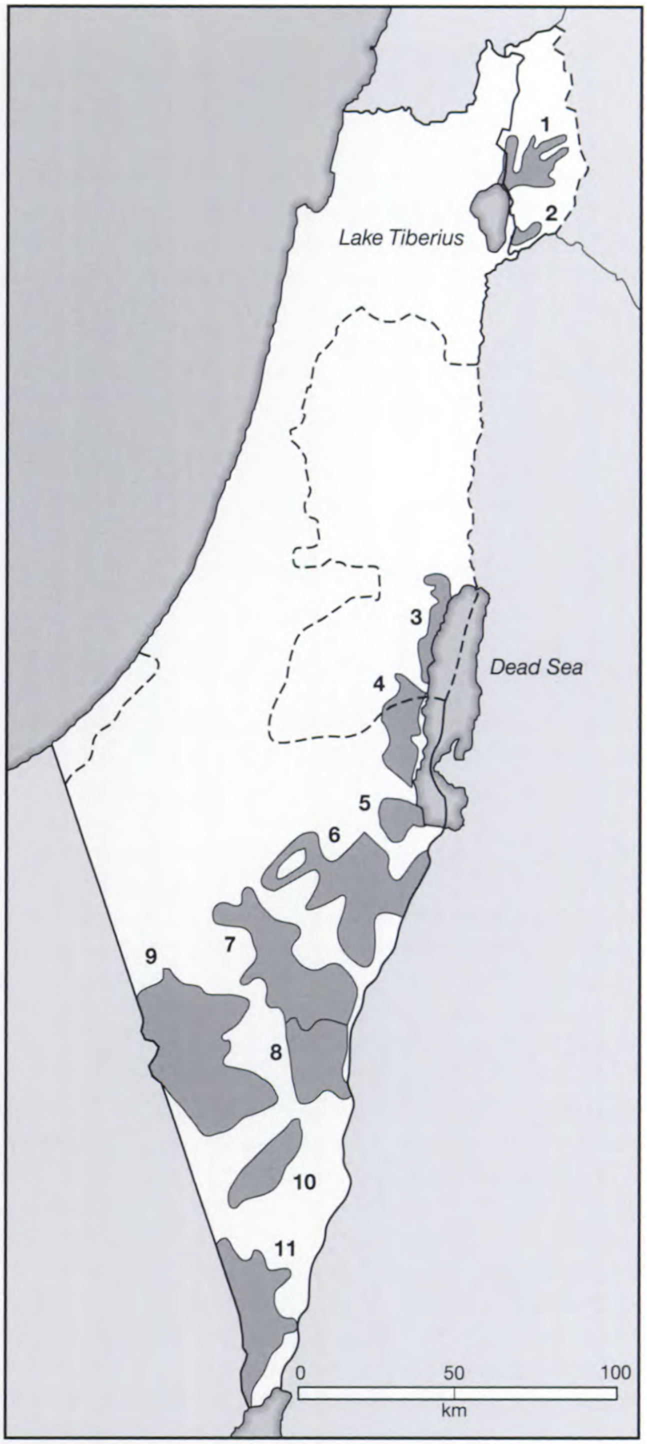
Current status of Caprinae

Nubian ibex (*Capra* [*ibex*] *nubiana*) are the only free-ranging wild caprin present in Israel, and are designated by the Nature Reserve Authority of Israel as "vulnerable" within their principal arid-zone range, and as "rare" in Mediterranean zones, including the Golan Heights. They occur naturally in steep, rugged terrain between 400m below to 1,500m above sea level, in the eastern and southern parts of the country. Their principal ranges are the Judean desert, the Negev desert and the Elat mountains, and these fall within the 50–100mm annual isohyet belt. Reproduction is strongly seasonal with mating peaking in October–November, and subsequent births in April–May; though variations may occur between and within populations. Nubian ibex were introduced into the Golan Heights in 1970 (6 animals from the Judean desert), and have established a sparse but viable population there. The available palaeozoological evidence indicates that ibex have occupied their present range in Israel (and Sinai) for at least 200,000 years (Prof. E. Tchernov, Hebrew University, pers. comm. 1989, 1992; Tchernov and Bar-Yosef 1982).

The Persian wild goat (*Capra aegagrus aegagrus*) formerly occurred in Israel in the Mediterranean zone, but disappeared during the Neolithic about 10,000 years ago, coincident with Pleistocene climatic changes and the advent of domestic grazing (Dayan *et al.* 1986). Except for a recently introduced herd of Asiatic wild ass (*Equus hemionus onager*) in the Ramon Makhtesh (crater) of the central Negev highlands, Nubian ibex are the largest wild ungulate in Israel. Ibex are held at zoos throughout the country, and a population of domestic goat (*Capra hircus*) × ibex hybrids ("yaez") has been developed by the Institute for Animal Research at Lahav in the northern Negev (Rattner *et al.* 1985).

General conservation measures taken

Comprehensive legal protection of wild birds and mammals in Israel was initiated in 1955 with enactment of the Wild Animal Protection Law, subsequently amended to encompass all wild, terrestrial vertebrates. That law afforded complete protection from hunting and other disturbances, to all species except those specifically designated as game or pest organisms. The National Parks and Nature Reserves Law of 1963 mandated complete protection to all biotic and non-biotic resources and protected areas. It also established the Nature Reserves Authority as the sole government agency responsible for protection and management of wildlife resources and Nature Reserves. This law was recently



Map 5.3.1. Locations of designated or established Nature Reserves known or likely to be used by Nubian ibex *Capra* [*ibex*] *nubiana* in Israel.

1) Ya'ad Yehudia (6,200ha; est. 1984; **2)** Mezukai Herev (2,290ha); **3)** Nahal Makhokh, Mazok Haheatikim, Enot Zukim and Enot Kana Hamar (combined area 11,060ha; designated); **4)** En Gedi (1,435ha; est. 1971); **5)** Midbar Yehuda (33,600ha; designated); **6)** Mahktashim and En Yahav (combined area 58,000ha; designated); **7)** Mezukai Hazinim (55,600ha; est. 1989); **8)** Ashossh (34,500ha; designated); **9)** Har Hanegev (104,900ha; est. 1989); **10)** Hanahalim Hagdolim (24,800ha; est. 1986); **11)** Masiv Elat (39,900ha; est. 1986).

amended in order to designate certain animals and plants as significant "natural assets" that are granted complete protection anywhere they occur in Israel.

Within this comprehensive legislative and administrative fabric, Nubian ibex are afforded complete protection under the Wild Animal Protection Law and are a designated "natural asset" species. Moreover, most ibex populations are associated with Nature Reserves. Effective protection of wild ibex has been rigorously enforced by the Nature Reserves Authority since its inception in 1963. The Authority employs rangers and biologists in regional offices throughout the country, and also maintains permanent staff at some Nature Reserves. No hunting permits or other exceptions to complete protection have ever been allowed for Nubian ibex in Israel. About 80% of important ibex range falls within Nature Reserves and other protected areas (Map 5.3.1), in which livestock grazing has been eliminated or significantly reduced.

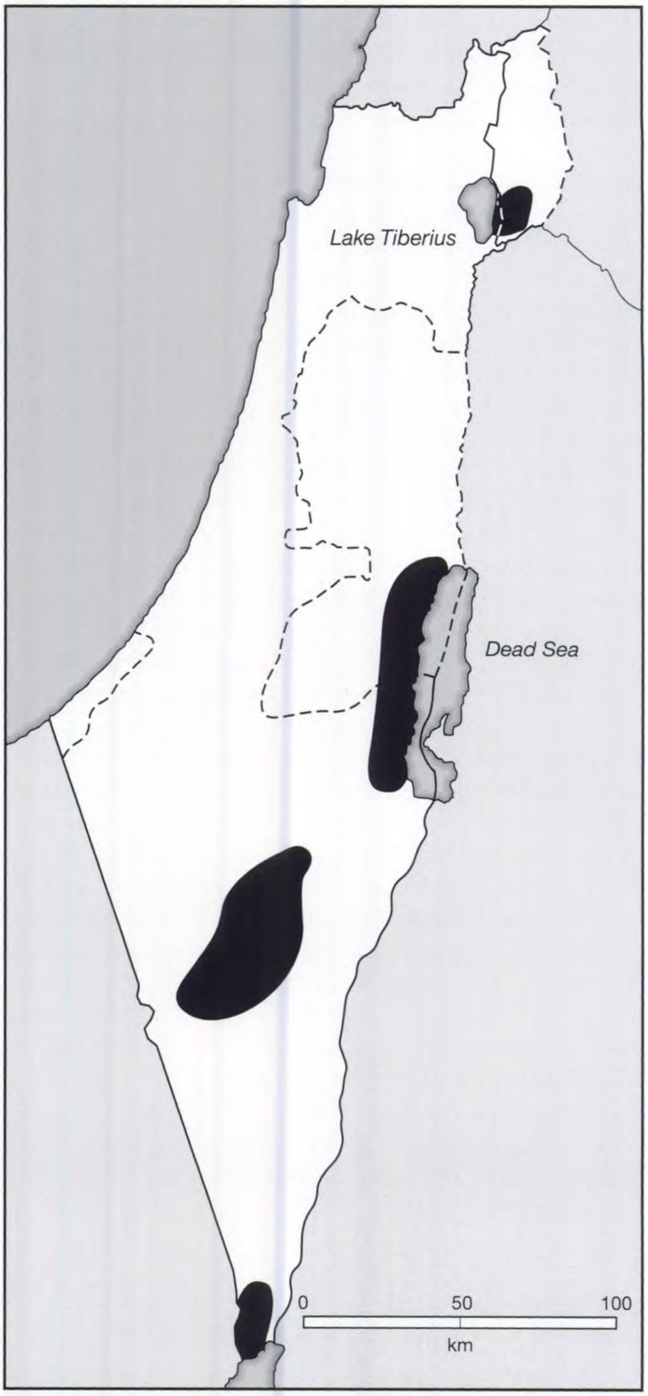
Species account

Several accounts of the biology of Nubian ibex in Israel and environs are available (Alkon 1988; Alkon and Kohlmann 1990; Aronson 1982; Baharav and Meiboom 1981, 1982; Chosniak *et al.* 1984; Finch *et al.* 1980; Greenberg-Cohen 1990; Gross 1990; Hakham 1981, 1985; Harrison and Bates 1991; Levy and Bernadsky 1991; Maltz and Shkolnik 1984; Mendelssohn and Yom-tov 1987; Shkolnik *et al.* 1980; Stüwe *et al.* 1992; Yom-tov and Tchernov 1988).

Nubian ibex (*Capra [ibex] nubiana*)

Distribution: Its former range is believed to approximate the present natural distribution of ibex, although populations were probably smaller prior to the 1960s. Today, ibex naturally occur in three major centres comprising mountainous and steep terrain in eastern and southern Israel: Judean desert, Negev, and Elat mountains (Map 5.3.2). The small, introduced population of the Golan represents an artificial range expansion. Substantial interchange of animals is likely within each of the major ranges, and is also likely between portions of the Judean desert and Negev populations. Ibex inhabiting the Elat mountains may be separated from other ibex in Israel, but more research is required to define connections among ibex populations in the country.

Population: Comprehensive, autumn 1-day ground surveys (supplemented by sporadic aerial counts) have been conducted annually within all major ibex ranges since 1981 by the Nature Reserves Authority. Total counts were relatively stable during 1982 to 1987, with a mean total count of 1,064 ±147 during this period, and a mean adult female-kid ratio of 2.2:1. Count data suggest that ibex are at carrying capacity in their major ranges. Given that the survey probably underestimates actual numbers, the total estimated number of Nubian ibex in Israel is about 1,500, of which 800 are in the Judean desert, 500 in the Negev, and 150 in the Elat mountains. No informed estimate is available for the size of the Golan Heights population.



Map 5.3.2. Principle delineated Nubian ibex (*Capra [ibex] nubiana*) ranges in Israel. Ibex may occur at least sporadically outside the boundaries shown.

Threats: Major potential threats include conflicts for scarce water resources and habitat degradation by contamination of water sources, and by high levels of tourists at watering, feeding and birthing sites. Ibex are effectively protected from hunting, but there is some predation by leopards *Panthera pardus*, and reproductive success and juvenile survival vary from year to year, probably depending largely on the nutritional status of adult females (Kohlmann and Alkon, unpubl.). No significant effects of parasites or diseases have been detected among wild populations. Foraging ibex have caused some damage to orchard trees and horticultural plantings, and ibex are in close proximity to domestic livestock in some parts of their range.

Conservation measures taken: Nubian ibex is listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). The Israel Nature Reserve Authority designates the species as "vulnerable" within their principal arid-zone range, and as "rare" in Mediterranean parts of the country (i.e. Golan Heights). In Israel, it is fully protected and the law is effectively enforced. At least 80% of ibex range is within 15 officially or designated protected areas, most of which are administered by the Nature Reserves Authority (Map 5.3.1). Designated Nature Reserves await formal establishment, but are effectively managed as Nature Reserves. Most established Nature Reserves had tenures of various durations as "designated" reserves prior to their final establishment.

Recent and current management involves annual, autumn 1-day ground surveys of ibex in all major ranges (except Golan), protection of populations and habitats, and encouraging research. A management plan has been developed for Avdat Canyon National Park which supports a large population of ibex in the northern Negev highlands (Ayal 1992). Artificial food patches have been maintained at the En Gedi Nature Reserve in the Judean desert, but are subject to increasing conflicts with agriculture for irrigation water. In 1970, six ibex from the Judean desert area were translocated to the Nahal Yehudia region of the southern Golan Heights (Map 5.3.1). The population has increased in size and range, and appears to be self-sustaining.

Status within country: Vulnerable.

Conservation measures proposed: 1) Develop formal management programs or conservation biology plans for ibex. Up to the present, conservation measures have emphasised the protection of ibex populations and their habitats, and monitoring the species' status. It is recommended that these include considerations of population dynamics, population genetics, habitat requirements and human disturbance. This would involve development and implementation of a more active management/conservation program that would include specific goals and objectives, accurate monitoring of the numerical and genetic statuses and dynamics of ibex populations, management of water resources and other key habitat components (e.g. nutritional ecology and habitat requirements; population dynamics and genetics; effects of human disturbances on ibex behaviour and habitat quality). **2)** Consider augmenting natural water sources for ibex

P. Alkon

An adult male Nubian ibex (*Capra [ibex] nubiana*) performing a low stretch and tongue-flicker display while courting an adult female (out of photo).

habitat improvement. Nubian ibex are highly dependent on water, and the lush vegetation around desert springs and other water sources may be important food sources. Present ibex ranges are centred around permanent water sources, and their protection and quality should be a paramount management objective. Conflicts of water allocation between wildlife needs and agricultural uses have arisen in the En Gedi Nature Reserve in the Judean desert. 3) Initiate a study of the dynamics of the large populations in the Judean desert (≈800 animals) and the Negev highlands (≈400 animals) that presently appear secure but which are poorly understood. Preliminary analyses indicate that recent annual fluctuations are around 30% density dependent and 70% related to stochastic environmental variation. Due to the small size of the populations, the Eilat mountains and Golan populations may be especially vulnerable to extirpation, but nothing is known of their demography. A recent study (Alkon and Kohlmann 1990) commissioned by the Nature Reserves Authority indicates that the current annual ibex surveys may be deficient in accurately estimating densities and structure of ibex populations, and recommends that alternative monitoring methods be considered. 4) Launch a research program on the genetic diversity among populations. This will be essential for planning appropriate population management programs. The Sede Boqer segment of the Negev highlands population contains substantial genetic diversity (Stüwe *et al.* 1992), but nothing is known of the genetics of other populations, or the extent of gene transfer among populations. Present data indicate some movement and possible interchange among elements of the Judean desert and Negev highlands populations, but the Golan and Elat mountains populations are probably genetically isolated. 5) Evaluate the effects of visitors on ibex ecology. Tourism and nature study are intense at several nature reserves and parks in the Judean desert and Negev highlands which are important for ibex. Studies of other wild animals and of Nubian ibex in the Negev highlands (Hakham 1985; Stone 1989) suggest that park visitors may disrupt ibex behaviour and movement patterns, and exclude ibex from desired sites. The biological and management consequences of human-ibex interactions are complex. On one hand, Nubian ibex appear to have adapted well to some human activities, and their presence has enhanced the value of the parks and reserves for human visitors, thus promoting public awareness and support of natural values. Conversely, the threshold levels at which human disturbance may adversely impact habitat carrying capacity are unknown, and are likely to vary seasonally, temporally, by location, and with the type of human activity.

Acknowledgements: S. Man and A. Shai of the Nature Reserves Authority, and E. Tchernov of Hebrew University, for useful unpublished information.

5.4 Jordan

C. Hays and N. Bandak

Introduction

The Hashemite Kingdom of Jordan is a constitutional monarchy which covers 89,411km^2 of undisputed territory. Since the Arab-Israeli War of 1967, Israel has occupied approximately 13,989km^2 of disputed territory, the West Bank, along the Jordan river. The three major physiographic regions are the Jordan desert, the East Bank uplands, and the Rift valley. The Jordan desert falls in the eastern part accounting for approximately 80% of the country. In the north, the desert is composed of volcanic lava and basalt, while in the south, sandstone and granite outcrops predominate. The East Bank uplands overlook the Rift valley and are comprised of an escarpment ranging in elevation from 600 to 900m asl, and rising to 1,750m in the south. Outcrops of sandstone, flint, limestone and chalk occur in all but the extreme south where igneous rocks are more common. A number of valleys and perennial streams occur in the north and central uplands, while those in the south running east into the al-Jafr depression are non-perennial streams. The Jordan valley is part of the Rift valley, and includes the western part of the Dead sea, which at 400m below sea level makes it the lowest point on the earth's surface. The disputed West Bank uplands have an average height of 915m asl. The area is dissected by a number of large valleys draining west into the Mediterranean, and by smaller ones running east.

The climate is classed as Mediterranean with rainfall decreasing along a north-south gradient from 400mm to 100mm per year, with the mean in the east and west uplands ca. 400mm. Jordan includes both the Irano-Turanian and Saharo-Sindian vegetation zones, both characterised by dwarf shrubs and either grasses or forbs.

Frescoes and mosaics from the 8th Century depict Jordan as historically having many species of wildlife. These included the Syrian brown bear (*Ursus arctos*), Arabian oryx (*Oryx leucoryx*), fallow deer and Syrian wild ass (*Equus hemionus hemippus*). However, many of these have since become locally extinct due to excessive hunting pressure and habitat destruction. In recent times, the advent of automatic weapons and desert vehicles has hastened the decline of remaining populations of large mammals, especially the ungulates. Furthermore, the increasing human population has exacerbated these declines by expanding agricultural, industrial and urban developments.

Current status of Caprinae

Bedan or Nubian ibex (*Capra*[*ibex*] *nubiana*) has inhabited the steep mountains of the Rift valley since Biblical times.

That they were well known to the ancient inhabitants of the Wadi Rum area is attested to by the numerous ibex depicted in prehistoric rock carvings. Apparently, they were far more numerous at that time than in recent times. Today, the species remains in the Rift valley mountains and the Rum mountains in the south. The ibex, however, is restricted to the most remote and rugged areas, occurring in relatively isolated and scattered pockets. Habitat destruction caused by overgrazing by domestic goats and sheep, together with poaching, continue to threaten Nubian ibex outside protected areas in Jordan and limit efforts to increase their numbers.

General conservation measures taken

In the 1960s, Jordan initiated a comprehensive conservation program, with the Royal Society for the Conservation of Nature (RSCN) created in 1966. This body is responsible for the establishment and management of nature reserves representative of the country's diverse ecosystems and indigenous biotic communities. The Society operates in co-operation with other local, regional and international conservation organizations. In addition, RSCN supervises and enforces hunting regulations throughout the country (Clarke 1979). Article 144-155 of Act No. 20, prohibits the hunting of wildlife without authorisation from the Ministry of Agriculture. Until 1978, ibex was legally hunted in Jordan, but since then it has received full protection and a total ban on hunting this species was put into effect indefinitely. The Protection and Hunting Control Division inspectors, for the Royal Society for the Conservation of Nature, patrol areas with remaining populations to prevent poaching of ibex and other species. In addition, a Hunter's Guide has been published which includes a full description of the ibex and the reasons why it has become endangered. The guide emphasises that the species is protected and should not be hunted under any circumstances.

Protected areas legislation is covered by a number of laws including the Woods and Forests law of 1927 (amended 1951), Law No. 18 (1952), Law No. 20 of the Code of Agriculture, and Natural Resources Authority Law No. 12. Responsibility for the establishment and management of protected areas has been delegated by the Ministry of Agriculture to the RSCN (IUCN 1992a). Jordan has a proposed system of wildlife reserves that will ultimately cover 4.8% of the country's total area. The

Map 5.4.1. Locations of protected areas with Nubian ibex (*Capra [ibex] nubiana*) in Jordan.

1) Wadi Mujib Wildlife Reserve (212,000ha; est. 1985);
2) Dana Wildlife Reserve (150,000ha; est. 1989);
3) Jebel Masadi Wildlife Reserve (460,000ha; proposed);
4) Wadi Rum Nature Reserve (570,000ha).

RSCN is currently in the process of implementing this strategy, and to date, six of the 12 proposed reserves have been established. Three of the established reserves contain remnant populations of Nubian ibex (Map 5.4.1). They include the Wadi Mujib Wildlife Reserve, an area of 212km² which includes the escarpment area of the Rift valley desert and extends as far as the Dead sea to 400m below sea level; Dana Wildlife Reserve protecting 150km² in the Rift valley mountains; and Wadi Rum Reserve extending over 570km² of the precipitous rocky outcrops of the Rum mountains in southern Jordan. The proposed Masadi Wildlife Reserve will cover 460km² and run from the mountainous plateau and escarpment, down to the Rift valley desert. Total protection of the remaining ibex populations in these four areas will allow numbers to increase, but the RSCN also plans to increase numbers with a captive breeding program. The San Diego Wild Animal Park sent 20 young ibex to Jordan in July 1989, and these animals are currently housed in a 0.25–0.4km² enclosure on the slopes of Wadi Mujib. They have reproduced and by 1992, there were 34 individuals. Plans are to release them into the protected reserve area. This project will supplement the critically low, native population of the Wadi Mujib area and help reduce any potential threats from inbreeding depression or stochastic events.

The RSCN recently undertook the task of raising public awareness about the ibex's plight. This is being implemented through a comprehensive program of conservation education aimed especially at rural communities in the vicinity of ibex populations. The need for protection of the species and of its habitat is strongly emphasised. Furthermore, the National Conservation Strategy, completed in July 1991, provides the necessary principles and guidelines for future natural resource management and conservation of biological diversity in Jordan.

Species account

Nubian ibex (*Capra* [*ibex*] *nubiana*)

Distribution: Currently confined to remote areas of rugged, mountainous terrain from the northeastern escarpment of the Dead sea, south along the Rift valley to Wadi Araba, and further southeast in the mountains of Wadi Rum (Map 5.4.2). Also recorded from Wadi Zerqa Main and Aqaba (Harrison 1968a).

Map 5.4.2. Distribution of Nubian ibex (*Capra* [*ibex*] *nubiana*) in Jordan.

Population: Although there are no estimates of numbers, it is obvious that they have greatly decreased since former times, primarily due to hunting. They are now believed to be stable in numbers (Maher Abu Jafar, pers. comm.).

Threats: Habitat degradation and poaching, even though this latter threat has decreased recently. The small size of remaining ibex populations and their isolation from each other is also cause for concern.

Conservation measures taken: Nubian ibex is listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). In Jordan, it has been fully protected since 1978, and the laws are enforced in conjunction with a conservation education program. Ibex occurs in three protected areas (Map 5.4.1); Wadi Mujib and Dana Wildlife Reserves, and in Wadi Rum Nature Reserve. It is also present in the proposed Jebel Masadi Wildlife Reserve (Clark 1979). The network of reserves that have and are being created should help ensure the future survival of the species in Jordan. As of 1992, a total of 34 ibex are housed in a 0.25–0.4km² enclosure on the slopes of Wadi Mujib. They originated from 20 animals transferred from San Diego Wild Animal Park in July 1989.

Status within country: Endangered.

Conservation measures proposed: **1)** Maintain the current strict measures of hunting control to ensure the survival of the species in Jordan. **2)** Conduct field studies to assess the status of existing populations and to determine factors controlling their demography. **3)** Census the population in Wadi Mujib Wildlife Reserve, annually, or preferably seasonally, to evaluate the results of the supplemental release into the Reserve.

If Jordan's wildlife reserves are to effectively protect the remaining ibex populations, the support of local people is essential and their community grazing rights must be adequately addressed. To these ends, it would be desirable to initiate a study to determine sustainable levels of domestic livestock grazing within potential ibex habitat. Furthermore, there is an urgent need for trained personnel, together with continued support from international conservation organizations and donor agencies.

5.5 Lebanon

A. Serhal

Introduction

The Republic of Lebanon runs for 215km along the eastern edge of the Mediterranean sea, bounded to the north and east by Syria and by Israel to the south. It is a narrow country, no more than 89km wide and covering approximately 10,230km². The topography of Lebanon is predominantly mountainous, and undergoes significant changes within relatively short distances. Four dominant physiographic regions are recognised. The narrow, discontinuous, but fertile coastal plain runs along the Mediterranean, formed by riverine alluvium and marine sediments. The Lebanon mountains (Jabal Lubnån), rising steeply from the eastern edge of the plain and running north-south, constitute the country's major topographic feature. These consist of limestone and sandstone mountains which run for approximately 160km, between 10 and 56km wide, intersected by deep, narrow gorges. The highest peaks are found in the northern part of the range and reach 3,090m on Qurnat Sawdå. The middle and lower slopes of these mountains are under intensive cultivation. On the east side of the Lebanon mountains lies the al-Biqå (Beqaa) valley with its fertile alluvial soils. Running for about 175km, up to 26km at its widest, the al-Biqå valley is part of the East African Rift System. The final major topographic feature, the Anti-Lebanon range (al-Jabal ash-Sharqi) forms part of the country's eastern border with Syria. The highest peak in this range is Mount Harmon at 2,816m asl.

Climatic conditions can vary, although Lebanon falls within the Mediterranean climatic region and so is generally sub-tropical. Precipitation ranges from 750 to 1,000mm on the coast to >1,270mm at higher altitudes. The driest area is the al-Biqå valley which receives on average 380 to 640mm precipitation annually. Although heavily forested in the past, most timber resources have been lost and the remaining native vegetation has been heavily impacted by domestic livestock grazing and agriculture. Remaining forest cover totals ca. 76,950ha, but consists mainly of scrub and degraded woodland. The largest remaining areas of forest are in the al-Biqå valley northeast of Bsharri, around Mount Qurnat as-Sawda to Hirmal, and in the hills near Byblos and east of Beirut. Only 300ha of closed cedar forest is estimated to remain. Many attempts at reforestation have been thwarted by domestic goat (*Capra hircus*) over-browsing and by illegal fuelwood gathering (IUCN 1992a; WCMC 1988a).

Current status of Caprinae

Both Persian wild goat (*Capra aegagrus aegagrus*) and Nubian ibex (*Capra [ibex] nubiana*) have recently become extinct in the country. The last reports were in the beginning of the 20th century (Kumerloeve 1975).

General conservation measures taken

Conservation of cedar forests has been practised by Druze and Maronite religious communities for centuries. In the past, establishment of protected areas fell under Articles 17 and 19 of Decree No. 8371 (30 December 1961), and was the responsibility of the Ministry of Agriculture. At present, protected areas are ruled by the Ministry of State for the Environment, which was established in 1991, when a "Commission on Natural Reserves and Protected Areas" was created under Decree No. 3/B. Protected areas also fall under the Ministry of Agriculture, "Commission on Natural Reserves, Decree No. 1/141 and 1/125". Both commissions share the responsibility of establishing national parks and other protected areas, whereby the Ministry of Agriculture manages Forest Reserves, and the Ministry of State for the Environment established and manages National Parks, Wildlife and Marine Reserves, as well as other protected areas.

The Society for the Protection of Nature and Natural Resources in Lebanon (SPNL) is a non-government, non-profit organization, founded in 1985 in accordance with acknowledgement No. 6/A (Ministry of Agriculture Decree No. 1/60, 8 January 1986), to develop and supervise national parks in co-operation with the Ministry of Agriculture. The goals of SPNL include setting up a system of national parks and protected areas throughout the country; protecting wildlife – especially mammals and birds, the re-introduction of extinct species to their native habitats; and environmental education, through lectures, seminars, workshops, television documentaries, etc. SPNL is represented in both Commissions on Natural Reserves described above. Most recently, SPNL has helped establish the legal framework necessary for creating four public protected areas in Lebanon (Rabbit Island marine reserve; Ehden Reserve; Mashgara Wildlife Reserve and Barouk multiple use area), and the only privately owned reserve in the country – Khalet Khazen reserve. It has also proposed a series of new natural, scientific and wildlife reserves to both the ministries concerned, in accordance with the new categories of the UN list of National Parks and Protected Areas (IUCN 1990). Recently, SPNL initiated a conservation education program in the major schools of Lebanon. The program includes the creation of a set of teachers' guides to native wild mammals and common birds.

Hunting, game management and law enforcement is the concern of the National Hunting Council which was established in 1974. Research on fauna, flora and atmospheric pollution is the responsibility of the National Council for Scientific Research of Lebanon (CNRS). The council reports directly to the Prime Minister, and its work also involves research for protecting wildlife and habitats and for establishing protected areas. However, much of the scientific conservation-related research is undertaken by the universities or by international organizations (IUCN 1992a; WCMC 1988a).

Currently there are only two national parks in Lebanon, but there are also several privately owned nature reserves, and a series of new national parks and nature reserves has been proposed. The armed conflict in Lebanon obviously hampered most conservation attempts amongst its other impacts (IUCN 1992a; WCMC 1988a).

General conservation measures proposed

Although the SPNL conservation education program has been initiated, posters, films, slides and brochures are still urgently needed to help children understand and appreciate the value of wildlife. Such a program is a priority if the following proposals are to be successful. A plan to re-introduce extinct species into the country is being developed. The first stage proposed by the plan is the development by the National Hunting Council and SPNL, of a captive breeding centre for wild goat and Nubian ibex. At the same time, the Ministry of State for the Environment is establishing a system of protected areas in which to place the offspring of these captive breeding units. These areas include Mashgara National Park (3,500ha) to be in the western Beqaa Valley, and the Barouk multiple use area in central Lebanon. Both these areas are very suitable for Caprinae re-introductions, but both species should not be released into the same reserve to avoid possible interbreeding. However, none of these proposals will be feasible until the armed political unrest ceases or declines significantly.

Species accounts

Published information on Caprinae previously found in Lebanon can be found in Kumerloeve (1975) and Serhal (1985).

Persian wild goat (*Capra aegagrus aegagrus*)

Distribution: Wild goat used to be relatively common in Barouk, the Ammiq mountains and on Mount Harmon, northern Lebanon. However, by the early 1900s, wild goat was extinct in Lebanon (Kumerloeve 1975; Harrison 1968a).

Status within country: Extinct.

Extinction of wild goat in Lebanon was caused by large scale habitat destruction and the disregard of hunting regulations.

Conservation measures proposed: A captive breeding plan and subsequent re-introduction program has been proposed (see above).

Nubian ibex (*Capra [ibex] nubiana*)

Distribution: Ibex was previously found in Barouk, the Ammiq mountains and on Mount Harmon, northern Lebanon until the early 1900s.

Status within country: Extinct.

Extinction of Nubian ibex in the Lebanon was caused by large scale habitat destruction and abuse of hunting regulations.

Conservation measures proposed: A captive breeding plan and subsequent re-introduction program has been proposed (see above).

5.6 Oman

R.H. Daly, M.D. Gallagher, P.N. Munton and T.H. Tear

Introduction

Occupying the southeast corner of the Arabian Peninsula, the Sultanate of Oman covers approximately 314,000km^2 with a coastline of about 1,800km. The country can be separated into several physiographic regions including the mountainous Musandam region which is separated by a narrow band of the United Arab Emirates. Running along Oman's northern coast with the Gulf of Oman, is the Batinah alluvial plain which is about 270km long and 30km at its widest. Separating this region from the rest of the country is the western Hajr mountain range, rising to 3,000m asl in the Jabal Akhdar. The southern face of the Hajr range drains into moderately sloping alluvial interior gravel plains, bounded on the southeast by the Wahiba Sands, and on the southwest by the Rub' al-Khali (Empty Quarter). This latter region extends 600km southwest along Oman's border with Saudi Arabia as far as the border with Yemen. The central desert plains consist generally of a flat, stony limestone plateau stretching southwards from the Rub' al-Khali to the coast of the Arabian Sea. The Huquf escarpment runs north-south along the eastern edge of the Jiddat al-Harasis reaching almost to the coast south of the Janabah hills which form the eastern side of the Huquf saline depression. In the south of the country are the Dhofar mountains, a range mainly of limestone about 300km in length and rising 2,100m asl, including Jabal al-Qamr, Jabal al-Qara and Jabal Samhan. Part of these mountains and their coastal plain differ from those in the north in that for about four months (June to September) they receive the effects of the southwest monsoon. These winds bring rain and fog moisture which supports extensive grass and woodlands on the mountains, their southern escarpments and the coastal plain.

The climate varies from region to region. In summer in the coastal areas, it is hot (40°C in the shade) and humid, while in the interior, it is hotter (up to 50°C in the shade) and dry. At higher altitudes in the Hajr and Musandam mountain ranges, the climate is temperate year round. The country's rainfall is generally low and irregular, with an average of around 100mm per year. However, in the mountains of the north and Dhofar, annual averages can range between 150 and 450mm, and in the spring of 1977, 500mm was recorded in 24 hours in the Dhofar mountains. There are no large, permanent bodies of water and the natural vegetation is generally sparse, although it does vary from region to region with the rainfall. The predominant trees are *Acacia* spp., *Prosopis cineraria* and *Ziziphus spina-christi* in the northern areas and central desert, and *Anogeissus dhofarica* on the Dhofar mountain escarpments.

Current status of Caprinae

Two species are known to inhabit parts of Oman: the Arabian tahr (*Hemitragus jayakari*) and the Nubian ibex (*Capra [ibex] nubiana*). Evidence for the possible existence of a species of a mouflon (*Ovis orientalis*) and for wild goat (*Capra aegagrus*) is given later. Probably the entire world population of Arabian tahr is today restricted to northern Oman, where it occupies north facing slopes between 1,000 and 1,800m, that are characterised by relatively high rainfall, cool temperatures and diverse vegetation. Nubian ibex is currently scattered through the coastal mountains south from 21°N. It may have occurred in the Hajr mountains in northern Oman as recently as 1967 (Harrison 1968a). Ibex populations are greatly affected by the rainfall pattern and those living on the Huquf escarpment, east of Yalooni, inhabit cliffs and hilly habitats, concentrating near large wadis or drainages which provide good shelter, forage and some permanent water.

The sole evidence for Asiatic mouflon (*Ovis ammon*) [sic] in the wild is given by Harrison (1968b:317–318): "It is an old adult male, shot November 15th, 1967 in the Wadi Khabora (Al Khabourah). The animal, killed by Hawasinah Bedu, was one of five seen. The species is well known to the local tribesmen, who apply to it the apt names "Kharoof al Jebel" (Mountain Ram) or "Abu Kharoof" (Father of the Ram). It is said to be common in this part of the Jebel Akhdar range, with a fair number being killed each month. When received from the Bedu by Major C. Seton-Browne, the head of the animal, with skin and horns intact, was malodorous and threatening putrefaction, but after treatment with alum the entire head was saved and dispatched to the author for study." The statement by the Omanis who presented the head is the

Sub-adult Arabian tahr (*Hemitragus jayakeri*), Jebel Akhda, Oman.

H. Jungius (WWF)

only available evidence that the species lived in Al Hajar al Gharbi (the western Hajar mountains of Oman). It has not been reported since. Furthermore, numerous sources state that individual wild sheep are often imported from Iran into the United Arab Emirates (UAE) and also into Oman, and that examples are to be found in private collections. This suggests that the Omani specimen may have been an escaped exotic, or that a previously unreported and unsuspected indigenous population has ceased to exist. Nevertheless, further field research is justified in case a population still exists, for it would certainly deserve Government protection.

A male wild goat was obtained by Captain J.P. Gouriet from a Bedouin who stated he had obtained it as a kid in the foothills near Masafi (25°19'N, 56°10'E; 32km from Manama both in the United Arab Emirates). Although unconfirmed, this specimen was suggested (Harrison 1967, 1968a; Harrison and Bates 1991) to be the possible occurrence of a previously unsuspected population of wild goat in the western Hajar of UAE and Oman. However, there has been no further evidence or suggestions that this species occurs in the wild in Oman. In 1995, C. Stuart (pers. comm. to S. Lovari) reported feral goats were commonly sighted during a survey of the Hajar mountains.

General conservation measures taken

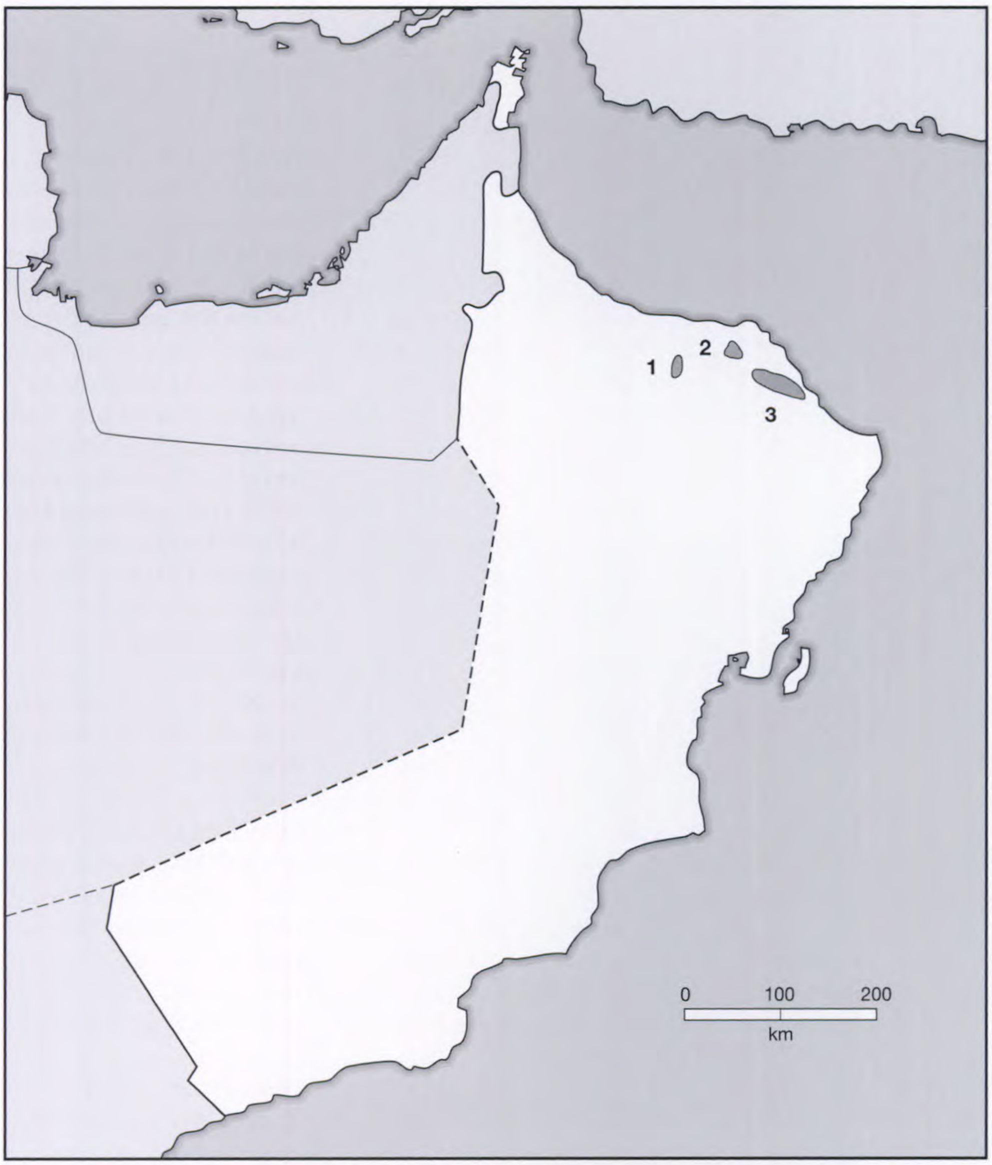
The Ministry of Environment was set up by Royal Decree in May 1984, and since then has undergone several changes. The most recent occurred in December 1991, when under a Royal Decree its powers were merged with those of a Ministerial committee (The Council for the Conservation of the Environment and Prevention of Pollution) into the Ministry of Regional Municipalities and the Environment. This Ministry has departments under the Under Secretary for Environmental Affairs which are responsible for drafting the National Conservation Strategy of Oman, and for future management of Nature Conservation Areas (NCAs). The Ministry is the implementing authority for a series of reserves already approved, but not yet managed, by a Ministerial level committee (the Planning Committee for Development and Environment) in the Governorate of Dhofar (PCDEGD), as part of "The Development Plan for the Governorate of Dhofar" (1991). These approved NCAs are based on those proposed by IUCN in "Proposals for a system of Nature Conservation Areas" (IUCN 1986) in Oman, together with a series of coastal zone management plans produced by IUCN for the Ministry of Commerce and Industry. All these proposals were reviewed by consultants in conjunction with the old Ministry of Environment and staff of PCDEGD as part of the preparation of "The Development Plan for the Governorate of Dhofar". No equivalent approval has yet been given for NCAs in other parts of Oman. However, an application has been sent to UNESCO for a large area in central Oman to be designated a World Natural Heritage Zone. This area contains substantial populations of Nubian ibex and mountain gazelle (*Gazella gazella*). It also has the recently re-introduced population of Arabian Oryx (*Oryx leucoryx*).

There are a number of administrative measures, mostly associated with the granting of Certificates of No Environmental Objection. These certificates can, and are, used to prevent developments which damage nature conservation areas identified by previous studies such as the Proposals for a System of Nature Conservation Areas (IUCN 1986). Currently there are only guarded areas (Map 5.6.1) for tahr (see below). The Ministry of Regional Municipalities and the Environment is preparing a national conservation strategy or plan, that will contain proposals for Nature Conservation Areas, ecosystem conservation, and measures to conserve individual species.

General conservation measures proposed

Areas in northern Oman, nominated in the Proposals for a System of Nature Conservation Reserves (IUCN 1986) remain to be approved and funded. Those in the Governorate of Dhofar have been approved but remain to be funded and implemented, although all areas enjoy some degree of administrative protection. Munton (1985) recommended that conservation of Arabian tahr would be best achieved by maintenance of the traditional conservation areas known as "Hamas" or "Hamyas". These areas contain the best tahr habitat in the country and were free of domestic livestock. It was also recognised that traditional Omani laws prohibiting felling of live trees should be enforced in these areas. Because the tahr and the unique northern flora are complementary, vegetation in these reserves could be used to provide a source of indigenous plants for re-vegetating other areas in northern Oman. Some species also had the potential for agricultural forage crops (Munton 1985), and others for forests (Lawton 1980).

Efforts should be made to determine whether a species of mouflon does occur in Oman and if so what its taxonomic and demographic statuses are.



Map 5.6.1. Locations of guarded areas with Arabian tahr (*Hemitragus jayakari*) in Oman.

1) Al Hamya, Jabal Nakhl (1,600ha; est. 1976); **2)** Wadi 'Asya (2,800ha; est. 1976); **3)** Wadi Sarin, Jabal Aswad, Jabal Abyad, Jabal Abu Daud and Jabal Bani Jabr (20,000ha: est. 1976, with Jabal Bani Jabr added in 1991).

Species accounts

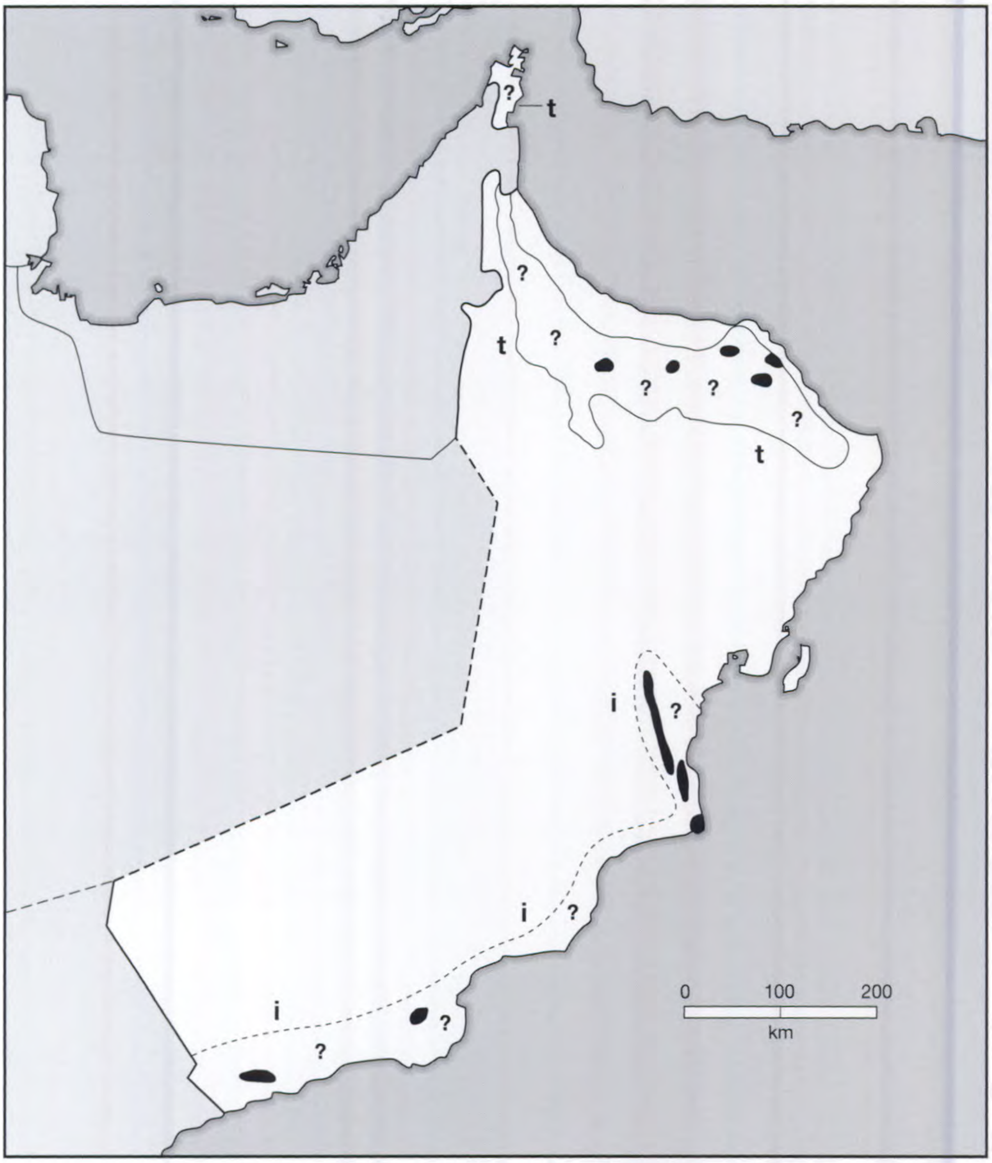
Limited published material on the biology of Caprinae in Oman is available for Arabian tahr (Munton 1979, 1985), and Nubian ibex (Sale 1980; Tear 1987).

Arabian tahr (*Hemitragus jayakari*)

Distribution: Tahr has been found in small, scattered populations throughout a 600km crescent of northern Oman, from the limestone massifs of the Musandam, through the arid Hajr mountains, south to the mountains northwest of Sur (Map 5.6.2).

Population: The total wild population was estimated to be about 2,000 animals (Munton 1985), although the extremely rugged terrain, low densities and small group size, make accurate censuses very difficult. In a 3-month zoological survey in 1995, C. Stuart (pers. comm. to S. Lovari) made only one sighting of tahr (a female and 2–3 month-old young) in the Hajar mountains. However, some populations may be increasing annually by approximately 6%, and the population in Wadi Sarin area doubled between 1978 and 1987 from around 360 to 700 individuals. There is no recent estimate of total numbers.

Threats: Although within guarded areas its status is sound, elsewhere problems include restricted available habitat, poaching, and most importantly, competition with livestock, primarily domestic goats. It is not known whether livestock numbers are increasing or decreasing in the interior. In some areas, tahr are probably severely stressed during periods of drought due to several possible causes including lack of food, competition with livestock



Map 5.6.2. Known and potential distributions of t) Arabian tahr (*Hemitragus jayakari*), and i) Nubian ibex (*Capra [ibex] nubiana*) in Oman.

including donkeys and feral goats (C. Stuart, 1995, pers. comm. to S. Lovari), and poaching at the limited waterholes. Diseases introduced by livestock may be a major threat to the small scattered populations of tahr.

Conservation measures taken: Listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It has been illegal to kill or capture tahr in Oman since the Royal Decree issued in 1976 (Ministry of Diwan Affairs, Ministerial Decision No. 4), but the terrain and distribution make this difficult to enforce. In 1975, a special wildlife guard force, administered by the Diwan of the Royal Court, was established to protect Arabian tahr in a 200km² area in the mountainous region 45km south of Muscat in the Wadi Sarin and Jabal Aswad areas. A number of tahr guards ("mushrafin") were appointed from local tribes originally to patrol just the Wadi Sarin-Jabal Aswad, but subsequently their jurisdiction has been extended to include Jabal Abyad and Jabal Abu Daud. The area patrolled by the guards has gradually been extended, and by 1992 they now protect tahr and mountain gazelle in an area of about 2,350km², including the Jabal Nakhl 70km southwest of Muscat and the Jabal Bani Jabr about 120km southeast of Muscat (Map 5.6.1). In addition, a number of villagers are retained to report any poaching attempts. All the patrolled areas contain good quality habitat, but tahr populations are small and isolated, and thus vulnerable to diseases introduced by domestic stock, and other stochastic events. In some areas, arrangements have been made with local tribes to keep their domestic livestock out of areas of particular importance for tahr. Tahr occurs in three guarded areas: in the Wadi Sarin-Jabal Aswad region, and in Wadi 'Asya (Jabal Nakhl) and Al Hamya. Populations of tahr which may be in the rest of the Hajr range and in Musandam are not guarded.

Tahr is one of the species kept in H.M. The Sultan's Captive Breeding Centre at Bait al Barakah in northern Oman, where it reproduces and grows well in captivity. As of October 1992, there were 23 animals held at this facility (13 males and 10 females). Surplus animals will be used for re-introductions and for supplementing existing populations.

Status within country: Vulnerable.

Conservation measures proposed: 1) Establish the series of five reserves that have been proposed to be maintained free of domestic livestock and patrolled against poaching. The reserves are designed to protect around 1,750 animals, and would include the majority of the known populations. **2)** The captive breeding program should continue to gather more information on the species and its genetics, and provide a source for re-introductions which could be especially important if disease struck wild populations. **3)** Consider establishing a second captive breeding group outside the region. **4)** Maintain and extend the present enforcement of conservation measures. Along with censuses and gathering further data on distributions, more ecological research on the species is required, including studies on competition with livestock. Active habitat management will be required to ensure the continued survival and conservation of Arabian tahr (Munton 1985). **5)** It is vitally important to develop a seed bank of the tahr's major forage species so that overgrazed areas can be re-vegetated. Such a bank would also be valuable for re-establishment of forages for domestic livestock, and help reduce competition for tahr. **6)** Re-enforce the traditional laws which restrict tree cutting in the Sultanate as another important component of habitat management (Munton 1985). **7)** Implement the new draft legislation prepared by the Ministry of Agriculture and Fishery Wealth to provide for better protection and management of rangelands and forests throughout Oman.

Nubian ibex (*Capra [ibex] nubiana*)

Distribution: Formerly, Nubian ibex may have occurred in the western Hajr mountains in northern Oman (Harrison 1967, 1968a; Harrison and Bates 1991), but as this was a single observation and there have been none since, it is possible that they are now absent or never existed as a viable population in this region. Currently, its known distribution is patchy and extends along the coastline in rugged terrain, south from the Huquf escarpment (approximately 21°N) to the border with Yemen. Five populations are known within this region, based on isolated sightings: Huquf Janaba Hills, Ra's Madrakah, Jabal Samhan, and Jabal al Qamr (Map 5.6.2). Recent evidence from radio-tracked individuals caught and released on the Huquf escarpment, indicates that there is some movement of animals between the Huquf and Janaba Hills populations.

Population: No data are available on the size, demographic status or trends of the total Nubian ibex population. Ibex distributions and numbers are most likely determined to a large extent by the temporal and spatial rainfall pattern, particularly in the most arid areas. However, surveys have been completed only in the Huquf escarpment area, where numbers appear to have been stable over the last five years. In the coastal hills to the south of this population, the status of ibex is unknown (but see Sale 1980). Generally, densities are likely to be similar to the Huquf escarpment where there are estimated to be one ibex/km².

Threats: One of the main populations (Huquf escarpment) is relatively safe at present because it is located in a remote and harsh environment, and it receives some protection from the Arabian Oryx Re-Introduction Project.

However, there is competition from expanding feral donkey (*Equus asinus*) populations in all areas, which requires study. In southern Oman, conditions in the Dhofar mountains are different (Sale 1980). Here, although hunting pressure is greater and there is less protection of wildlife, the population may be larger than further north.

Conservation measures taken: Nubian ibex is listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It is fully protected by law (Ministry of Diwan Affairs, Ministerial Decision No. 4 1976) throughout Oman, but the actual level of protection varies somewhat, in part due to the rugged and isolated terrain, and also to local conditions. Nubian ibex occur in no guarded areas, but in central Oman, notably on the Huquf escarpment, ibex are protected by the guards of the Arabian Oryx Re-introduction Project based at Yalooni in the Governorate of the Central Region. Around the Huqf escarpment, the local Harasis tribe are more amenable to conservation and poaching is minimal. In the Governorate of Dhofar, there is no active enforcement system of the law protecting the ibex, although local individuals make voluntary reports of poaching activities from time to time, some of which are followed up by the local authorities.

Both the Huquf escarpment and the main portions of the Jabal Samhan (Dhofar mountains) were included in a 1987 proposal for a national system of Nature Conservation Areas (IUCN 1986). The plan is still under consideration. Research is currently being conducted in the central region on the Huquf escarpment and is planned to continue for several years.

Status within country: Indeterminate.

Conservation measures proposed: **1)** Determine numbers and distributions throughout the taxon's range. The first priority area is the eastern range of the Dhofar mountains, the Jabal Samhan, where large concentrations of ibex, as well as conservation problems, have been reported (e.g. Sale 1980). A survey of this area should also include identification of conservation and research needs. Second, the Huquf escarpment study should be continued, focusing particularly on population dynamics, because this population is probably the easiest to study due to its proximity to the oryx project. **2)** Surveys for ibex should also be conducted in the Hajr mountains in conjunction with work on Arabian tahr, to determine if it occurs in these northern ranges. **3)** Initiate ecological studies throughout the ibex's range to enable appropriate conservation plans to be developed for this species. These should also include a study of the level of competition between ibex and feral donkeys. **4)** Give priority to the establishment of the six protected areas recommended in the 1986 IUCN proposal which would provide protection for ibex populations and their habitat. The proposed protected areas with ibex are: ***Central Region*** – Janabah Hills National Nature Reserve (290,000ha), Janabah Coast National Scenic Reserve (69,000ha), Az Zahr National Scenic Reserve (225,000ha); ***Southern Region*** – Arkad National Resource Reserve (264,000ha), Jabal Samhan National Nature Reserve (346,000ha), and Shuwaymiyah National Resource Reserve (60,000ha).

5.7 Saudi Arabia

K. Habibi and H. Tatwany

Introduction

The Kingdom of Saudi Arabia is estimated to cover 2,240,000km², and occupies approximately 80% of the Arabian peninsula. Its physiography is dominated by a central plateau rising abruptly from the Red Sea. Along its western edge, elevations of the escarpment range from 1,500m asl in the north to over 3,000m asl in the south. This escarpment is broken by numerous steep, short wadis, by the Wadi al-Hamd near Medina which runs inland for about 160km, and by a gap northwest of Mecca. The Tihama coastal plain lies mainly south of Medina. From this western escarpment, the central plateau dips gently eastward towards the Persian Gulf at around 760m asl. In the interior, the broad plateau of the Najd is covered by volcanic debris, lava flows and sand, and bordered on the east by a series of deep canyons. The most prominent of these is the Tuwayq escarpment (Jabal Tuwayq) which extends nearly 1,000km up to Najran. The southern part of the country forms part of the vast Rub al-Khali (the Empty Quarter) covering more 647,500km².

Winter falls between December and February, when temperatures are relatively cool (14° to 23°C), and frosts and snow may occur in the southern highlands. Temperatures reach their hottest in summer (June to August), exceeding 38°C in the shade throughout the country. Annual precipitation is generally low and varies greatly between years, ranging ca. 65mm along the Red Sea coast, but with as much as 480mm falling in the highlands of Asir in the southwest, and none falling for up to 10 year stretches in the Rub al-Khali. Much of the vegetation is typical of the North African-Indian desert region. Plants are generally small xerophytic shrubs and forbs adapted to extreme aridity, intense isolation and high soil salinity. Some small areas with grass and trees occur in southwestern Asir, and though widespread, the date palm (*Phoenix dactylifera*) grows mainly in ash-Sharqiyah province. Annual plants predominate with large numbers of ephemerals appearing after sporadic rainfall. In wadis where the water table may be high, woody perennials such as *Acacia* spp. are common. While endemic species are poorly represented in the large desert stretches, they do grow at higher elevations, though these patches are isolated by lowlands with their contrasting ecology. The isolated hills and mountains have a greater potential for harbouring unique varieties of plants. Despite its large size, only 64 species of mammals are found in Saudi Arabia; the majority are rodents and bats. Over 300 species of birds are known in the Kingdom, of which the majority are winter visitors or passage migrants. Among the ungulates, the legendary Arabian oryx (*Oryx leucoryx*) is extinct in the wild, and three species of gazelles are endangered. Several species of felids, including leopard (*Felis pardus*), caracal (*F. caracal*) and sand cat (*F. margarita*) are found in small numbers. The cheetah (*Acinonyx jubatus*), however, is extinct in the Kingdom. Only the red fox (*Vulpes vulpes*) is common and is widespread throughout the Peninsula, while Hamadryas baboons (*Papio hamadryas*), able to adapt to human activities, are increasing in the Sarawat mountains of the southwest.

Current status of Caprinae

Saudi Arabia has a single caprin the Nubian ibex (*Capra* [*ibex*] *nubiana*), known as the "Wáal" or "Badan" in Arabic. This species is found mainly in the western highlands and the Tuwayq escarpment of central Saudi Arabia. It is a mixed grazer-browser living on perennial grasses, dwarf shrubs and acacia leaves. Its dependency on water limits its movements to higher elevation wadi beds where seepages and rock pools are available. During the hot season, the animals seek well concealed shady areas among rock crevices and ledges from which they emerge to feed in the wadi beds at sunset. The rugged mountainous terrain, in the range of Nubian ibex, is not frequently used by other wild ungulates. In some areas, however, relict populations of mountain gazelle (*Gazella gazella*) live sympatrically with ibex. This may be the result of human pressure which has forced the gazelles to move to higher, more isolated habitat.

In general, habitat conditions for ibex are less degraded than those of other wild ungulates in Saudi Arabia. The vegetation, in terms of structure and species diversity, has remained relatively stable. The main reason for this being that ibex habitats are characterised by difficult terrain, which tends to limit access for livestock. As a result, ibex are found in a wide diversity of habitat types, ranging from low altitude, dissected escarpments (500m asl) in the central Tuwayq, to the juniper (*Juniperus* spp.) dominated mountain summits of over 2,000m asl.

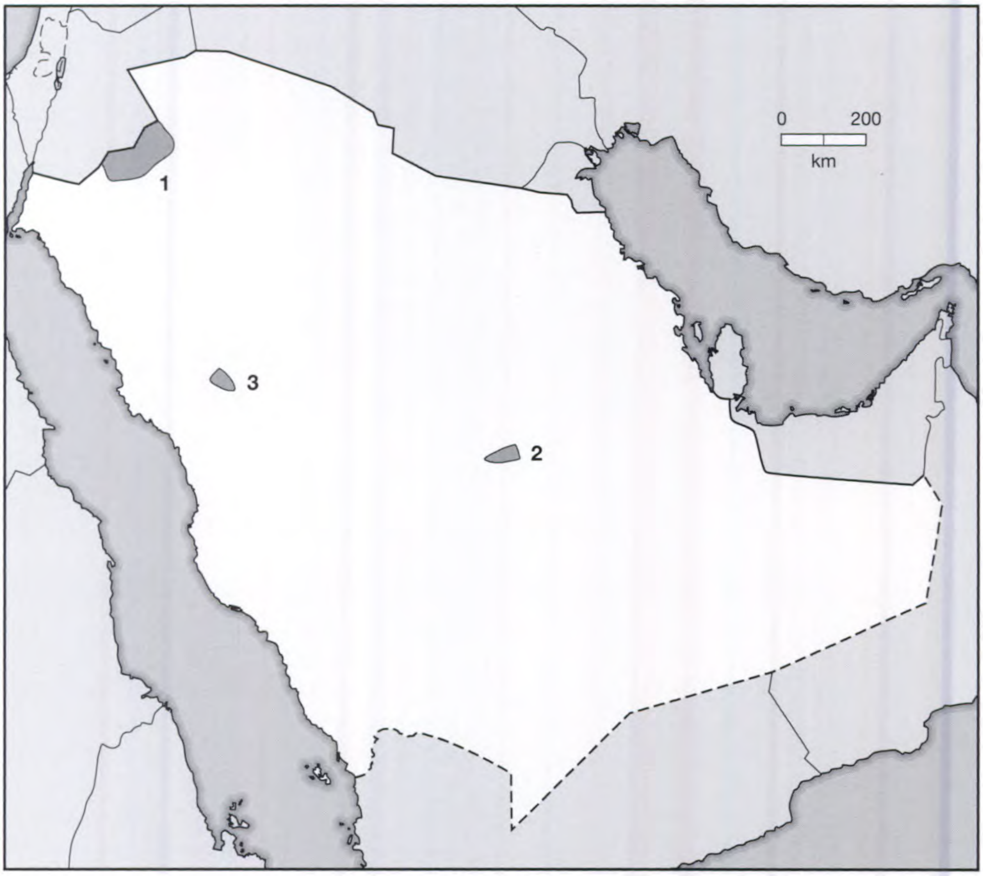
The recent accelerations of habitat destruction (mainly through overgrazing by livestock), and of hunting, have been major causes for the decline of ibex in the country. Increased road access and other development projects in some areas of core ibex habitat, have also contributed to the decline in ibex numbers. Despite such pressure, the species has survived in much of its former range, albeit in small enclaves which are isolated from each other by human development and other unsuitable habitats. The future of Nubian ibex in Saudi Arabia depends on a conservation program that takes into account both the historical and cultural factors which have caused the decline of wildlife in the country, and that seeks out solutions which counteract the threats posed by the rapid changes which have taken place in Saudi Arabian society in recent decades.

General conservation measures taken

Setting aside protected areas in Arabic society is a pre-Islamic practice dating back hundreds of years. To deal with frequent drought and arid weather conditions, protected areas or "hemas" were established by a tribe for grazing, bee-keeping or tree production purposes. Hemas were especially popular in the western mountain chain where, prior to the development of new roads and townsites, the majority of the population was concentrated. Among the hemas where ibex have been historically protected by the local inhabitants, Hawtat bani Tamim in central Tuwayq, and Hemah Fiqrah (southwest Hejaz), are especially important. Grazing is not allowed and as a result the ibex continue to survive in both these areas.

In 1979, the government passed a hunting by-law through which a hunting season was established, and the hunting of gazelles and ibex was banned. The Ministry of Agriculture and Water (MAW) set up the first national park in the country in the Asir mountains in 1984. MAW is also responsible for the management and conservation of forests and other parks in the Kingdom. Species conservation has not been given a priority in the Asir National Park, which is used mainly as a tourist attraction.

Institutionalised conservation started with the establishment of the National Commission for Wildlife Conservation and Development (NCWCD) in 1986. The Commission functions as an independent government agency, and is responsible for the protection and development of the country's natural resources. Since its inception, NCWCD has declared seven nature reserves. The ibex reserve at Hawtat bani Tamim and the At Tubayq Reserve were created in 1988 specifically to protect Nubian ibex (Map 5.7.1). Hunting is prohibited in these reserves and management plans, which include controls on access and livestock grazing, are being implemented. The two areas, however, represent only a small portion of



Map 5.7.1. Locations of protected areas with Nubian ibex (*Capra [ibex] nubiana*) in Saudi Arabia.

1) At Tubayq Reserve (12,000,000ha; est. 1988); **2)** Ibex Reserve (2,369,000ha; est. 1988); **3)** Hemah Fiqrah Tribal Area (not an official protected area).

the total ibex range in the country. To ensure adequate numbers of this species, additional areas have been surveyed and proposals presented to the Commission's board of governors to declare additional reserves to protect ibex in the Kingdom.

Species account

Several reports and publications deal with the biology and conservation of Nubian ibex in Saudi Arabia (e.g. Gasperetti 1978; Habibi 1986, 1990, 1991, 1992, 1994; Habibi and Grainger 1990; Harrison 1968).

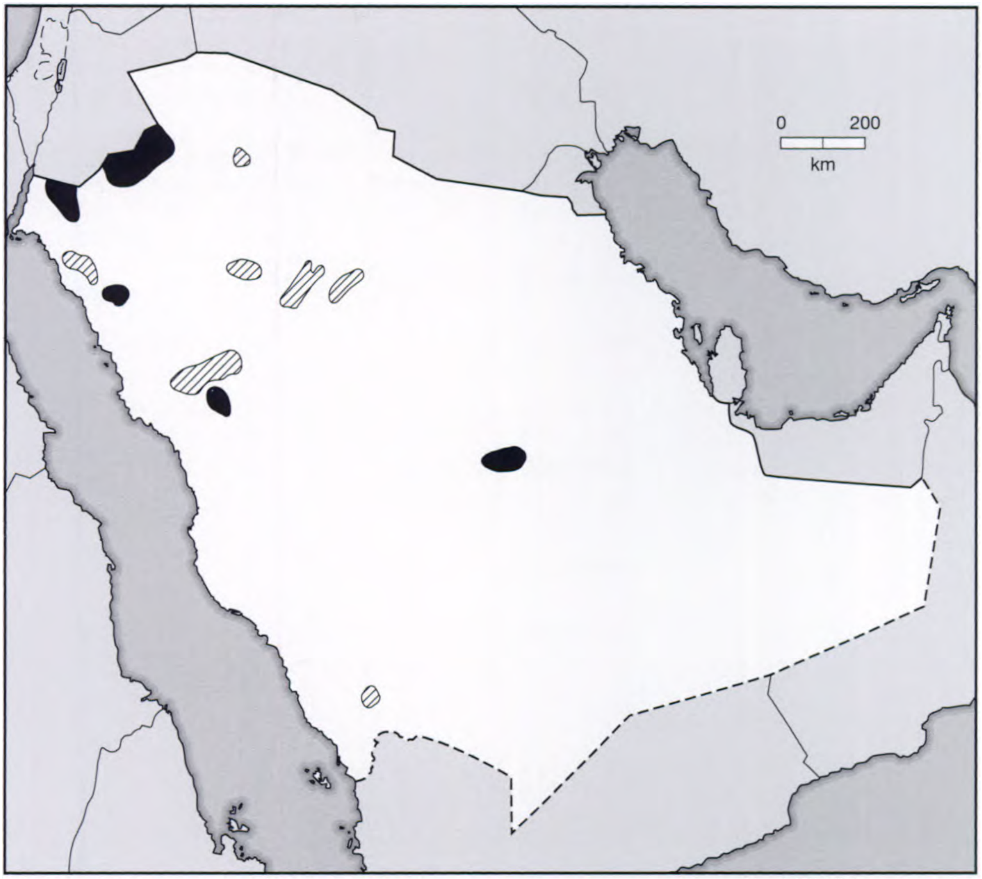
Nubian ibex (*Capra [ibex] nubiana*)

Distribution: Few systematic censuses have been made. Most data come from brief aerial and ground reconnaissance surveys made to locate populations. Among the 15 sites where ibex have been found, major concentrations occur in the western mountains of the Arabian shield, with isolated populations located in the north, north-central and central regions (Map 5.7.2). Only scattered observations have been made in the south (Map 5.7.2). The highest densities appear to be in Jabal Qaraqar, Hemah Fiqrah and Hawtat bani Tamim.

Population: There are no population estimates, but overall, numbers are believed to be decreasing in areas where ibex are not protected. In contrast, ibex numbers are believed to be increasing in the two protected areas. Here recruitment is satisfactory and females appear to give birth to twins frequently.

Threats: Habitat destruction, competition with domestic livestock, and poaching. Nubian ibex continue to be threatened by habitat degradation, particularly through the extension of roads, livestock encroachment and other development pressures in and around its remaining refuges. Continued displacement and isolation of ibex populations will further limit opportunities for dispersal and genetic interchange between scattered populations. Although the general ban on hunting ibex was promulgated in 1979, it is difficult to control poaching, especially in remote areas. Such areas are frequently visited by Bedouins because the availability of water tankers and 4-wheel drive vehicles allows them access to the most isolated regions. Accompanied by large numbers of livestock, these nomadic people stay in an area until the vegetation has been totally exhausted.

Conservation measures taken: Nubian ibex is listed as Endangered (C2a) in the 1996 IUCN Red List of



Map 5.7.2. Distribution of Nubian ibex (*Capra [ibex] nubiana*) in Saudi Arabia.

Threatened Animals (IUCN 1996). Ibex is legally protected by a hunting by-law passed in 1979, which along with gazelles, gives the species total protection. This law, however, can be difficult to enforce in some remote areas. In Saudi Arabia, it occurs in two official reserves; At Tubayq Reserve in the north, and the Ibex Reserve in Hawtat bani Tamim in the east-central region (Map 5.7.1). Ibex also inhabit the Ahmadi tribal hema (Hemah Fiqrah) in the Western Mountain chain which may become an officially delineated reserve in the future.

Status within country: Vulnerable.

Conservation measures proposed: 1) Vigorously enforce the hunting ban and create legislation banning the movement of Bedouins and hunters into protected areas, to halt the indiscriminate poaching of ibex. **2)** Launch an education program in the school system in an effort to inform the public about the merits of conservation, and of the role which wildlife plays in the stability of fragile ecosystems. **3)** The current priority of NCWCD must be to establish contiguous protected areas in the mountain chain of western Saudi Arabia, which constitute the major habitats of Nubian ibex.

5.8 Syria

A. Serhal

Introduction

The Syrian Arabic Republic is situated on the east coast of the Mediterranean Sea and covers around 185,180km². There are three major physiographic regions. A coastal strip, which runs for about 180km along the Mediterranean, is narrow and interrupted by spurs of the Jabal Nusayriyah north of Tartus. To the south, it widens into the Sahl 'Akkar (Plain of 'Akkar) which continues south into Lebanon. Along the eastern border of the coastal plain running southwest-northeast are the Jabal an-Nusayriyah (Jabal Alawite) mountains, ranging from 900m asl in the north to 600m asl at their southern end. Directly east of this range lies the Ghab depression with the Orontes river valley running through it. Further south, are the Jabal ash-Sharqi (Anti-Lebanon mountains) running along Syria's border with Lebanon, averaging between 1800 and 2100m asl, and including Syria's highest mountain, Jabal ash-Shaykh (2,814m). Other, smaller mountain ranges are scattered throughout the country, including Jabal ad-Duruz in the extreme south, and Jabal Abu Rujmayn stretching north-eastward across central Syria. The remainder of the country is covered by the undulating, rock-gravel plains of the Syrian Desert which lies mostly at elevations between 300m and 500m asl, except in the more mountainous south central region of al-Hamad.

A Mediterranean climate prevails in the coastal region and in the mountain ranges along its western border, where below 1,500m asl, summers are hot and winters mild. The climate becomes more arid inland with hotter summers but colder winters. The coast and western border mountains receive on average 760 to 1,016mm rainfall each year, but precipitation decreases rapidly inland. The mountain region of Jabal ad-Duruz gets >20mm, but the southern desert around al-Hamad receives <15mm. Forests grow in many mountain areas, especially in the Jabal an-Nusayriyah in the northwest, with drought resistant shrubs such as arbutus, boxwood, broom, myrtle, wild olive and turpentine in the south. The steppe desert regions are vegetated mainly for a brief period in May in response to seasonal rains.

Current status of Caprinae

The nubian ibex (*Capra [ibex] nubiana*) was found in Syria as recently as 1930 (Harrison 1968), but is now believed to be extinct. The species was originally found in the mountain ranges north of Dimasq (Damascus). It became extinct primarily as the result of overhunting, although competition from livestock degraded their habitat. Persian wild goat (*Capra aegagrus aegagrus*) may also have occurred in Syria (Harrison 1968), but it too is believed to be extinct. The general distribution areas of these two species overlapped as they occupied some of the same mountain ranges, but whether there was any ecological or geographic separation between them is unknown.

General conservation measures taken

Legislative Decree No. 152 (1970) covers hunting regulations and the provision of hunting councils. In 1979, Legislative Decree No. 50 banned all hunting for a 5-year period (Anon 1981). Whether this is still in effect is unknown. Syria has no protected areas and hunting regulations are not enforced. It was believed that two areas, each about 20,000ha, had been set aside one in 1968 the other in 1983, as areas for "le patrimoine animal".

Species account

Persian wild goat (*Capra aegagrus aegagrus*)

Distribution: Wild goat was reported in northern Syria, in the mountains north of Dimasq. However, it is now believed to be extinct (Harrison 1968).

Status within country: Extinct.

Extinction was probably caused by habitat destruction and hunting.

Conservation measures proposed: Implement the proposed joint re-introduction with Lebanon.

Nubian ibex (*Capra [ibex] nubiana*)

Distribution: Based on records provided in Harrison (1968), Nubian ibex was found in the Jabal ash-Sharqi mountain ranges north of Dimasq which run southwest-northeast, as far as Halab (Aleppo) and to just south of Tadmur (Palmyra), presumably in the Jabal al Khunayzir. The species is now believed to be extinct in Syria.

Status within country: Extinct.

Conservation measures proposed: Implement the proposed joint re-introduction with Lebanon.

5.9 United Arab Emirates

M.A. Reza Khan and D.M. Shackleton

Introduction

The United Arab Emirates is a union of seven emirates, together occupying 77,000km^2 along the southwestern edge of the Persian Gulf. Almost the entire union is a desert of sand and salt flats. Only in the extreme northeast is there obvious relief where the northern extension of the al-Hajr (Hajar) mountains out of Oman, extend along the eastern part of the Musandam peninsula. Here, steep mountains rise over 1,500m asl. Along the coast, the climate is hot and humid, while inland temperatures are even higher but conditions are arid. Dust-bearing northerly and north-easterly winds, called "shamal", blow during mid-winter and early summer. Annual rainfall averages 75 to 100mm, and the mean temperature is 18°C in January and 33°C in July. Such climatic conditions result in limited vegetation, which primarily consists of low-growing shrubs.

Current status of Caprinae

A small number of Arabian tahr (*Hemitragus jayakari*) were previously reported in the Jabal Hafit, Abu Dhabi, near Burai, on the border with Oman. In 1991, a horn believed to belong to be from an Arabian tahr was discovered at the foot of Jebel Hafit, an extension of the Hajr range where it runs into the Al Ain area of Abu Dhabi

Emirate. However, no living specimens have been reported for many years in this region of the United Arab Emirates (R.H. Daly, *in litt.* 1992). It is believed to be extinct in the Emirates but whether due to overhunting, lack of habitat, or for both reasons, is uncertain. It is possible however, that a few individuals may occasionally stray into the Emirates from Oman, but as such areas are extremely remote and inaccessible, reports are essentially non-existent.

5.10 Yemen

D.M. Shackleton

Introduction

Estimates of the size of the recently reunited Yemen range from 343,750 to 537,950km². The uncertainty is due mainly to the difficulty of defining its border through the Rub al-Khali (the Empty Quarter) desert. In the northern part of the country, four main physiographic regions can be recognised. The first is the narrow strip of arid coastal plain, the Tihamah, extending eastward from the Red sea to an elevation of 200m asl. From this point the plain changes into jagged canyon-like valleys and low plateaux of the Upper or Tihamah mountain, which also runs parallel to the coast. Its eastern edge lies at 460 to 1,400m asl. Running through the centre of the country are the high rugged mountains of the Yemen highlands. Generally, they reach between 1,500 and 3,355m asl, but some peaks are even higher. In the eastern part of the country, the land gradually slopes down from the Yemen highlands towards the edge of the Rub al-Khali and its ill-defined border. Much of this eastern region consists of extensive plateaux 915 to 1,830m asl, and separated by well defined valleys. The southern part can be divided into two physiographic zones, the coastal plain and the inland mountains. The coastal plains run approximately 1,130km along its Gulf of Aden coastline, ranging between 8 and 65km wide. It is interrupted irregularly by wadis which originate at the foot of the first low (300 to 600m asl) ranges of the inland mountains. Further inland is a plateau averaging 990m asl, followed by the remaining inland mountains which average more than 2000m asl with many peaks 2,440 to 2,750m high. Beyond these ranges lies the southern extension of the Rub al-Khali desert.

The climate is controlled by two major air masses, the regular northerly winds and the southwest monsoons, which provide northern Yemen with fairly defined and regular seasons. Annual rainfall is ca. 300mm, while some coastal regions may receive none some years. As many as seven climatic regions are recognised, and the relatively high rainfall throughout much of the country results in it being one of the most fertile regions of the Arabian Peninsula. The damp coastal steppe covered by dense salsola scrub and low prickly grass (*Panicum turgidum*), merges into the more arid Bokar zone. Acacias are the dominant trees in the wadis, while thorn trees form a continuous belt near the foothills of the western slopes. Mountain vegetation between 180 and 1,222m includes a mixture of native and cultivated species (e.g. myrrh, carob, fig, date palms, mango), and higher up, an evergreen zone is found between 1,222 and 2,044m asl, dominated by euphorbia, together with eucalyptus, acacia and budelia. Land above 2,044m is treeless and vegetation is equivalent to an Alpine steppe-thorn shrubland.

Current status of Caprinae

Only Nubian ibex (*Capra* [*ibex*] *nubiana*) was reported in Yemen where it was considered to be rare even by 1915 and absent from some parts of its former range (Bury 1915, cited in Harrison 1968). Nothing is known of the ibex's current distribution or population status.

General conservation measures taken

Responsibility for conservation of nature, wildlife and genetic resources lies with the Ministry of Culture and Tourism.

Species account

Nubian ibex (*Capra* [*ibex*] *nubiana*)

Distribution: Previously reported from the mountains in south-east Yemen which join with the Dhofar mountains of Oman (Harrison 1968). No recent surveys of current distributions have been made, however, it appears to still exist in greatly reduced numbers in the remotest regions of the dry mountains of the Hadramawt in the east (C. Stuart, in litt. 1996).

Population: No estimate.

Threats: Automatic weapons are owned by many people throughout the country and hunting is probably the greatest threat to this ibex.

Conservation measures taken: Listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Nubian ibex reportedly occur in proposed Jabal al-Ara'is Reserve, in Abin Province (Mahir Abu Ja'far 1984)

Status within country: Indeterminate.

Conservation measures proposed: Field surveys to determine the status of Nubian ibex and potential for re-introductions. If re-introductions are recommend there are probably several sources where animals could be obtained from both wild and captive populations.

5.11 Regional summary

P.A. Alkon

Caprinae distribution and abundance

The Mid-East Region comprises much of western-most Asia. It extends eastward from the eastern Mediterranean littoral, encompasses the entire Arabian Peninsula, and includes Iran and Iraq in Asia Minor. The total area is more than 5.5 million km^2. Thirteen nations occur within these bounds, including 10 for which at least some information was obtained for the Caprinae Action Plan. No information was obtained from Iraq or Yemen. Wild Caprinae have occurred in all 10 countries in recent times, but are now reported extinct in three (Lebanon, Syria, and United Arab Emirates), and are very possibly extinct in a fourth (Iraq) (Table 5.11.1).

According to the country reports, there are either three or four extant species of wild caprins in the region, depending on whether one or two species of wild sheep are recognised. Some authorities recognise urial (*Ovis vignei*) and mouflon (*Ovis gmelinii*) as separate species, while others consider them to belong to the same species (*O. orientalis*). A total of seven subspecies of Caprinae is confirmed for the region: Arabian tahr (*Hemitragus jayakari*), Persian wild goat (*Capra aegagrus aegagrus*), Nubian ibex (*C.* [*ibex*] *nubiana*), Armenian mouflon (*O. o. gmelinii*), Laristan sheep (*O. orientalis laristanica*), Esfahan sheep (*O. o. isphahanica*), and Transcaspian urial (*O. o. arkal*) (Table 5.11.1). Moreover, some authorities recognise two hybrid populations of wild sheep; Alborz red sheep (*O. gmelinii gmelinii* × *O. vignei arkal*) and Kerman mouflon (*O. g. laristanica* × *O. v. blanfordi*).

Iran supports the greatest diversity of Caprinae in the Mid-East, including all the extant sheep taxa of the Region, probably the sole regional populations of Persian wild goat, and the majority of the world's population of Armenian mouflon. Oman supports two Caprinae species, including the entire world population of wild Arabian tahr. The four other countries with known existing wild Caprinae populations support only one taxon, the Nubian ibex.

Table 5.11.1. Summary of conservation status (category of threat[1]) of Caprinae in the Mid-East.

Taxon	Iran	Iraq	Israel	Jordan	Lebanon	Oman	Saudi Arabia	Syria	UAE[2]	Yemen	Red List[3]
Wild goat *Capra aegagrus aegagrus*	K	?	-	-	Ex	-	-	-	-	-	VuA2cde
Nubian ibex *Capra [ibex] nubiana*	-	-	V	V	Ex	I	I	Ex	-	K	Enc2a
Arabian tahr *Hemitragus jayakari*	-	-	-	-	-	V	-	-	Ex	-	Enc2a
Armenian mouflon *Ovis orientalis gmelinii*	I	K	-	-	-	-	-	-	-	-	VuA2cde
Esfahan sheep *Ovis orientalis isphahanica*	K	-	-	-	-	-	-	-	-	-	VuA2c
Laristan sheep *Ovis orientalis laristanica*	K	-	-	-	-	-	-	-	-	-	VuA2c
Transcaspian urial *Ovis orientalis arkal*	K	-	-	-	-	-	-	-	-	-	VuA2cde
Alborz red sheep[4]	K	-	-	-	-	-	-	-	-	-	-
Kerman sheep[4]	K	-	-	-	-	-	-	-	-	-	-

[1] Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List of Threatened Animals (Groombridge 1993); ? = presence in country uncertain; – not present.
[2] UAE = United Arab Emirates.
[3] Global category of threat listed in 1996 IUCN Red List of Threatened Animals (IUCN 1996); – not listed.
[4] Considered by some authorities to be hybrid populations between urial and mouflon.

Estimates of total regional numbers of Caprinae are available for only the Arabian tahr (about 2,000 estimated in Oman). Country-wide totals are available only for Nubian ibex in Israel. Nearly all extant caprins are classed as "Indeterminate" or "Insufficiently Known" by country, the only exceptions are Nubian ibex in Israel and Jordan, and Arabian tahr in Oman, both of which are classed as "Vulnerable".

Realities and issues

Few regions of the world have been so continuously and profoundly influenced by human activity as have portions of Mid-East. Social, political, and environmental change and disruption, including armed warfare, have marked the region's history to the present day. Within this ancient, politically turbulent context, wildlife has played important cultural and subsistence roles in the lives of Mid-East peoples. Here, caprins have had a significant association with humans since the Neolithic and before. The domestic goat and sheep, two of the most important livestock animals, were first developed from wild Caprinae precursors in the region about 10,000 years ago.

The current precarious status of Caprinae and other wildlife in much of the region may largely be attributed to at least four main causes:

1) the advent of firearms and motorised vehicles, leading to more efficient hunting of wildlife;
2) destruction or degradation of habitat resources owing to human and livestock population pressures;
3) the absence of effective conservation and wildlife management programs; and
4) the political uncertainties which hamper long-term policy and planning.

Major, specific impediments to Caprinae conservation include: a) lack of adequate population inventories, b) lack of effective legal protection, c) absence of sufficient protected areas, d) absence of wildlife conservation priorities and mechanisms, and e) uncertainties regarding the taxonomic status of some caprins.

Exceptions to this generally bleak picture should be noted. Effective wildlife conservation and research programs exist in Israel, and steps towards improved inventory and/or protection of wildlife resources are being undertaken in Jordan, Oman, and Saudi Arabia. Conversely, a formerly vigorous Caprinae conservation program in Iran has declined significantly over the past two decades. Latest reports suggest that numbers of most caprins have declined dramatically since the 1970s due to hunting pressures and poaching, much of which is taking place in protected areas.

Regional co-operation for wildlife conservation in the Mid-East may seem premature given a) the political enmity and instability in relations among nations of the region (e.g. formal states of war still exist among some Mid-East countries); b) the obvious and urgent need for even rudimentary wildlife conservation practices at the national level; and c) differences among nations in wildlife taxa and habitats, and in conservation goals.

Nonetheless, some significant steps towards normalisation of relations among nations and peoples of the Near East have been taken within the past two decades. These include the Egypt-Israel peace treaty, the start of multilateral and unilateral negotiations between Israel and neighbouring Arab states, and the Israel-Palestinian autonomy process. On one hand, regional co-operation in wildlife conservation could benefit from these political processes, while they might also contribute to normalisation of political relations between neighbouring states. Wildlife conservation seems an especially appropriate vehicle for such progress because:

1) the principles governing the status and management of biological resources are widely accepted and are independent of political and socio-economic divisions;
2) wildlife resources are not a contentious issue among most Mid-East countries; and
3) managers, conservationists and biologists are especially likely to forget political and ethnic differences in the interest of the region's biological resources.

The increased world-wide recognition of the importance of biodiversity conservation at the highest national and international political levels, may also justify some optimism with regard to future regional co-operation in the enlightened protection and management of Mid-East wildlife resources.

In considering shared Caprinae resources within the Region, the Nubian ibex occurs or has recently occurred in at least seven countries: Israel, Jordan, Lebanon, Oman, Saudi Arabia, Syria and Yemen. Five of these nations have been involved to at least some extent in recent peace negotiations, and some have even established a discourse with respect to environmental and resource management issues. Moreover, Egypt, an important nation outside of the Mid-East region, also supports Nubian ibex populations, and also has played a significant role in promoting political dialogue among regional states and entities. The Nubian ibex may thereby serve as a useful focus for engendering regional co-operation in the conservation of Caprinae. Within this context, international organisations and politically disinterested third parties may play effective roles in promoting contacts and co-operation at various scientific, management, and political levels.

Recommendations

The Mid-East region requires substantial improvements in political relationships among the various countries before major, open regional conservation programs can be undertaken. However, several levels of co-operation and interchange appear feasible, especially given the greatly increased scope of discourse and negotiation that has taken place in the recent years. Accordingly, the IUCN SSC Caprinae Specialist Group may act to facilitate Caprinae conservation in the Mid-East by undertaking the following:

1) Facilitate informal meetings of biologists and officials from various countries within the Region at international meetings and other venues.
2) Promote sponsorship of support for bilateral and multilateral Caprinae conservation projects within the Region by international organisations, interested outside countries, and non-governmental parties.
3) Promote support for wildlife conservation education programs within the Region by appropriate international organisations.
4) Promote the inclusion of wildlife conservation issues within the framework of ongoing bilateral and multilateral Mid-East peace negotiations.
5) Organise an international Nubian Ibex Workshop. Invited participants would include experts and authorities from all countries in which Nubian ibex presently occur or have occurred in the Region within recent decades. The workshop should be held at a site open to all potential Regional participants. The IUCN and other international organisations should also promote the inclusion of wildlife conservation as a topic in ongoing bilateral and multilateral discussions and negotiations among Regional nations and entities.

Chapter 6

Europe

6.1 Albania

L. Gjiknuri

Introduction

The Republic of Albania lies along the eastern edge of the Adriatic Sea, bounded to the north and east by Yugoslavia and to the south by Greece. Almost 70% of its 28,748km^2 is mountainous, mainly comprised of the Dinaric mountain system stretching from Yugoslavia to Greece. The predominantly limestone mountains, with their frequent karst formations, are separable into three main regions. The Albanian alps span the northern part of the country in a northeast-southwest direction, their limestone peaks reaching 2,693m asl on Mount Jezerce (Jersece). Within these alps is a subregion, the dome-like plateau of the Krastë-Cukalit. To the south, are the central uplands, with the Mali i Shebenikut ranges extending up to around 2,260m along the eastern side, and other massifs broken by river systems. These uplands include both rounded volcanic and limestone mountains, whose maximum elevations include Albania's highest mountain, Mount Korab (2,751m), on the eastern border with Yugoslavia. The southern highlands include three subsidiary ranges, whose peaks range between 2,100 and 2,400m asl. The main lowland region is in western Albania, mainly along its coastline, but also running inland in finger-like extensions especially from the central coastline.

The climate, while greatly influenced by the Mediterranean, is also affected by its rugged topography, and so is marked by a wide climatic range. Rainfall is highest along the coast (around 1,400mm) but is almost twice this in the north and less in the central lowlands. In the north, the climate tends to resemble that of central Europe with harsh winters, while central Albania has a typical continental climate with a wide range of temperatures. Albania experiences three different winds; the unique, strong coastal-slope wind called the "bora", the hot "sirocco" blowing in winter from the North African interior, and the cooler "mistral" of summer. Maquis vegetation is typical of the lowland Mediterranean regions up to ca. 400m. Forested areas were previously widespread throughout much of the country, although many have been logged with some replanting. Below 1,000m, oaks (*Quercus* spp.) dominate, with beech (*Fagus* spp.) and conifers at higher elevations.

Current status of Caprinae

The only autochthonous caprin in Albania is the Balkan chamois (*Rupicapra rupicapra balcanica*), known in Albanian as "dhia e egër". It occurs scattered through most of the mountain regions of the country, especially in the east, south-east and northeast regions. While found in 39 hunting zones, it can be hunted only under special permit. Its status is classed as Vulnerable.

General conservation measures taken

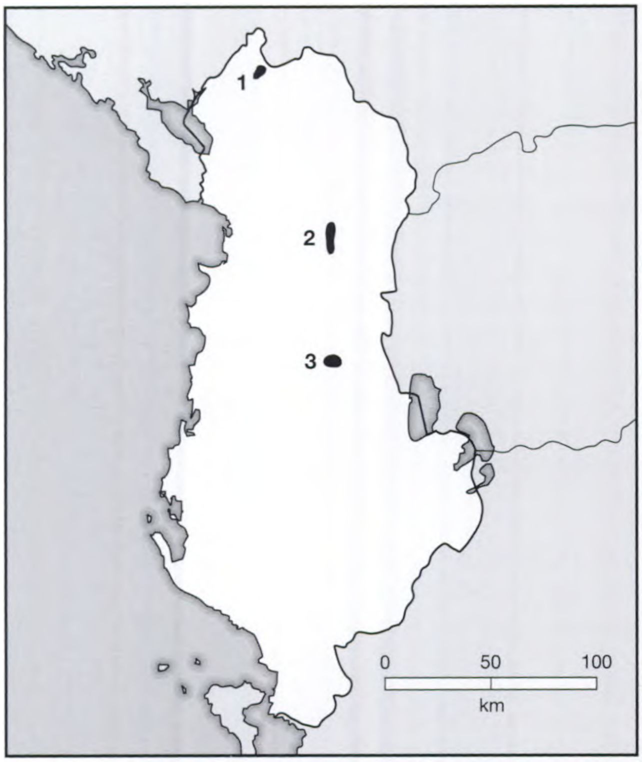
All land is publicly owned in Albania and all protected areas are state property, while nature conservation is primarily concerned with rare species. The major laws relating to conservation are the Law on Forest Protection (No. 3349, 3 October 1963) and the Law on Hunting (No. 1351, 1 November 1951), both of which form the basis for the creation of national parks. There are three types of protected areas that vary in their level of conservation management; national parks, integral reserves and orientated reserves. Of these, integral reserves are the most strictly controlled, providing total protection and permitting no human activities, including no public entry (IUCN 1989b, 1992a). Balkan Chamois receives protection in three areas (Map 6.1.1). Decree No. 3150 (18 July 1961) deals with hunting and fishing, although a new hunting law is currently being prepared. Regulations of the Ministry of Agriculture are issued under Decrees No. 3150, 4411 (16 July 1968) and 5607 (30 June 1977).

Chamois gained protection in Albania under Law No. 3150 (1961), although no clauses refer specifically to this species. Hunting and capture of chamois are permitted only for scientific purposes such as research, museums and zoos, and for re-introductions to other areas. Such activities require special authorisation from the General Directorate of Forest Economy.

Species account

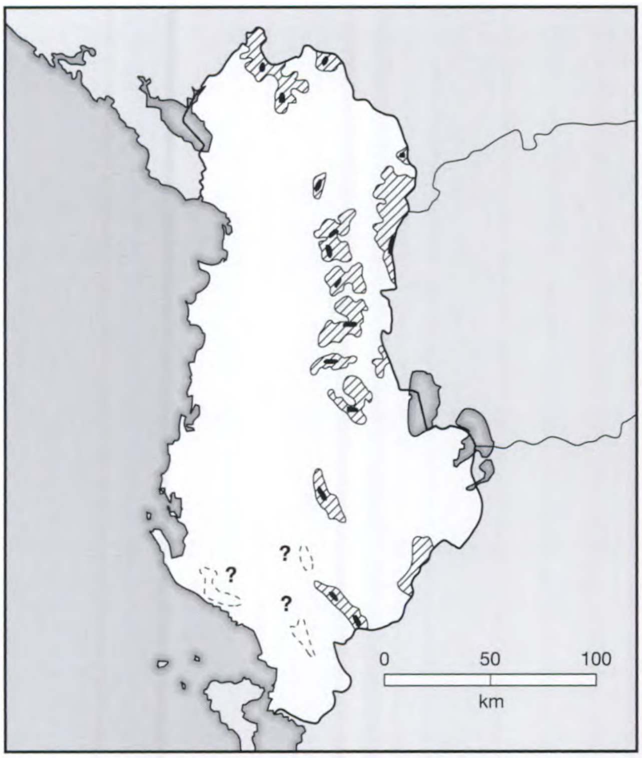
Balkan chamois (*Rupicapra rupicapra balcanica*)

Distribution: Chamois inhabits most of the mountain regions of Albania. In the north it occurs in the Alps of Albania (Shkodrë, Tropojë, and Kukës); in the eastern regions, in the Dibra highlands, the Librazhd region, Pukë, Mirditë and Mat; in the central region, in Barat



Map 6.1.1. Locations of protected areas with Balkan chamois (*Rupicapra rupicapra balcanica*) in Albania.

1) Thethi National Park (4,500ha; est. 1966); **2)** Lura National Park (4,000ha; est. 1966); **3)** Kuturman (Senisht Qerret Mirake) Nature Reserve (4,000ha; est. 1966).



Map 6.1.2. Distribution of Balkan chamois (*Rupicapra rupicapra balcanica*) in Albania.

and Skrapar; and in the south and southeast, Kolonjë and Përmett (Map 6.1.2).

Population: Population densities vary from 0.03 animals/km² in Tomorr, to 1.6/km² in Kastriot Sllovë of Dibra. Numbers were believed to total around 1,050 individuals in 1990.

Threats: Habitat loss is a major threat in some regions due to land demands from expanding human populations. There appears to be no competition from domestic livestock. Poaching does occur but the extent is not known.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), Balkan chamois is protected under Law No. 3150 and can be hunted or captured only with special permission from the General Directorate of Forest Economy. It occurs in three protected areas in Albania: Thethi and Lura National Parks, and in Kuterman Nature Reserve (Map 6.1.1).

Status within country: Vulnerable.

Conservation measures proposed: Increase the number of protected areas for chamois, beginning with establishment of those proposed in Dragobi, Vermosh and Tomor.

6.2 Austria

H. Gossow and H. Zeiler

Introduction

Austria is located in the centre of Europe, with 52,600km² (≈ 63%) of its total area of 83,600km² belonging to the alpine zone along the main alpine divide and at its southeast border (Karawank Alps). The Austrian Alps run the length of the country and can be divided into rugged northern and southern limestone ranges separated by a less rugged and geological different central mountain range. The highest peak is the Grossglockner (3,797m asl) in the western section. To the north of the Alps is a hilly, subalpine region extending to the Danube that runs through the northeastern section of the country.

The western regions have an Atlantic climate and annual rainfall of ca. 1,000mm, while the drier eastern sections come under more continental influences. Originally, at least 80% of the country was forested, but agriculture, human settlements, industrialisation, and traffic demands, have reduced this by nearly half, so that today it varies from 25% and 50% depending on local topography. In the alpine ranges, especially in the remaining high altitude areas, pastoralism has cleared many forests and lowered timberline sometimes by several hundred meters (Kral 1971). About 25% of Austria is under alpine pastures and agriculturally "unproductive" ranges (rock, scree and glaciated areas), or vegetated only with brushy alder (*Alnus* spp.) and creeping pine (*Pinus mugo* var. *pumilio*). However, with the increasing importance and number of hydro-electric powerplants, tourist developments, ski-lifts and hiking trails located within the glacier and rock region, the qualification of "unproductive" appears inappropriate (Beckel 1989). Similarly, interpretations such as "remote", "undisturbed", and "pristine" are also becoming questionable for most of these high mountains.

Current status of Caprinae

Two species of Caprinae are native to Austria. Alpine chamois (*Rupicapra rupicapra rupicapra*) is an autochthonous species that has experienced a recent and significant habitat extension into forested areas (see below). Alpine ibex (*Capra ibex*) was previously exterminated but now occurs in several colonies within and outside its historic range. Re-introductions and transplants of ibex were not always made in the most suitable habitats (Elsner-Schack 1982; Schröder 1985), and sometimes led to emigration of the founder animals to more suitable areas, or to their complete disappearance. The ibex's preferred winter habitat is steep and south-exposed slopes with grassy vegetation and rugged, rock-interspersed meso-relief above 2,000m asl, with annual precipitation <1,300mm (Elsner-Schack 1982; Gossow and Dieberger 1989; Kofler 1982; Wiersma and Schröder 1985); conditions that occur mainly in the inner, dry alpine valleys. Introduced European mouflon (*Ovis orientalis musimon*) also exists in many insular populations. In 1988–89, a total of ca. 7,500 were estimated (Tomiczek 1989). Mouflon must be considered a problematic game species not only because it is introduced (Türcke 1989) but because of the forest damage it causes.

In its central ranges, chamois population densities appear to have been much higher in the early 1900s than today. Secondary chamois habitats have been created in what were previously forested areas by hunting and tourism impacts on the alpine meadow zone, and by clear-cutting and road-building for forestry. The absence of large predators such as wolf (*Canis lupus*) and lynx (*Lynx lynx*) minimises the effectiveness of forests as migration barriers. As a result, chamois have extended beyond their former ranges into lower altitudes, or have concentrated in less disturbed areas (e.g. steep forested slopes) that they may occupy year-round ("forest chamois" ecotype). They are increasingly a problem for forestry (browsing impacts) and for their own welfare (e.g. infections of sarcoptic mange, kerato-conjunctivitis); (Boch and Schneidawind 1988; Gossow and Dieberger 1989; Onderscheka *et al.* 1988). These latter factors significantly impact chamois population demography (Onderscheka *et al.* 1988) and also affect some ibex colonies. Expansion of chamois ranges (see Smidt 1977) could indicate avoidance reactions to human activities and/or an increase in chamois population numbers with dispersal into adjacent forested areas.

While potential habitats have been increasing, more recently their year-round availability is being restricted by expansion and intensification of recreation activities

P. Didier (WWF)

The speed and agility typical of many Caprinae, are demonstrated by this Alpine chamois (*Rupicapra rupicapra rupicapra*).

(e.g. skiing, climbing, mountain-biking, hang-gliding, mushroom and berry collecting, etc.). Reduced habitat accessibility caused by these activities affects both ibex and chamois; in particular, their natural grouping behaviour is negatively affected. Grazing capacities also may be reduced, or new game-damage problems created. For example, timberline may be advanced upwards eliminating pastures, because local grazing rights are relinquished or because intensive high altitude reforestation and forest protection stabilisation projects occur. In other areas, intensified cattle grazing reduces forage biomass available to wild ruminants.

General conservation measures taken

Federal legislation on nature conservation does not exist but is the individual responsibility of the nine Federal Provinces. The basic legal principles for conservation are laid down in the Provincial Laws (Landesgesetze) with wildlife covered by ordinances (Verordnungen, Anordnugen), and their administration specified in separate regulations (Verwaltungsvorschriften). Provincial Laws also cover hunting regulations, while forestry, fisheries, physical planning and water laws also include conservation aspects (IUCN 1987b).

Free-ranging Caprinae are game species and their conservation is mainly the direct result of the hunters' interests in trophies, with selective killing for a desired population structure being an important aspect (Hege mit der Büchse). Supplemental feeding is practised only in some poor quality ibex winter habitats, and is less frequent for chamois. Although Austria has no federal, legal framework for hunting, all Caprinae are covered by hunting legislation except populations held in enclosures for shooting, breeding or wildlife watching. In several federal provinces, ibex either are not yet legally hunted, or hunting is practised only locally where herds are thriving or overpopulated. Hunting legislation attempts to regulate harvests, and prescribed harvest structures strive to mimic natural mortality patterns. However, legislative differences between the provinces reflect the latest hunting law amendments more than local ecological conditions. Hunting systems are commonly based on private estates or hunting areas leased from private or federal land owners or communes known as "Reviere". These are exclusive hunting territories ranging in size from 115ha to some of several thousand hectares. The larger territories are usually supervised by professional hunters, however, division of larger, leasable hunting grounds results in fewer professionals. All hunters must pass an examination requiring substantial theoretical and practical knowledge of game, ecology, land-use, weapons, conservation techniques, legislation, etc. Austrian hunters are effectively involved in overall game management as far as conservation, pest control, and damage or epizootic prevention are concerned.

Unlike ibex, chamois were never over-hunted in Austria in historical times. Winter severity was probably the main regulatory factor for most populations (and also for ibex), at least periodically (Schröder 1971, 1985). Harvesting chamois intensified in the 1970s, but since 1977 annual harvest has been relatively constant at between 24,000 and 26,000 animals. How this harvest relates to the species' population dynamics is unknown. Lynx, reintroduced into eastern Austria in the 1970s, are now expanding naturally and have become a serious problem particularly for mouflon and roe deer (*Capreolus capreolus*) in enclosures (cf. Gossow 1987a, b; Haller 1990), and may eventually impact chamois.

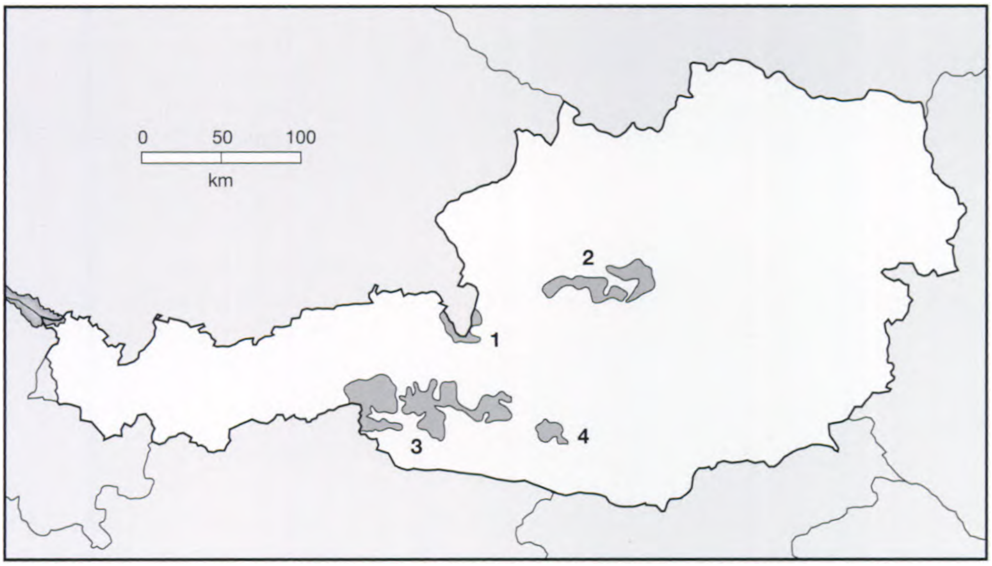
No federal administrative body oversees protected areas which are the responsibility of individual provinces. There are six main categories of protected areas: Nature Reserves (Naturschutzgebiet), Protected Landscapes (Lanschaftsschutzgebiet), Natural Monuments or Sites (Naturdenkmal), Nature Parks (Naturpark), National Parks (Nationalpark), and Biosphere Reserves (Biosphären-Reservat). There are also others and conditions varies among provinces. A number of privately owned protected areas exist such as those operated by the Austrian Association for Nature Conservation, by Oesterreichischer Naturschutzbund (OeNB), and by WWF-Austria (IUCN 1987b). Hunting is permitted in all protected areas. Only in the recently established Special (or Strong) Conservation Areas within the High Tauern National Park is hunting prohibited along with other land use practices (e.g. pasturing, timber use, hydro-electric developments). However, game culling may be practised if needed. Gossow and Dieberger (1989; c.f. also Schröder 1971, 1985; Zeiler *et al.* 1990, 1992) have provided recommendations for the management of such totally protected areas. WWF-Austria has taken a 10-year lease on a large hunting area in the High Tauern Alps that it operates in co-operation with the Wildlife Biological Society of Munich, as a model for alternative hunting and wildlife management practices. Another, older wildlife management research area is operated by Fonds fuer Umweltstudien (FUST; c.f. Bubenik and Schwab 1974; Hamr 1985, 1988; Stringham and Bubenik 1974) in Achenkirch (Tyrol). Disturbance-free areas exist, but have little importance for Caprinae. It would be valuable for chamois or ibex to have such sanctuaries above timber-line in their main winter ranges (without skiing activities) and in birthing grounds (without livestock grazing and mountain climbing).

General conservation measures proposed

Specific recommendations are difficult to make because attitudes towards nature conservation along with hunting or even forestry (e.g. forest die-back problems, timber market changes, etc.) are changing rapidly. Land-use patterns over the last few decades have led to multiple, over-use of habitats, so any proposed conservation measures must be integrated within wildlife and land use management planning. Currently, this is only beginning to be practised. For the long-term, the current hunting situation, with its wildlife-use policy and regional regulations, appears more effective for Caprinae conservation than would a total hunting ban or establishment of local game sanctuaries. Present efforts are aimed at solving short-term problems, particularly population declines caused by epizootics. However, long-term plans are becoming increasingly important in the rapidly changing environment of the Alps. Difficult aspects to assess at present are the integration of Austria into the European Community, and the effects of potential global climate change on mountain ecosystems (c.f. Nilsson and Pitt 1991).

National parks in mountainous regions are presently in the planning phase (Map 6.2.1). Those already established do not qualify as IUCN Category II national parks due to the unresolved sport-hunting question. Also, the minimum requirement of 1,000ha for core areas may be impractical in central Europe with its high human density and hunting systems. Recreation demands, extensive pasturing and other agricultural practices, together with forestry in surrounding areas, all affect populations in protected areas, especially their self-regulatory capacities. Consequently, though culling or alternative active regulatory methods may be acceptable to IUCN, they do not suit local hunting traditions and attitudes (Gossow and Dieberger 1989, 1990; Schröder 1985; Zeiler *et al.* 1990, 1992). The guidelines in the World Conservation Strategy (IUCN 1980) may offer compromises. On the other hand, national parks or nature conservation areas are usually established in Austria to protect mainly vegetation units, but often are also areas of high hunting value or, until recently, exploited for other natural resources. With contrasting land use practices around protected areas, conflicts from increasing ungulate populations are almost inevitable. Adequate conservation and control measures, and adaptive management strategies need to be developed (Gossow 1987b, 1992).

Other issues in Caprinae conservation in need of immediate attention include basic and applied research, and procedures to address forest, tourist and epizootic issues. Habitat evaluation techniques should be used before re-introductions and transplants (of ibex or mouflon), for determining carrying capacities (of chamois and tourists), and for developing protected forest rehabilitation and sustainability (ruminant ungulates) programs. Problem-oriented research is required on population genetic problems of Caprinae (e.g. susceptibility to sarcoptic mange vs. pure geographic barriers; founder effects and low genetic diversity, Stüwe and Scribner 1989; minimum viable population sizes and founder stocks particularly for ibex colonies), because current conservation research in Austria is focused primarily on threatened species such as game birds, brown bear (*Ursus arctos*) and river otter (*Lutra lutra*). Hunting of Caprinae appears to be no real threat, with the regional kill rates ranging from <10% to ca. 25%. However, with the spread of sarcoptic mange (locally also kerato-conjunctivitis), a more thorough population control program for chamois, and perhaps also for some ibex colonies, may become necessary. Though neither disease could totally eradicate caprins, Austrian hunting rights depend on land ownership, and game use as a legal land



Map 6.2.1. Locations of proposed National Parks with Caprinae in Austria.

1) Kalkochalpen, **2)** Kalalpen, **3)** Hohe Tauren, **4)** Nockberge.

use practise includes legal obligations to improve game productivity (e.g. supplemental feeding, medication programs).

Species account

Considerable published information is available on Caprinae in Austria (e.g. Bauer 1991, 1992; Bubenik and Schwab 1974; Elsner-Schack 1982; Hamr 1985, 1988; Hartl and Willing 1987; Knaus and Schröder 1983; Kofler 1982; Kofler and Schröder 1985; Meile and Bubenik 1976; Miller and Hartl 1988; Onderscheka and Jordan 1974; Perle and Hamr 1985; Rauer-Gross 1992; Rauer-Gross *et al.* 1988; Schröder 1971; Stringham and Bubenik 1974; Zeiler *et al.* 1990, 1992).

Alpine chamois (*Rupicapra rupicapra rupicapra*)

Distribution: Occurs in high to moderate numbers in suitable habitats throughout the Austrian Alps, and also increasingly in less suitable, forest-dominated habitats (forest chamois ecotype) (Map 6.2.2).

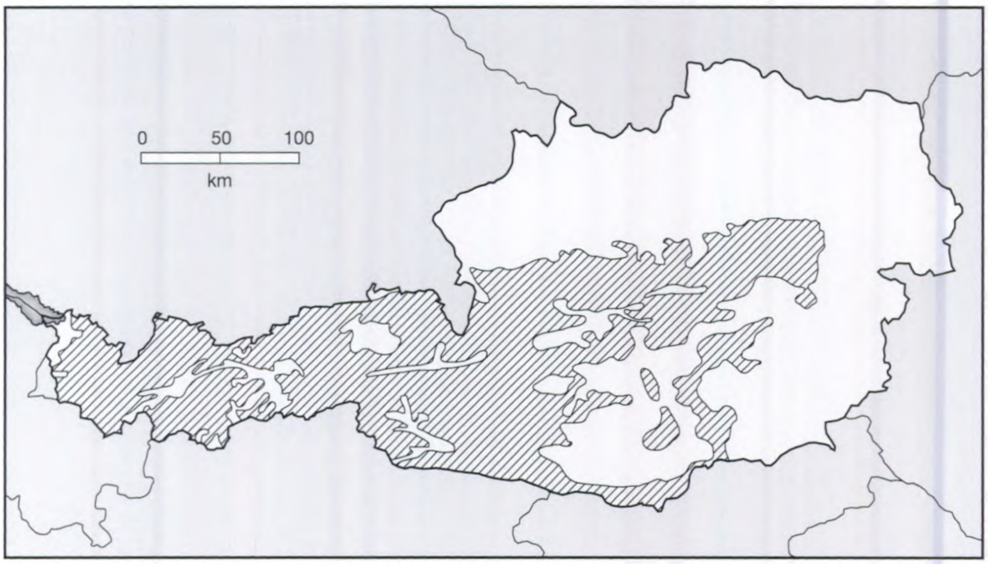
Population: The last estimate for total chamois numbers was 157,000 animals, and this was made in 1976. Data suggest that numbers and total range occupied increased in the 1970s. The total range occupied by chamois continued to increase at least until 1983 when it was estimated to inhabit 2,908,00ha (after Smidt 1977 and Gruber 1985). More recent data on chamois in Austria are not available although they are in preparation (Gruber, pers. comm. 1993).

Threats: Sarcoptic mange is a problem and will continue to be so unless measures are taken to prevent its spread. There are also concerns about the relative overharvesting of older males (e.g. Zeiler *et al.* 1990, 1992).

Conservation Measures Taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Chamois occurs in each of the four proposed protected areas (Map 6.2.1). It is legally hunted throughout Austria and harvest levels are set based on estimates or counts of the sizes of local populations. Current efforts to control sarcoptic mange in chamois and its possible spread to other species are centred on better pro- and post-prophylactic strategies. However, medication programs have not been sufficiently effective under field conditions (Onderscheka *et al.* 1988), and earlier attempts to limit this disease spread by fencing, also had little effect. With the gradual return of lynx, some populations of chamois have been effectively controlled by predation (Breitenmoser and Haller 1987; Haller 1990). Lynx re-introductions are also being recommended by foresters as a means of ungulate game control, especially for "forest" chamois (e.g. in the provinces of Salzburg and Tyrol).

Status within country: Not threatened.

Conservation measures proposed: 1) Minimise disturbance within mange-affected areas and centres of mange epidemics, to avoid dispersal and emigration of infected animals to mange-free herds (Boch and Schneidawind 1988; Gossow and Dieberger 1989; Miller 1986; Onderscheka *et al.* 1988), by limiting or prohibiting skiing, climbing, hiking, hang gliding and similar tourist activities. However, once chamois are infected with mange, the carrying capacity of the population's range decreases, as occurred in Switzerland as a result of kerato-conjunctivitis (Blankenhorn 1988; Gossow and Dieberger 1989). Under these circumstances it may be more appropriate to



Map 6.2.2. General distribution of Alpine chamois (*Rupicapra rupicapra rupicapra*) in Austria (after Smidt 1977 and Gruber 1985).

2) significantly increase the cull of chamois, rather than allow much higher losses from mange epidemics in overpopulated or poor quality populations. Culling should be increased in the remaining mange-free ranges adjacent to mange centres for two to three years on a broad 20 to 30km belt, to reduce food competition and improve body condition and resistance. Not only would all sick, weak, and poor-conditioned chamois have to be killed, but a higher cull of the medium-aged female chamois (the most productive and numerous female age class) would be required. This would be a significant departure from official hunting guidelines and hunting practices (cf. Bubenik and Schwab 1974), so it will be difficult to realise and to convince the average hunter of its necessity.

Alpine ibex (*Capra ibex ibex*)

Distribution: All current populations originate from re-introductions, although not always into former or even suitable habitat. The first colony was re-established in 1924 in the Bluhnbach valley (Hagen mountains), and the second in 1936, farther east in Wildalpen, so that by 1988, ca. 740 ibex had been realised (Bauer 1991). The species is now found in the Blühnbach valley (Hagen mountains), in the Northern Limestone alps in Wildalpen, and in the Pitz and Kauner valleys of Tyrol, and in the Styria (Hochlantsch massif) (Map 6.2.3).

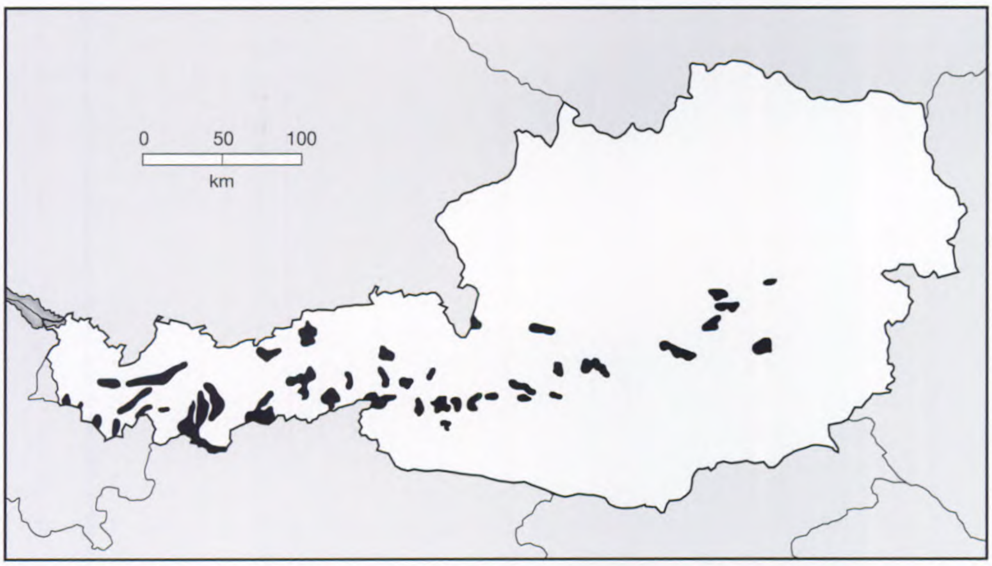
Population: The most recent estimates of the total population are just over 3,000 ibex in 1988/89 (Bauer 1991), and 3,300 in 1990/91 (Bauer 1992).

Threats: Although not threatened, there is concern regarding genetic diversity, the founder effect and minimum viable populations (see Bauer 1992; Stüwe and Scribner 1989). Ibex colonies with >60 individuals are believed to be viable as long as diseases do not impact them.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Ibex is found in two protected areas in Austria; Hohe Tauern and Kalkhochalpen National Parks (Map 6.2.1). It also occurs in areas proposed for protected status (e.g. Carynthia, Salzburg). All current populations are the result of re-introductions into former habitats, or introductions into areas where they were not known to occur historically. Small numbers of ibex are legally hunted each year, but only from a small number of populations in the federal provinces of Styria and Tyrol. For example in 1988, the legal harvest was 70 males and 50 females. However, an additional 56 ibex were also known to be lost that year from mange.

Status within country: Not threatened.

Conservation measures proposed: **1)** Any future re-introductions should be made only after a thorough evaluation of the potential release site and its surroundings has been made and shown to be suitable. The total estimated carrying capacity of ranges in Austria is between 4,000 and 4,500 ibex (Bauer 1992). **2)** Give serious consideration to controlling free-pasturing of domestic sheep and goats in alpine ranges used by ibex because of potential grazing competition (Onderscheka *et al.* 1988), disturbance (Nievergelt 1966), hybridisation (see Randi *et al.* 1990) and disease transmission. Usually, livestock grazing is practised by individuals without pasturing rights, or involves overuse and increased numbers of livestock. Regulative efforts appear necessary despite the difficulty of realising and controlling them.



Map 6.2.3. Known distribution of Alpine ibex (*Capra ibex*) colonies in Austria (after Bauer 1991).

6.3 Bulgaria

J. Spiridinov and P. Genov

Introduction

Bulgaria occupies over 111,000km^2 of the eastern section of the Balkan peninsula with its western border formed by the Black sea. Topographically it can be divided basically into three parts: the Danubian plain, the Balkans and the Rila-Rhodopian massif. The Danube river forms the northern border with Romania and the Danubian plain runs along the entire northern part of the country. These fertile plains, with an average elevation of 178m asl, extend southward to the foothills of the Balkan mountains. With an overall average altitude of 720m, these steep sloping, calcareous mountains reach up to 2,376m on Mount Botev. Several ranges comprise the Balkan mountains including the Strara Planina in the north, the Sredna Gora in the south-centre, the Vitosha in the west, and the Lisa range in the east. The Rhodope (Rodopi) mountains are separated from the Sredna mountains in the southern Balkans by the Thracian plain. The Rhodope mountains run along Bulgaria's southern border with Greece, and at their western end lie the rugged Rila and Pirin mountain massifs rising to almost 3,000m asl.

Most of Bulgaria experiences a moderate continental climate affected by the Mediterranean. Four principal biomes meet in Bulgaria: temperate steppe (forest-steppe), temperate deciduous forests, scattered evergreen forests, and a mixed system of mountains and plateaux. The forest-steppe no longer exists in the Danube plain nor south Dobroudja, but was converted several thousand years ago into agricultural lands. The deciduous forests vary with geography and relief. In the Danube plain and the lower Prébalkans, the remaining forests are comprised principally of oaks (*Quercus* spp.). Forests of oak and beech (*Fagus orientalis*), typical of southern elements, are found in the east Balkan mountains up to 600m asl. In Stranja, the vegetation is a relic of the Tertiary epoch, with beech and oak forests and an understorey of southern evergreen shrubs (e.g. *Rhododenron* spp.) or Mediterranean species such as *Erica arborea*. The vegetation in east Rhodope is similar to that in Thrace, where in some areas there are mixed evergreen shrubs, but the fauna is more representative of Mediterranean species. Overall, the vegetation of this region is dominated by *Q. pubescens*. In the western mountains forests are primarily deciduous, with oaks, *Carpinus betula*, and *F. moesiaca* in the foothills and lower mountain ranges, and *F. sylvatica* in mountain regions between 1,600 and 1,700m asl. At higher elevations, small patches of coniferous forest have survived. The sub-alpine is covered with secondary grasslands and *Juniperus sibirica* shrubs, above which are alpine meadows. In the Rilo-Rhodopian massif above 1,400 to 1,500m, forests are generally comprised of conifers (*Pinus, Picea,* and *Abies*). Forests in Perin and Slavianka are characteristic of the sub-Mediterranean mountains. In the Rhodopes, *Pinus nigra* forests occur in the same zones as in Perin and Slavianka, and the sub-alpine zone contains mostly aborescent *Pinus mugo* along with meadows and secondary junipers (e.g. *J. sibirica*). The alpine zone exists only in the Rila and Pirin mountains above 2,500m asl (e.g. on Mussala peak, 2,925m, and Vihren peak, 2,915m).

Current status of Caprinae

The Balkan chamois (*Rupicapra rupicapra balcanica*) is the sole autochthonous representative of the Caprinae in Bulgaria. It is found generally above 1,000m asl throughout the northern Rila and Pirin mountains, in the central Balkan mountains, and in some areas of the western Rhodopes. In the Rila and Pirin ranges, its principal habitats are the sub-alpine and alpine zones with man-made grasslands, rocky areas, shrublands of *P. mugo* and *J. sibirica*, as well as the coniferous and *F. sylvatica* forests. In the Balkan mountains, it occurs in the subalpine zone, again comprised of natural and man-made grasslands, rocky areas, *J. sibirica* shrublands, and beech and coniferous (*Picea abies, A. alba*) forests. By contrast, the chamois in Rhodope is entirely a forest dweller. Alpine chamois (*R. r. rupicapra*) have been introduced in some areas.

Protection measures were first taken for native chamois after the restoration of the Bulgarian State in 1878. Thanks to the actions of the Forestry Administration and sportsmen, Balkan chamois still survives today. The Bulgarian Academy of Sciences has also played a major role in the conservation and increase of the subspecies since 1978. It is the least threatened species listed in the Bulgarian Red Book (1985), and it receives almost full protection. It has been gradually increasing in numbers since at least 1955 (Genov and Massei 1989). A total of seven populations are well distributed throughout the country helping ensure its survival. Despite protection, a small number of foreign hunters are allowed to shoot some animals each year. If current trends continue, it is projected that by the end of this century, numbers may increase to >2,500 in protected areas.

The first European mouflon (*Ovis orientalis musimon*) were introduced to Bulgaria in 1967, but numbers are still low and it is restricted to lower elevation areas than chamois. Currently, it does not pose a threat to chamois. In the mid 1980s, alpine ibex (*Capra ibex ibex*) were introduced into the Rila mountains. Remains of this species in Bulgaria have been found dating from the Upper Pleistocene (N. Spassov, pers. comm.), and it probably survived until the great forest expansion during the Atlantic period 6,000 to 7,000 years BP.

General conservation measures taken

As outlined in the first Conservation of Nature Act of 1936 and in the Nature Protection Decree of 1961, nature conservation is every citizens' constitutional duty. Various other acts define the duties of organisations and agencies responsible for flora, fauna and habitat protection. Nature conservation legislation stems from the Constitution, Article No. 31, and the Law on Nature Protection of 1967. In 1977, guidelines for the protection of the environment were approved by the State Council and have a major role in the formulation of environmental policy. Protected areas are declared by the Committee for Environmental Protection of the Council of Ministers, following consultation with the Bulgarian Academy of Sciences. There are five types of protected areas; nature reserves, national parks, nature sanctuaries, protected sites and historical sites. Nature reserves offer strict protection but can be used for scientific research, while the other types of protected areas allow for varying degrees of recreation and development. Several bodies have direct responsibility for administering protected areas, and they include the Ministry of Forests and Forest Industry, the Ministry of Architecture and Works, the Balkan Tourist Agency, the Bulgarian Academy of Sciences, the Nature Protection Commission, the Ministry of Education, the Committee of Arts and Culture, the Academy of Agricultural Sciences, and the Bulgarian Union of Hunters and Fishermen. However, direct supervision of protected areas is by forest administrators and rangers. In 1986, the government committed itself to a long-term conservation program and recommended that the Committee for the Protection of the Environment be merged with the Ministry of Agriculture and Forests to form a new Ministry of the Land, Forests and Environmental Protection (IUCN 1989b, 1992a).

The Nature Protection Act (Decree No. 18833, 1962) protects 43 species of mammals including the Balkan chamois. Game management is the legal responsibility of the Forestry Committee, and under the Protection of Nature Act, management of protected species also belongs to this Committee. Ultimate control of the management, operation and protection of nature and natural resources, including protected areas, belongs to the Ministry of Environment. The Bulgarian Academy of Sciences advises the Ministry and the Committee on issues regarding protected species and their habitats.

Hunting female chamois was prohibited by the Hunting Law of 1897. Under this law, hunting males was also closed for "certain periods". Despite these legislative measures and the efforts of the Forestry Administration, poaching after W.W.I almost exterminated this chamois throughout all mountain ranges. Hunting chamois was then prohibited by the 4th Hunting Law of 1926, until the Hunting Law of 1948, when the hunting season for chamois was opened, but only during October. With the new Hunting Law of 1983, the annual hunting season for male chamois was extended from 1 October until 30 April, and females could be hunted from the 31 October to 31 January. Until now,

Map 6.3.1. Locations of protected areas with Balkan chamois (*Rupicapra rupicapra balcanica*) in Bulgaria.

1) Pirin National Park (40,000ha; est. 1952; World Heritage Site 1983). ***Reserves:*** **2)** Rila Monastery Forest (3,446ha; est. 1986; buffer zone of 2,402ha); **3)** Urdini ézéra (1,150ha; est. 1985); **4)** Goliam Skakavets (4,180ha; est. 1985); **5)** Marinchini ézéra (1,509ha; est. 1951; Biosphere Reserve 1977); **6)** Ibâr (1,701ha; est. 1985; buffer zone of 700ha); **7)** Dupkata (1,211ha; est. 1956; buffer zone 656ha; Biosphere Reserve 1977); **8)** Kupéna (1,084ha; buffer zone of 1,359ha; Biosphere Reserve 1977); **9)** Sténéto (3,579ha; est. 1963; buffer zone of 2,522ha; Biosphere Reserve 1977); **10)** Stara réka (1,975ha; est. 1981); **11)** Sévérén Djéndem (1,610ha; est. 1983); **12)** Péeshti skali (1,465ha; est. 1979); **13)** Sokolna (1,250ha; est. 1979); **14)** Djéndema (4,220ha; est. 1953; Biosphere Reserve 1977).

the Forestry Committee has controlled the number of permits and on average seven to eight chamois have been allowed to be killed each year. However, the chamois has never been a protected species in the strict meaning of the Nature Protection Laws (1936, 1960, 1967).

The first protected area for the Balkan chamois, the Marichini ézéra Strict Reserve in Rila, was established in 1951 (Stoilov *et al.* 1981). Following studies by Prof. V. Martino, a second protected area, the Djendema Reserve in the Balkans, was created in 1953. Between 1978 and 1991, many other reserves were also created or enlarged primarily for chamois protection, principally as a result of the efforts of the senior author (G. Spiridinov, Institute of Ecology). Today, Balkan chamois occur in 14 protected areas in Bulgaria (Map 6.3.1) some of which are Biosphere Reserves and World Heritage Sites (Spiridinov, in press). These 14 protected areas represent the principal habitat of Bulgarian chamois in the country. For example, Pirin National Park shelters most of the regional population and assures the preservation of the subspecies in Bulgaria. The Balkan reserves contain about 60% of the regional population, while the Rila Reserve contains 300 to 320 chamois, or >50% of the regional population. There are only 10 to 15 chamois in the Rhodope Reserve.

Until now, the only non-government organisation that has contributed to the preservation of chamois is the Union of Bulgarian Hunters and Fishermen. Other conservation organisations are in their infancy, and only the future will show their orientation. Educational programs pertaining to the conservation of chamois do not currently exist in Bulgaria.

Species account

Balkan chamois (*Rupicapra rupicapra balcanica*)

Distribution: Found in Bulgaria's four main massifs; the Rila, Pirin and Rhodopi mountains, and Balkan Range (Map 6.3.2).

Population: From information supplied by 168 forestry administration units, the total number of chamois in 1988 (censused at the end of winter) was between 1,560 and 1,630 (Spiridinov and Mileva, unpubl.). This estimate is not significantly different from the 1,700 reported by Genov *et al.* (1990), because the sources of information were the same. Actually, some differences are the result of duplication in cases where two or more administrative units reported figures for the same area. Separate population estimates were available for each of the main massifs: Pirin – 400 to 420; Rila – 590 to 620; Balkans – 200 to 220; and Rhodopi – 370 to 390. Populations are either stable or increasing slowly (Genov and Massei 1989).

Threats: Hybridisation with alpine chamois. In Rhodope this is almost complete (mostly areas 4 and 5, Map 6.3.1), and is also a potential danger at Rila. The Balkan population which has been isolated for about 100 years is still small and vulnerable, and poaching has not yet been eliminated. The majority of the populations in Rila and Pirin are not directly threatened, but neighbouring populations are potentially threatened

Map 6.3.2. Distribution of Balkan chamois (*Rupicapra rupicapra balcanica*) in Bulgaria.

by hybridisation. Outside the protected areas, poaching remains a problem.

Conservation measures taken: Protected by law throughout the country, although a small number is legally shot by foreign hunters each year. Balkan chamois is fully protected in 14 protected areas (Map 6.3.1). Measures which have played a significant role in the conservation of this chamois include the hunting restrictions of 1926 and also after 1990, and establishment of protected areas after 1974. This was when the Pirin National Park was enlarged and a good network of strict reserves created in the Balkans and Rila.

Status within country: Rare.

In 1980, the chamois was classed as "vulnerable", but since this time its status has improved. In only 10 years, the number of chamois increased by 200 to 450 animals, whereas in the previous 45 years (between 1935 to 1980) the population increased only by 250 to 350 animals.

Conservation measures proposed: Conservation measures are required to counter the following actual and potential threats to the subspecies: a) Potential hybridisation of Bulgarian and alpine chamois in the mountains of Préspa (Rhodopes). b) Insufficient numbers to assure the long term viability of the regional population and poaching pressure in the Balkans. c) Insufficient protected areas in the Rhodopes. Measures which can or have been proposed to address these issues are: **1)** Eliminate the small population of Alpine chamois at Préspa (Genov *et al.* 1990). **2)** Implement the proposal to create the Central Balkan National Park (ca. 18,000ha) which will encompass nine strict reserves along with their buffer zones (Map 6.3.1, reserves 9 to 14, the Tsarichina Biosphere Reserve of 3,274ha, the Boatin Biosphere Reserve of 1,597ha, and the Kozia stena Reserve of 904ha). This is the official proposition of the Institute of Ecology in 1981 (No. 355 of 13 May), and now actualised (No. 220 of 15 May 1990) (Spiridinov 1982, 1983). **3)** Create Rila National Park, an area of about 95,000ha which will encompass six mountain reserves. This is the official proposition of the Institute of Ecology (No. 460 of 16 July 1982, and No. 188 of 24 February 1987; Spiridinov 1982). **4)** Create a strict reserve and enlarge the current Baévi dupki-Djindjiritsa Biosphere Reserve. The Biosphere Reserve would be increased to 6,100ha, the new reserve would be 3,400ha, and the strict protected reserve in Pirin National Park, which is currently is 2,873ha, would be increased to 9,500ha. **5)** Consider re-introductions of Balkan chamois in some areas because present human activities are probably limiting natural re-colonisation of suitable habitat (Genov and Massei 1989). **6)** Implement the proposals made for the Ministry of the Environment by G. Spriridinov. This will help guarantee the future viability and also contacts between the two regional sub-populations of most of this subspecies in Bulgaria (at Rila at least 1,000 animals, at Pirin about 600, and in the Balkans at least 500). The three regions are inhabited by predators such as wolves (*Canis lupus*), brown bear (*Ursus arctos*), and golden eagle (*Aquila chrysaëtos*). **7)** Consider regulating numbers in the event of an overpopulation of ungulates, first in areas surrounding the parks, and if this does not work, then in the national parks themselves (but excluding the strict reserves). In Rhodope, three to four natural parks would be able to accommodate up to 500 chamois, but outside them chamois numbers will be low. Where sympatric, competition between Balkan chamois and introduced ibex should be carefully monitored in case problems are created for the chamois. If necessary, elimination of ibex may be warranted.

6.4 Cyprus

E. Hadjisterkotis and J.R. Bider

Introduction

Covering 9,251km², Cyprus is the third largest island in the Mediterranean sea. It is about 224km in length, and from north to south is 96km at its widest. Two ranges, almost parallel and slight curved, determine the shape of the Island. The Kerynia mountains, reaching a maximum height of 900m, run just inland for 160km parallel to the northern coast and form the southern extension of the great Alpine-Himalayan chain in the eastern Mediterranean. In the south and southwest, the Troodos mountains cover a roughly oval area of some 2,300km², and are surrounded by undeformed, largely calcareous sediments of Upper Cretaceous to recent age (Gass 1968). They extend inland about 80km from the coast to Stavrovouni peak (689m asl) located 19km from the southeast cast. Its highest peak, Mount Olympus, reaches 1,951m asl. The flat, low-lying Mesaoria plain lies between these two mountain ranges, from Morphou bay in the west to Famagusta bay in the east.

The Mediterranean climate is strongly seasonal, with hot dry summers (June to September), wet winters (November to March), and short, changeable spring and autumn seasons. Annual rainfall is variable but averages around 500mm, with the lowest average of 356mm falling around Nicosia in the north-central area and the highest of 1,041mm recorded on Mount

Olympus. At Stavros tis Psokas Forest Station, located near the centre of the Paphos Forest, normal annual precipitation averages 844mm. Along the northern coast is a narrow fertile plain with evergreen trees. The Troodos range is covered by *Pinus brutia*, dwarf golden oak (*Quercus alnifolia*), plane (*Planatus orientalis*), and cedar (*Cedrus brevifolia*) forests. Forests are very limited and found only in the mountainous areas. The flora and mammalian fauna are predominantly comprised of Mediterrano-Turkestanian and Irano-Turanian elements (Spitzenberger 1978). Relationships for many species can be traced to the mainland, especially to southern Anatolia. However, Cyprus has been an island for at least 15 million years and was never connected to the mainland (Robertson 1987).

Current status of Caprinae

The only wild caprin on the island is the Cyprus mouflon (*Ovis orientalis ophion*). It was once more widespread throughout the island, but is now restricted to the Paphos Forest. Its unique status means that the Cyprus mouflon has economic, cultural and recreational significance for the Republic of Cyprus, not the least because it is the island's national emblem. Tourism makes a major economic contribution to the Island, and mouflon are one of its main attractions. The species is culturally important because a local belief holds that the animals originated either from the flock of St. Mamas, that they were brought to Cyprus by the Jesuits during the crusader occupation, or that they were animals belonging to a Cypriot who left his flock in 1821 to travel to Greece and join the Greek revolution for independence. Mouflon are the only big game mammal on the island, and because hunting is popular, it has significant recreational potential (Hadjisterkotis 1987).

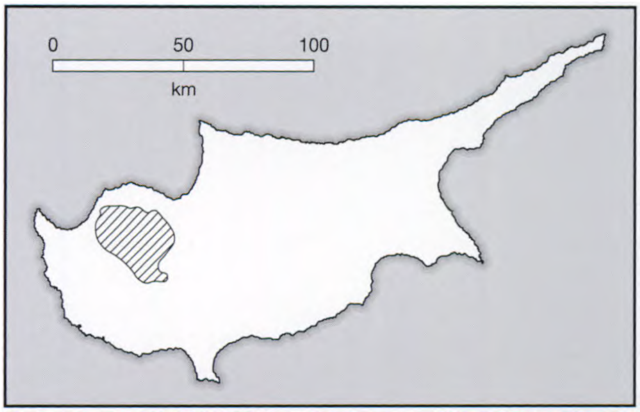
Eight out of 11 mouflon necropsied had moderate to severe parasitic pneumonia (*Mullerius* spp. or *Protostrongylus* spp.) (Hadjisterkotis and Bider, unpubl.). These disease organisms are common in domestic sheep (*Ovis aries*) living on Cyprus, and wild sheep are extremely susceptible to livestock-born diseases (Jessup 1985). The mouflon's range at the periphery of the Paphos Forest overlaps the area grazed by domestic sheep and goats (*Capra hircus*), so it is possible that livestock diseases will continue to affect wild sheep. Towards the end of summer and early autumn, mouflon may suffer from deficiencies in digestible protein and phosphorous. Mouflon are in poor physiological condition at this time and the highest mortality levels coincide with the first seasonal drops in ambient temperature between October to December, due to a combination of starvation, parasites and cold stress.

General conservation measures taken

The Forest Law of 1879 was the first legislation dealing with the Island's environment. It was enacted during the British occupation which had begun in 1878. This was followed in 1913 by the Goat Exclusion Laws and the Forest Law which limited the number of goats that could be owned by the public and regulated grazing in the forest. These laws were in effect until Cyprus became independent in 1960. In spite of the forceful division of the Island in 1974 following the Turkish invasion, only the Government of the Republic of Cyprus is recognised by the international community. Although there is no central conservation legislation covering wildlife, several laws exist. Of these, three are most pertinent to Caprinae: the Forest Law 14/1967 dealing with the sustained management and protection of forests, the protection of important ecological features and the creation of State Forest protected areas; the Town and Country Planning Law (90/1972) which gives the minister the power to order the establishment of protected areas for natural sites with "special natural character"; and the Game and Wild Birds Protection and Development Law (39/1974 to 1991) that covers the establishment of game preserves.

Three types of protected areas are important for the mouflon. Hunting Reserves fall under the Game and Wild Birds Protection and Development Law which allows the creation of temporary game reserves for game and wild birds. Within State Forests, three classes of protected areas can be created: **1)** Permanent Forest or Game Reserves, which also come under the 1974 Game and Wild Birds Protection Development Law and that are used primarily for their natural resources useful to industry, **2)** National Forest Parks used for recreation purposes and **3)** Nature Reserves whose purpose is flora and fauna protection (IUCN 1992a).

In 1938, the Cyprus game laws were improved to provide greater protection for mouflon, and in 1939, the Paphos Forest (620km²) was declared a Game Reserve (Map 6.4.1). In 1985, 823ha of this Forest around Mount Tripilos, the highest point of the Forest, and an area which included all the indigenous Cyprus cedar, were made a Nature Reserve. Before 1973, the Department of Forestry was responsible for wildlife management in Cyprus, after which it was transferred to the newly created Game and Fauna Service of the Ministry of the Interior. The Service is gradually expanding and passing new laws making its operations more efficient. The most recent law governing wildlife management including mouflon, is the Game and Wild Birds Protection and Development Law No. 39/1974 to 1991. According to paragraph 9, no one is allowed to shoot, kill, capture or chase mouflon without a special permit from the Minister of the Interior. The penalty for infringement is up to three years in jail and/or a fine



Map 6.4.1. The location of the Paphos State Forest (620,000ha; est. 1939); this area also represents the general distribution of Cyprus mouflon (*Ovis orientalis ophion*) on Cyprus.

of (Cyprus) £500 (US $1,000). Anyone found in possession of the meat or parts of mouflon faces up to two years jail and/or a fine of (Cyprus) £300. The law seems to be well enforced. Law No. 158/90 was created in 1990, to give more powers to game wardens. In addition to the work of game wardens of the Game and Fauna Service, the Hunting Federation of Cyprus has a number of volunteer wardens, who have similar duties and powers to government wardens, under the 1974 to 1990 law.

The Cyprus mouflon lives primarily within the Paphos Forest Reserve, although it has expanded its range in some areas from 1 to 3km outside the Reserve's boundaries. There, mouflon enter both forested and agricultural lands, particularly near the villages of Anadiou, Gerakies, Kritou Marotou, Sarama and Vretsia. A small captive group comprised of one male and two females was established in 1950 at Stavros tis Psokas Forest Station. By 1988, a total of 64 animals had been reintroduced from this group to the wild. In 1987, the captive group numbered 30 animals, but by April 1992 only eight remained, mainly because several had escaped during the previous two years. Two mouflon were transferred in 1955 from the group to the Limassol Zoological Garden for public viewing and for another captive breeding program from which 16 animals have been reintroduced into the wild. At present, only one pair remains in the zoo, and apparently due to intensive inbreeding which took place over 37 years, this has led to high lamb mortality and low fecundity during the last 12 years.

As Cyprus accepted Ultimate Responsibility for Endangered Species (IUCN) for the Cyprus mouflon in 1967, and it is a national symbol, such combined status appears to help reduce poaching. Mouflon sometimes are attracted to agricultural crops growing just outside the Paphos Forest. Wheat and barley have been planted at certain areas along the boundary to try and discourage such movements, but these efforts have not been totally successful in eliminating the mouflon's use of agricultural areas.

Species account

Information on the ecology and behaviour of the Cyprus mouflon has been published by Hadjisterkotis (1987), Maisels (1988) and Van Haaten (1970).

Cyprus mouflon (*Ovis orientalis ophion*)

Distribution: In the Middle Ages, this mouflon was plentiful throughout most of Cyprus. Just prior to the British occupation in 1878, mouflon were still believed to be numerous and herds of 20 or more were common (Dept. Forestry, unpubl. rept.). Shortly after this, all but a single herd of 25 mouflon were believed exterminated and a ban on hunting was imposed (Biddulph 1884). By 1884, numbers were thought to be increasing. A herd of at least 20 were known to inhabit the Troodos Forest, and a similar number was in the Paphos State Forest, around 1930. However, by 1937 the Troodos population had been reduced by persistent poaching to 15 animals, and by 1945 it no longer existed. Mouflon are now restricted to the Paphos State Forest and its immediate environs (Map 6.4.1). However, in November 1991, a female mouflon was shot by a poacher on top of Troodos Mountain, indicating that the species may have re-entered the Troodos Forest.

Population: The population gradually increased from 1970 when the population was estimated at 200 animals, so that by 1983, the Forestry Department estimated there were 500 to 600 animals (Hadjisterkotis 1987), and by 1988, the total estimate was approximately 2,000 mouflon. However, helicopter censuses flown in February 1992, suggest that numbers in the forest have declined over the last four years, perhaps by as much as 50%, while those at the forest edge may have remained stable. The total estimate of numbers is now around 1,200 animals (Hadjisterkotis and Bider 1992).

Threats: That there is only one population of this subspecies, is the main threat to its continued survival. This condition predisposes the Cyprus mouflon to epizootics or other stochastic catastrophes. The present management system, particularly the protection measures, appears to be working. Poaching, which is the limiting factor, is reduced considerably, although not completely eliminated. A number of animals are found shot dead, particularly at the edge of the forest near areas that overlap with summer dove hunting.

Conservation measures taken: Cyprus mouflon is listed as Endangered (A1a) in the 1996 IUCN Red List of Threatened

Animals (IUCN 1996), and legally protected by Cyprus game laws such that killing and possession of fresh parts (hide, meat, etc.) is forbidden. Enforcement is satisfactory. The total free-ranging population occurs only within Paphos Forest Game Reserve (596,000ha) which includes the Paphos Nature Reserve (892ha). Two small captive groups, one at Stavros tis Psokas Forest Station and the second at Limassol Zoological Park, are both used to provide animals for release into the wild.

Status within country: Vulnerable.

Conservation measures proposed: 1) Make the solution of agricultural damage caused by mouflon a government priority. Either farmers must be compensated for damage caused by mouflon, or the population near the forest edge must be reduced through selective culling or harvesting. The second alternative appears more probable, because even farmers without crop losses are beginning to complain in anticipation of some kind of compensation. **2)** Establish additional, spatially separate and free-ranging populations of the taxon. This is necessary because Paphos Forest has been used frequently in past political upheavals as a refuge for the resistance movements, with the result that it has been deliberately set fire to. Although these are now historical facts, in 1974 during the Turkish invasion, one third of the Island's forest was burned. The Turkish occupation of part of the Island continues, so new hostilities might lead to the loss of the Forest and its species. Therefore, additional populations are required before Cyprus mouflon can be considered out of danger. **3)** Before translocation to new localities, animals should be examined for parasites and diseases, and if necessary, kept in quarantine for a short period. **4)** Reduce inbreeding in captive populations by **a)** keeping genealogical records for animals bred in captivity, and **b)** taking all necessary measures to minimise inbreeding by exchanging animals between breeding units, or by periodically introducing individuals from the wild. **5)** Ban tree felling by the Department of Forestry in Paphos State Forest near cliffs used as lambing grounds. This is especially important to avoid when the mouflon are in late pregnancy and during the two month period following lambing to avoid disturbing females, or driving them into areas where the young are more vulnerable to predators. Similarly, important lambing areas such as the Pakhnioutis Cliff, should not be developed as a quarry as has been done in some other areas. **6)** Consider developing a management plan to provide controlled opportunities for tourists to observe mouflon in the wild. Besides the enclosure at the Stavros tis Psokas Forest Station, reconstructed in 1989 for public viewing, certain lambing grounds can be viewed without disturbance. Stations equipped with telescopes could be established on mountain tops on opposite sides of the valley from these cliffs.

6.5 France

F. Roucher

Introduction

The largest country in Western Europe, France covers an area of approximately 543,965km². Three main geological regions can be recognised; the plains, the ancient mountains, and the more rugged younger mountains of the south and southeast. The plains are composed of four different regions. The northern plains extend north from the Ardennes to the North Sea and Belgium. The Paris basin is the largest region consisting of numerous plateaux, and is surrounded by the Ardennes and the Vosges to the north and northeast, and the Massif Amoricain in the west. The third section, is the Loire plains in southwestern France which follow the Loire valley, and joins the fourth area, the Aquitaine basin bounded to the south by the Pyrenees. The ancient mountains, none of which rise above 1,900m asl, consist of the Ardennes in the north and the Vosges mountains in the northeast. The Massif Central complex covers almost 15% of the country and is an asymmetrical area usually divided into four sections. It stretches northwards, from the south-central part of the country, to merge with the plain of the Paris Basin and Loire lowlands. The third part of the ancient mountains is formed by the Massif Amoricain running from northwest Bretagne (Brittany) north-eastward into Normandie. The younger mountains are comprised of the Pyrenees, the Jura, and the Alps. The Pyrenees run for 450km along France's border with Spain, and reach peaks of >3,000m asl. The Jura, a chain of limestone mountain ridges, lie near France's border with Switzerland, with the highest mountain, Crête-de-la-Neige, reaching 1,723m asl. The Alps in France represent the western limit of this European mountain chain and include its highest peak, Mont Blanc (4,808m). These mountains run along Frances eastern border with Switzerland from Lake Geneva south along the Franco-Italian border to the Mediterranean. About 31% of its mountain areas are covered with forests.

France's climate comes under oceanic, continental and Mediterranean influences. The Atlantic Ocean predominates affecting the country's climate as far as the Alps. The sheltered plains of the northeast fall under continental influences, while a Mediterranean climate extends from the southeast coast as far as the Lower Rhône Valley and also affects the southern Alps and southeastern slopes of the Massif Central.

Current status of Caprinae

France contains four species of wild Caprinae consisting of five subspecies. As its name implies, the Alpine chamois

(*Rupicapra rupicapra rupicapra*) inhabits these eastern mountain regions and survive in relatively large numbers. It has occupied the Alps since the end of the last glacial period, but colonised the Jura mountains only in the 1950s and 1960s, expanding across the border from Switzerland. The species has also been successfully introduced into the Vosges in 1956 and into the Massif Central in 1978. There have been no scabies epizootics in chamois in France unlike in other parts of Europe, but kerato-conjunctivitis did occur in the 1970s in some national parks and reserves, and in some hunting areas in the Alps and Pyrenees. This disease caused population crashes, but died out spontaneously. Today, numbers are high and the subspecies is in no danger. However, a second subspecies, Chartreuse chamois (*R. r. cartusiana*), is endangered. Restricted to a small, limestone mountain region of the Pre-Alps around Grenoble, it appears to be genetically distinct (Pemberton *et al.* 1989), and not only are numbers extremely low, but its increase is limited by the presence of introduced ungulates. These include Alpine chamois, mouflon, red deer (*Cervus elaphus*) and domestic livestock, which threaten the endemic chamois either by creating direct ecological competition for resources, or in the case of the Alpine chamois, by potential hybridisation and genetic swamping. The isard or Pyrenean chamois (*Rupicapra pyrenaica pyrenaica*) is found in southwest France where it inhabits the north slopes of the Pyrenees along France's border with Spain. While not threatened, Pyrenean chamois is far less numerous than the Alpine chamois.

As in most western European countries, Alpine ibex (*Capra ibex ibex*) or Bouquetin was exterminated by hunting in France by the beginning of the 19th Century. Current populations are the result either of translocations, or of natural colonisation from Italy (to Vanoise and Mercantour National Parks) and France (from Vanoise to Encombres), and are restricted to areas above the timberline in the mountains along France's eastern borders with Switzerland and Italy.

The two autochthonous populations of European or Sardo-Corsican mouflon (*Ovis orientalis musimon*) in France are both located on the island of Corsica. Although they have been protected from hunting for the last 30 years, numbers are still very low. In continental France, introduced populations of mouflon occur in 23 of the 93 French Departments. However, most originate from Central European stocks where it is suspected that they may have been crossed with domestic sheep at some time in their history.

General conservation measures taken

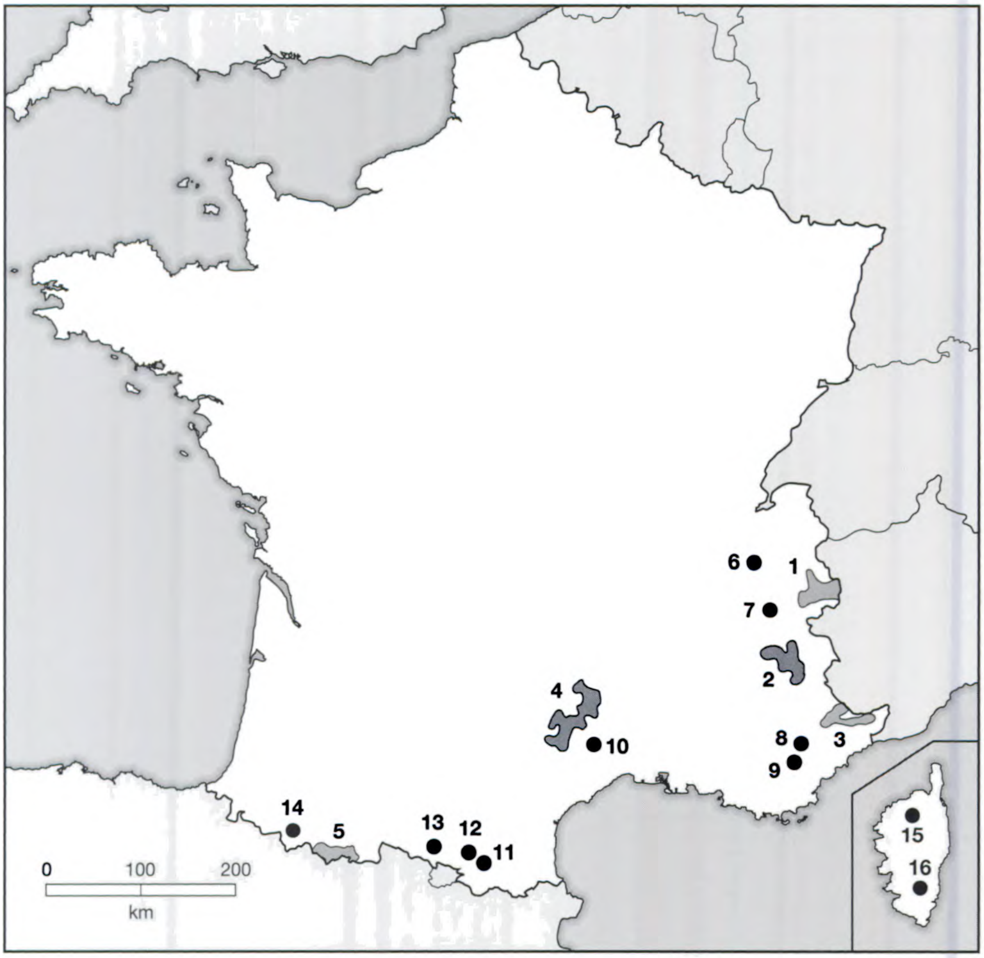
Current conservation legislation relating to protected areas originates with Act No 60.708 of 22 July 1960. This Act, together with its enforcement order (No. 61.1195 of 31 October 1961), covers the general procedures for establishing National Parks (Parcs Nationaux). However, it is open to interpretation and has led to variation in protective measures among parks. The first state reserves were created out of hunting reserves in 1961, followed by the first national park (Vanoise) in 1963. There are other types of protected areas in France. Nature Reserves (Reserves Naturelles) were first created in the 1920s, but the range of permissible categories of reserves was broadened

A male Alpine ibex (*Capra ibex ibex*) lying ruminating on a subalpine slope in Stelvio National Park, Italy.

under the Nature Conservation Act of 10 July 1976 (Act No.76.629). Like Nature Reserves, Regional Natural Parks (Parcs Naturel Regionaux) can also be initiated by local authorities, but are primarily designed for tourism and promoting regional development. Of importance for Caprinae are Hunting Reserves where hunting is not permitted, Game Reserves with limited hunting, Biogenetic Reserves, and Buffer Zones around national parks (IUCN 1987b).

Currently, mountain regions are heavily represented in France's protected areas. Of France's six national parks, five are in the mountains and contain Caprinae, and there are an additional nine National Mountain Reserves (Reserves Nationales de Montagne) with Caprinae (Map 6.5.1). Protection for threatened plants and animals is provided for by the 1976 Nature Conservation Act, with big game animals receiving protection in national hunting reserves. The Ministry of the Environment and the Quality of Life is responsible for the administration of nature conservation, and within this ministry as of 12 May 1992, there are five directorates under the Department of State of the Environment. Of these, the Directorate of Nature and Landscape contains the Department of Hunting, and the Department of Parks and Reserves. Hunting is banned in all of the national parks except Cevennes which was one of the conditions of acceptance by the local people. Currently, however, forestry livestock grazing and tourism are still not adequately controlled within national parks.

Hunting laws in France can be traced back to the Roman period, whereby game as *res nullius* belong to nobody and the right to shoot belongs to the landowner. However, before the 1789 Revolution, this right was the privilege of royalty, and only following the Revolution were the privileges of the nobility abolished and hunting rights returned to all landowners. As early as 1790, abuses led to the first restrictive laws establishing closed seasons, and giving the right for farmers to kill game in order to protect their crops. Game species were distinguished by a 1844 law, which prohibited certain over-efficient hunting methods and also required shooting licences. From this date, the law evolved towards strengthening game conservation, enforcing game laws, and legalising the capture of game for translocations. After World War II, the law evolved in two directions. The first, which made conservation more difficult, was the democratisation of hunting (there are about 1,800,000 hunters today, but they have been decreasing by about 2% per year since 1975), and fragmented estates. The second direction was to promote



Map 6.5.1. Major protected areas with Caprinae in France.

***National Parks*: 1)** Vanoise (52,839ha; est. 1963); **2)** Ecrins (91,800ha; est. 1973); **3)** Mercantour (68,500ha; est. 1979); **4)** Cevennes Park (84,410ha; est. 1970); **5)** Pyrénées-Occidentales (45,707ha; est. 1967). ***National Mountain Reserves*: 6)** Bauges (5,171ha; est. 1974); **7)** Belledonne (2,380ha; est. 1984); **8)** Pierlas (1,100ha; est. 1982); **9)** Quatre Cantons (1,418ha; est. 1982); **10)** Caroux (1,830ha; est. 1973); **11)** Roc-Blanc (12,950ha; est. 1975); **12)** Orlu Nature Reserve (4,151ha; est. 1975); **13)** Mont-Vallier (8,815ha; est. 1975); **14)** Moudang (2,433ha; est. 1966); **15)** Asco (3,510ha; est. 1979); **16)** Bavella (3,900ha; est. 1950). Natural Reserves are not shown.

conservation using scientific and technical research paid for by revenue from hunting licences (Office National de la Chasse), and in co-operation with university and agronomic institutes. Three recent laws also promote conservation. A national deer harvest plan and crop damage scheme were established in 1963, and resulted in deer becoming more numerous than since the Middle Ages. Hunters paid up to $30 million for crop damages in 1991. In 1975, the second law made examinations for shooting licences mandatory, and in 1976 by the Nature Conservation Act (see above) specified for the first time offences other than those related solely to acts of hunting or fishing.

Chamois and mouflon are classified as game species, while ibex are provisionally protected. Conservation of Caprinae depends on the level of control of shooting in preserves, and on improvements in hunting regulations outside them. In 1989, a harvesting plan for both species of chamois became law, which required that every animal shot must be tagged immediately. It is hoped that with this plan, chamois numbers will increase and a more even distribution of animals will result in both the Alps and Pyrenees. However, as in the cases of mouflon and red deer, acceptance of the harvesting plan has been acquired at the expense of a much longer hunting season. When the chamois quota is reached, hunting ceases but chamois can still be disturbed by hunters and their dogs pursuing deer, mouflon, wild boar and hare, all of which share the winter ranges of *Rupicapra*. This problem is magnified by the very large number of hunters and the high density road access for both legal and illegal hunters. In almost all areas, there are insufficient game wardens for the number of hunters. As an example, in the Isère department around Grenoble, 19 National Wardens of the Office National de la Chasse (ONC) are responsible for supervising 28,000 hunters over 9,000km^2 (1 warden/1,500 hunters or 1 warden/500km^2).

There are several large, private organisations concerned with nature conservation including the National Society for the Protection of Nature (SNPN) and the French Federation of Nature Conservation Societies (FFSPN), and some have created and manage their own protected areas (IUCN 1987b). The advice of these two major non-government organisations is often sought by the Ministry of Environment and by departmental authorities (Prefectures). Although they are private societies, they are supported by public funds rather than by members' fees. There are also 93 Departmental Federations of hunters that currently pay annual fees which total around $100 million. These fees are used first to pay state taxes and then for the ONC under the Ministry of Environment. The ONC pays for crop damages, National Reserves management, a corps of 1,500 National Game Wardens, and for the Centres Nationaux d'Etudes et de Recherches Appliquées (CNERA), including the Mountain Fauna Section based at Grenoble. This latter section carries out research and consultation on mountain wildlife.

Species accounts

Accounts of the general biology, ecology and social behaviour of some of the Caprinae in France can be found for example in Couturier (1938, 1962), Gonzalez (1984, 1985), Pfeffer (1967), and the numerous publications produced or supported by the National Hunting Board (ONC), by National Parks, and by the Ministry of Environment.

Alpine chamois (*Rupicapra rupicapra rupicapra*)

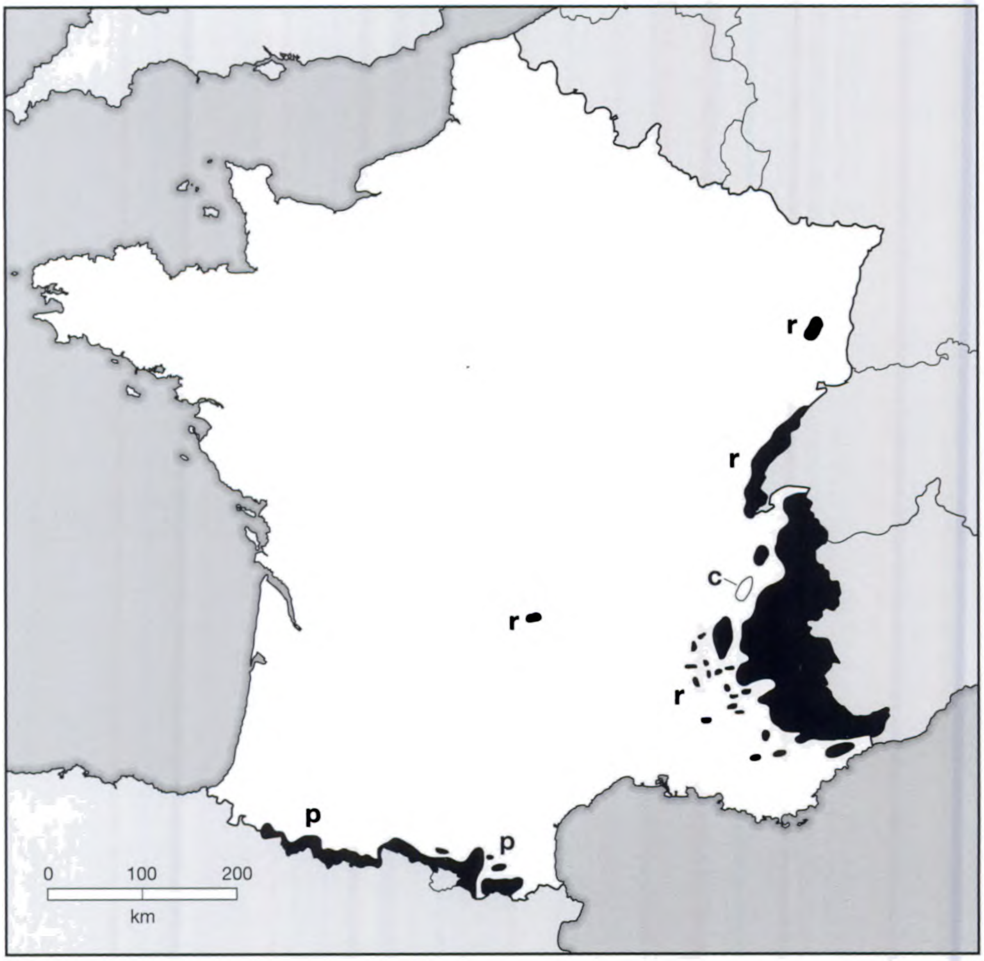
Distribution: Found throughout the Alps in eastern France (Map 6.5.2).

Population: Estimates for the total population in 1989 ranged from 32,000 to 40,000 chamois. These estimates are divided among the major mountain ranges as follows: 30,000 to 36,500 in the Alps, 1,300 to 1,600 in the Jura mountains, 580 to 640 in the Vosges and 160 to 200 in the Massif Central.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Alpine chamois is found in the following protected areas: Vanoise, Ecrins and Mercantour National Parks, and in Bauges, Belledonne, Pierlas and Qautre-Cantons National Mountain Reserves (Map 6.5.1). It also occurs in 39 Natural Reserves (Reserves Naturelles) throughout the Alps, and in six in the Jura mountains.

Status within country: Not threatened.

Conservation measures proposed: **1)** Establish a network of winter preserves where both hunting and other human disturbances, such as skiing, are prohibited. The survival of Caprinae in France has been due primarily to the game preserves and other protected areas. However, none of the national parks is sufficient to cover the annual home range of the chamois populations inhabiting them because most of the low elevation, forested winter ranges are outside Park borders. National parks must remain as protected areas and permit studies of non-hunted populations for comparative purposes. However, human disturbance (e.g. year-round tourism, and livestock grazing) should be restricted and even prohibited in particularly sensitive or important areas. **2)** Provide protection for chamois wintering outside those national parks whose boundaries are too small to include winter range. **3)** Consider re-introductions of predators such as lynx and wolf, although compensation for livestock losses will have to be provided by members of societies such as SNPN and FFSPN, as hunters currently do for crop damage. **4)** Re-evaluate the mandatory national shooting plan which is supposed to



Map 6.5.2. Distribution of r) Alpine chamois (*Rupicapra rupicapra rupicapra*), c) Chartreuse chamois (*R. r. cartusiana*) and p) isard or Pyrenean chamois (*R. pyrenaica pyrenaica*), in France.

favour population growth and better geographic distributions of chamois. If this result was achieved, the large reserves to provide animals for restocking would be of questionable value, and several questions may be raised: Should the right to harvest chamois in an area be allowed before a harvestable surplus is demonstrated? How are bag limits to be enforced with so many hunters and so few game wardens? How compatible are long hunting seasons and minimal disturbance to chamois during their annual cycle? Should hunting licences for chamois be restricted to proven marksmen?

5) Address potential problems of chamois populations damaging their habitat. Chamois is primarily a forest and mid-altitude dweller, and if it is to be allowed to continue to expand its range over the Alps and Pyrenees, disturbance caused by big game hunting in their forest habitat should be minimised. This could be achieved by limiting the hunting season to a 3-week period, which would still allow for the required annual cull. It is also important to note that despite the chamois' habitat-altitude preferences in France's national parks, animals there are forced to spend the entire annual cycle at around 2,000m asl. In addition, in some protected areas such as Ecrins National Park, where in summer, 7,200 Alpine chamois share 16,000ha of alpine meadows with 1,400 mouflons, 48,000 domestic sheep and 1,500 cattle, the environment's capacity must be being stretched to its limits. One result has been that overgrazing has drastically reduced plant diversity and damaged the whole ecological chain (e.g. insects, molluscs, reptiles, amphibians, etc.) in this national park. Introduced mouflon populations are protected by harvest plans, but neither mouflon nor red deer should be introduced into areas already inhabited by chamois because they compete for food. Introducing wolves may help disperse red deer and mouflon, but not all areas are capable of supporting a population of these large carnivores.

Chartreuse chamois (*Rupicapra rupicapra cartusiana*)

Distribution: This subspecies is restricted to a 350km^2 area of the Chartreuse limestone massif, centred around Grenoble in the Pre-Alps, at the western edge of the French Alps (Map 6.5.2). As a result of heavy hunting pressure, its main range is restricted within this larger region to a 60km^2 area of State Forest.

Population: The population has decreased from around 300 to 400 individuals in the 1970s. The most recent official censuses (1986–87) put the total population at a minimum of 150 animals.

Threats: Many factors threaten this subspecies, and the most important include: food and space competition with domestic livestock, red deer and introduced mouflon; hybridisation with introduced alpine chamois; overharvesting and poaching; forestry; summer tourism and winter cross-country skiers. The carrying capacity of the Chartreuse massif has been estimated at around 2,000 chamois, and its current low number can be compared to neighbouring Bauges massif in the Pre-Alps, where within a 5,000ha preserve there are at least 950 Alpine chamois. The age structure of the population of Chartreuse chamois has been altered by shooting immature animals, and the sex ratio is biased due to a greater harvest of males than of females. Despite this, too many productive females are still shot. Animals living to over 10 years of age are rare.

Conservation measures taken: This subspecies of chamois is listed as Critical (C2b,D1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). None occur within a protected area. As a result of a long-sighted hunter education program and warnings since 1973, a shooting plan was requested by local hunters and established in 1985. This was followed by 22 communal syndicates joining to form a single Chartreuse management unit. In 1986, Roucher (1987), on behalf of this management group, proposed an integrated management plan that would include all human activities within the chamois' range, not just hunters. The plan involves a conservative culling plan once the carrying capacity has been reached; modification of forestry practices in specific areas of traditional chamois habitat; removal of Alpine chamois, mouflon and red deer; control of tourism; and enforcement of anti-poaching regulations and penalties. The local hunting syndicates then requested a 6-year shooting moratorium and study period by CNERA technicians. However, due to various, and sometimes contradictory local interest groups, the process is not progressing as well as it was planned in 1987.

Status within country: Endangered

Conservation measures proposed: Unless steps are taken quickly, the Chartreuse chamois' future is uncertain. If the co-operative efforts of the various interest groups (foresters, farmers, hunters, communes, conservationists, etc.) are unsuccessful, conservation of this subspecies could then rest with designation of National Park or Nature Reserve status for the whole massif.

Pyrenean chamois (*Rupicapra pyrenaica pyrenaica*)

Distribution: Found throughout the Pyrenees along France's southwest border with Spain (Map 6.5.2).

Population: Densities are low outside protected areas, where numbers are probably too high. The 1989 estimate for the total number is around 15,500 Pyrenean chamois.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Pyrenean chamois is found in the following protected areas: Pyrénées-Occidentales National Park, in Roc-Blanc, Moudang and Mont-Vallier Mountain Reserves, and Orlu Nature Reserve (Map 6.5.1). As with Alpine chamois, the hunting plan is designed to correct geographic imbalances in numbers and distributions, but may be difficult to achieve.

Status within country: Not threatened.

Conservation measures proposed: See proposals for Alpine chamois above.

Alpine ibex (*Capra ibex ibex*)

Distribution: Along the eastern edge of the French Alps (Map 6.5.3).

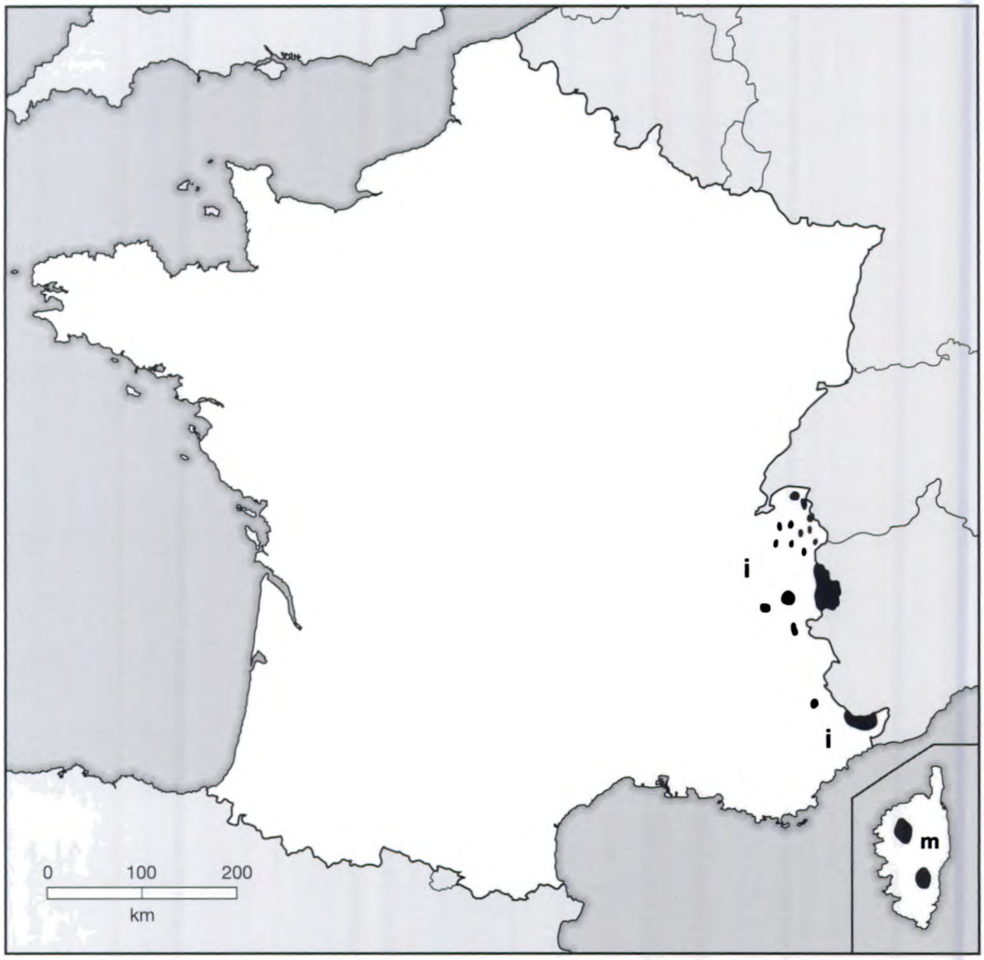
Population: The total number was estimated to be around 1,530 animals in 1989, and about 2,260 in 1990 by a CNERA census.

Threats: Although numbers are still relatively low in France, its protected status and distribution in adjacent countries has resulted in a sufficiently large total population in western Europe so that the species is now considered secure.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Protected by the 10.7.76 Law on Nature Protection, it is illegal to hunt ibex in France. It occurs in four protected areas: Vanoise, Ecrins and Mercantour National Parks, and in Belledonne National Mountain Reserve (Map 6.5.1). Ibex is also found in 17 Natural Reserves within the Alps. All current populations are the result of translocations or natural dispersal, first from Italy and later from French populations.

Status within country: Not threatened.

Conservation measures proposed: If current management efforts are maintained they should suffice, however, care should be taken to ensure that tourism and other human



Map 6.5.3. Distribution of i) Alpine ibex (*Capra ibex ibex*) and autochthonous m) European mouflon (*Ovis orientalis musimon*), in France.

activities do not encroach on important ibex habitat. Re-introductions should also be carefully planned. The main proposal for ibex conservation is to continue restocking populations in appropriate habitats.

European mouflon (*Ovis orientalis musimon*)

Distribution: Autochthonous populations are restricted to the island of Corsica, where they are almost entirely restricted to two protected areas (Map 6.5.3). There are many introduced populations in mainland France, but they originate from eastern Europe where some may have hybridised with domestic sheep.

Population: A total of 1,050 animals was estimated for Corsica in 1989, with the most recent estimate by CNERA revised down to 700 to 800 individuals. The total estimate of introduced populations on the mainland was 5,655 mouflon in 1989.

Threats: Poaching is probably the main threat to the dispersal of mouflon outside the two protected areas they inhabit on Corsica. However, it is still relatively well controlled and does not appear to account for the low productivity of the Corsican mouflon population. Introduced mainland populations do not suffer such productivity problems.

Conservation measures taken: European mouflon on Corsica are listed as Vulnerable (A2cde,D1+2) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Autochthonous mouflon are found in two protected areas, both on the island of Corsica: Asco and Bavella National Mountain Reserves (Map 6.5.1). Research and public education by ONC has led regional authorities to take special care of this species in Corsica.

Status within country: Rare.

Conservation measures proposed: 1) Control poaching outside the two protected areas. This would probably allow the populations to increase in distribution and numbers. **2)** Control introductions of mouflon on the mainland, and avoid creating competition for autochthonous species such as chamois. **3)** Remove (shoot or translocate) some populations of introduced mouflon from areas where they currently cause problems for chamois.

6.6 Germany

L. Briedermann, J.J. Bauer and W. d'Oleire-Oltmanns

Introduction

Germany covers a total area of 357,042km^2 in which four broad physiographic regions can be recognised. Across the north of the country west of the Berlin region, the North German plain is generally flat except in the north where it is covered by rolling morainic hills running roughly parallel to the Baltic sea. To the south of this region are the Mid-German highlands stretching across the whole country. The western part of the highlands is formed by the Rhine plateau through which the Rhine flows in a relatively steep gorge. At the plateau's eastern edge is the complex upland-lowland trough drained by the Weser and Leine rivers. The Harz mountains form the eastern edge of the trough with the Thüringer Wald lying to the south. The Mid-Germanic highlands end with the Erzgebirge along Germany's border with the Czech Republic. The third region, Southern Germany, stretches from the Mid-German highlands south to the Bavarian alps, and from the Black Forest along the east bank of the Rhine, west to the Bohemian Forest (Böhmer Wald) along the Czech border. The Swabian Jura (Schwäbische Alb) and the Franconian Jura, forming the southern part of this region, are the main mountainous areas. To the south of the Jura lies the most southerly mountain region of Germany, the Bavarian alps and plateau, which abut Switzerland and Austria. Germany's climate is intermediate between the western oceanic and eastern continental regimes, in turn influenced by the varied topography of its different regions.

Current status of Caprinae

There are two native species of Caprinae in Germany, Alpine chamois (*Rupicapra rupicapra rupicapra*) called Gemse or Gams in German, and Alpine ibex or Steinbock (*Capra ibex ibex*). Only a small portion of Germany provides suitable habitat for these species. Both species have a patchy and isolated distribution. For chamois, the Bavarian Alps is the most important area. For ibex there is even less suitable habitat, and that is restricted to parts of the Allgäuer alps, the Wetterstein mountains and Berchtesgaden. Despite geographic and temporal variations in management strategies (Bauer 1990a, 1991), both species appear to be in satisfactory condition, particularly alpine populations.

Currently, there are nine populations of chamois in Germany. Chamois in the Bavarian Alps were severely reduced in numbers in the past, but have since rebounded through a combination of their high breeding potential (Bauer 1982, 1983, 1985, 1987, 1990a, 1991; Briedermann and Still 1987; Caughley 1970; Schröder 1971) and a series of mild winters. However, many small, isolated non-alpine chamois populations have suffered from a lack of consistent and appropriate management policies, and a public perception of the species not being native in these predominantly forested habitats that is not supported by the animals' behaviour (Bauer 1986, 1991; Bauer and Pflieger 1989; Briedermann and Still 1987; Krämer 1969), patterns of habitat and vegetation use (Bauer 1986, 1991; Elsner-Schack 1982; Hamr 1980, 1985, 1986), reproductive ecology (Bauer 1983, 1985, 1987), colonisation abilities (Bauer 1985; 1989b; Caughley 1963) and its wide distribution in different sub-alpine habitats during the Neolithic period (Bauer 1984, 1991; Heptner *et al.* 1966; Kränkle 1979; Salzmann 1975).

The virtual elimination of Alpine ibex through hunting from Germany and the remaining parts of the European alps by 1850, may be attributed primarily to superstitious beliefs about the magic properties of almost every part of the animal's body. Re-introductions were mostly carried out in areas considered suitable (Graf and Schröder 1978), and not based on historic records. Future re-introductions could be based on suitability models of available habitat (Wiersma and Schröder 1985). Today, ibex occur in four populations in the Bavarian Alps. All were reintroduced relatively recently. The first was made in 1936 at Köenigsee, Berchtesgaden, using 24 animals from the Berlin and Munich Zoological Gardens which originated from the Aosta valley, Italy. Because this species still exists only in low numbers in Germany, it is not considered problematic, nor is it hunted. However, its sedentary behaviour and limited colonisation abilities can detrimentally affect alpine vegetation locally (Kofler 1983; Kofler and Shröder 1985; Schröder and Kofler 1986).

General conservation measures taken

At the federal level, general conservation legislation is provided by the 1976 Federal law on Nature Conservation, but most specific legislation operates at the state level. Each state has a ministry responsible for administering its protected areas, along with a scientific and technical agency. Research and advice is also provided to federal agencies by the Federal Institute for Vegetation Research, Nature Conservation and Landscape Management. Consultative input at all government levels is provided by various Councils for Nature Conservation.

Administration and management of game species, including Caprinae, are regulated by the Forestry department within state owned forests. Large private landowners maintain their own independent forest service, usually with an important game management section. For the remaining areas leased from landowners (e.g. farmer co-operatives leasing to hunters), administration is maintained by public hunting authorities within the offices of the district presidents. These in turn, answer to the State Ministries of Rural Areas, Food, Agriculture and Forestry. So far only two of the 16 ministries include small wildlife units to advise them. Research and advice are also provided by federal agencies such as the Wildlife Division of the Federal Research Institute for World Forestry in Hamburg, several small wildlife ecology institutes attached either to forestry or veterinary faculties at universities (e.g. Freiberg, München, Göttingen, Kiel), together with a network of state Forestry Research Institutes (FRI). One of the most significant ecological research institutes, maintained and operated within the former DDR, the Institute for Forest Research in Eberswalde, is being dissolved, and unless replaced will be a significant loss for wildlife research in Germany.

All large mammals, including Caprinae, are subject to federal hunting law (Budesjagdgesetz) of 29 November 1952 (BGBI. 1, p.780 ff), modified 28 June 1990 (GBBI 1, p.1221 and p.1249), and by the "Einigungsvertrag" of 31 September 1990. Hunting laws may be modified within states (Landesjagdgesetz: e.g. hunting season) and are only marginally treated by conservation legislation, except in national parks. Hunting is generally not affected by protected area status (except in national parks) unless declared a non-hunting game reserve under the hunting legislation. For this reason, the status of ungulates is not reflected by the presence of viable populations existing in protected areas, but by persistent hunting regulations. These are powerful enough to determine the status of a species. Private hunting and conservation groups may also own and manage nature reserves. Most state hunting associations have become accepted, though critically regarded, members of the German Conservation Union (Deutscher Naturschutzverband). There have been several encouraging attempts at co-operation between hunters and strict conservationists, but in general the results have not been satisfactory. Increasingly, hunters are taking a more active role in the establishment of harvest and conservation strategies of game species, by financing or carrying out their own research and management projects.

Except for waterfowl, hunting occurs within hunting territories and the right to hunt comes with land ownership. To be able to hunt, however, the landowner must own at least 75ha, or at least 150ha if several people are to share the hunting rights. Any landowner, or leaser of hunting rights, has obligations and is liable for maintaining a diverse and healthy population of game and non-game species in natural habitats. Game has to be managed in such a way that agriculture, forestry and fisheries are not affected detrimentally, and any damage caused by game has to be compensated. Restrictions and hunting quotas determined by forestry or the regional administration are obligatory. An important component in German hunting is the hunters' obligation to co-operate with the government in mitigating the effects of hard winters on game, in controlling feral dogs and cats, and with fighting the spread of endemic diseases (rabies) and pathogens dangerous to humans (e.g. tapeworms, etc.). Therefore the role of the German hunter includes an important land husbandry component. Quality is assured by comprehensive hunting examinations that follow a typical preparation period of about 12 months.

The five classes of protected areas within Germany are: National Parks (Nationalpark), Nature Parks (Naturpark), Protected Landscapes (Lanschaftsschutzgebiet), Natural Monuments or Sites (Naturdenkmal) and Nature Reserves (Naturschutzgebiet) (IUCN 1987b). Caprinae occur in several protected areas, although hunting is possible in all except those designated non-hunting game reserves under the Hunting Laws. To date, hunting has been virtually unrestricted in protected areas, and even to some degree in national parks. As for the other types of protected areas, conservationists are demanding that these be closed to hunting. As most protected areas, other than national parks, are either small or very small in size, the value of this demand is being generally questioned.

General conservation measures proposed

Ungulate management in Germany has a long history and has resulted in a large body of legislation, regulations and often conflicting ideas. These have rarely satisfied either foresters or hunters. In particular, specific needs of populations or of species are missing from forestry master plans. Harvest plans are not based on management concepts such as maximum sustained yield, but are usually aimed at minimising "ungulate damage", a poorly defined criterion whose definition, measurement, evaluation and mitigation have not been elucidated despite much research. As a consequence, ungulate management with few exceptions is poorly defined, inconsistent, and very often inefficient (see Bauer 1990a). One of the major unresolved management problems facing chamois is the question of the public's and decision maker's attitudes about the species. Forestry interests tend to view chamois as forest pests, hunters are preoccupied with trophies, and conservationists tend to ignore chamois and other ungulates, or if pressed, tend to support unquestioningly, forest protection.

There is a great need for regional and local management plans for Caprinae based on sound ecological studies made on site. Forestry, which spends several 100 million marks each year on often inefficient protective measures, should consider giving effective research a much higher priority within its well equipped and staffed Forest Research Institutes (Forstliche Versuchsanstalt) than it does currently (Bauer 1990a). The same is true of hunters, who, well equipped and represented in hunting organisations with access to considerable financial resources, spend too much money on administration and political representation, while insufficiently exploring their own research and management potentials. Chamois is especially poorly managed in small and isolated sub-alpine populations that are greatly affected by human-caused disturbance (e.g. tourism, forestry activities, and uncontrolled hunting).

Species accounts

Most aspects of chamois biology have been studied in Austria, Switzerland and France. The German literature is somewhat restricted (e.g. Bauer 1984, 1985, 1986a, 1986b, 1990a; Briedermann 1961, 1975; Briedermann and Still 1987; Elsner von der Malsburg 1982; Elsner-Schack 1986; Knaus and Schröder 1983; Miller 1987, 1989; Schröder 1971, 1977; Schröder *et al.* 1983; Storch 1989). Research on ibex is even less extensive (e.g. Giacometti 1991; Graf and Schröder 1978; Kofler 1981; Kofler and Schröder 1985; Niethammer 1963; Wiersma and Schröder 1985).

Alpine chamois (*Rupicapra rupicapra rupicapra*)

Distribution: Found in nine populations in Germany (Map 6.6.1). **1)** The only known endemic population within recent history occupies a narrow strip, 20 to 30km wide and 250km long, along the northern slopes of the Bavarian alps from Salzburg in the east to Lindau in the west. **2)** A small area (ca. 5,000ha) in the highland region of Adelegg in the southern alps. This sub-alpine, long established (>80 years) population (ca. 70 animals in 1988) has declined to <20 animals recently. **3)** Natural recolonisation appears to have been responsible for the population which occupies a 10,000ha area of the Upper Danube valley. There are about 40 to 50 chamois, that are highly mobile and unstable (Bauer 1991). **4)** The Neckar valley population near the town of Rottweil resulted from an introduction of seven animals in 1963 and from natural colonisation from the Black Forest population. The population is restricted to some steep slopes along the sides of the valley, and is highly endangered due to

Map 6.6.1. Distribution of Alpine chamois (*Rupicapra rupicapra rupicapra*) in Germany.

the attitude of local foresters and conservationists. It is also heavily hunted. Numbering >30 in 1970, the population has declined recently to <10 animals. **5)** Another population, derived from released animals in 1959, inhabits precipitous terrain along the northern boundary of the Suebian Jurassic, south of Balingen. This population was estimated to be ca. 30 animals in 1980 (Bauer 1986) and seems to have remained stable. **6)** Until 1935, an endemic, remnant population existed in the Black Forest. At the end of the 1930s, 21 animals were introduced from Austria into the Zastler valley near the "Feldberg", the region's highest peak (1,492m asl). The population is subdivided into five more or less isolated sub-populations (Feldberg, Belchen, Kandel, Schiltach, Südschwarzwald) distributed over an area of about 41,000ha. The population reached its peak around 1970 with ca. 1,700 animals. It has since declined due to reductions by foresters and hunters, and is presently around 1,000 animals. **7)** Another population established 30 years ago, hangs on in the beech forests of Weissenburg, south of Nurenberg. It consists of <10 animals confined to a quarry within the forest. **8)** The Elbsandsteingebirge contains the most northerly distribution of chamois. Here, it is restricted to small isolated rock outcrops along river valleys, similar to those in the Suebian Jurassic and the upper Danube valley. The population was introduced in 1906 after much earlier attempts in 1556 and 1690 had failed (Briedermann 1961; Briedermann and Still 1987). A second introduction took place between 1937 and 1939. The present population distribution lies east of Dresden, north of the Elbe river and on the German-Czech border, covering an area of about 15,000ha. Most, however, inhabit range in the Czech Republic. The total population of 30 animals had remained relatively constant for the last 30 years. Since 1990, the German part of this population's range has been part of Sächsische Schweiz National Park, but animals have virtually disappeared due to excessive tourist activities. There appear to be no animals permanently residing in the German part of this range at present. **9)** There are no recent data available for the population in the Bavarian Forest, but numbers appear to be very low.

Population: The total German population of chamois is estimated to be around 9,000 to 11,000 animals, comprised of 9,000 to 10,000 in the Bavarian Alps, 20 in Adelegg, 30 to 40 in the Upper Danube valley, 10 to 15 in the Neckar valley, 25 in the Jurassic, 800 to 1,000 in the Black Forest, and 10 animals at Weissenburg.

Threats: Although not threatened overall in Germany, the small sub-alpine populations are vulnerable to poaching and stochastic events, and possibly to inbreeding depression. Disturbance acts as a major threat to small populations and has caused declines in some (e.g. at Elbsandsteingebirge). Unless steps are taken to reverse this threat, declines will continue and most small populations are on the verge of extinction. Even large populations face threats. Numbers in the Bavarian Alps are currently decreasing due to sharply increased harvest rates. Tourist development has also affected many sub-populations negatively (e.g. disturbance, habitat isolation).

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Chamois occurs in a number of regions with some protected area status. However, because it is classed as a "game species" and thus subject to hunting laws, the question of protected area status may be considered irrelevant. In most areas, harvest rates are annually reviewed, and pressure from hunters helps maintain its existence. Local herds are frequently exterminated to protect forests, but rapid recolonisation usually occurs.

Status within country: Not threatened.

Conservation measures proposed: **1)** Conduct adequate population surveys throughout the total range. **2)** Bring harvest rates in line with a population's ability to withstand hunting pressures. **3)** Develop specific management plans for very small populations of particular concern, to deal with their future survival. In these cases, DNA studies may be useful and the possibility should be offered to hunter groups to pursue.

Alpine ibex (*Capra ibex ibex*)

Distribution: Four ibex populations have been established in Germany (Map 6.6.2). The first introduction was made at Koenigsee (Berchtesgaden) in 1936 with 24 animals. The founding animals came from the Aosta valley (Italy), from Peter and Paul, and from the Berlin and Munich Zoological Gardens. The animals dispersed after a few years to the Austrian Bluebachtal. In 1951, the population was reduced considerably after an outbreak of sarcoptic mange, but since then numbers have increased slowly and at present there are about 100 animals. The population straddles the German-Austrian border, wintering in Austria and summering in the Bavarian alps in Germany (Giacometti 1991). A second population was established at Jachenau, partly the result of immigration of one male from the Austrian colony at Baechental supplemented by four animals from Swiss founder populations in 1967. After the addition of several more ibex, this population increased to about 100 members, however, its range is very restricted and there is little potential for expansion. A small colony in Oberaudorf (Buelow 1984) was the result of an introduction in 1963 which failed to disperse. It is now restricted to an area of about 100ha, and foresters consider it a problem because of range over-use. Another small, restricted population became established through natural dispersal from Austria (Kleines Walsertal), but its size is unknown.

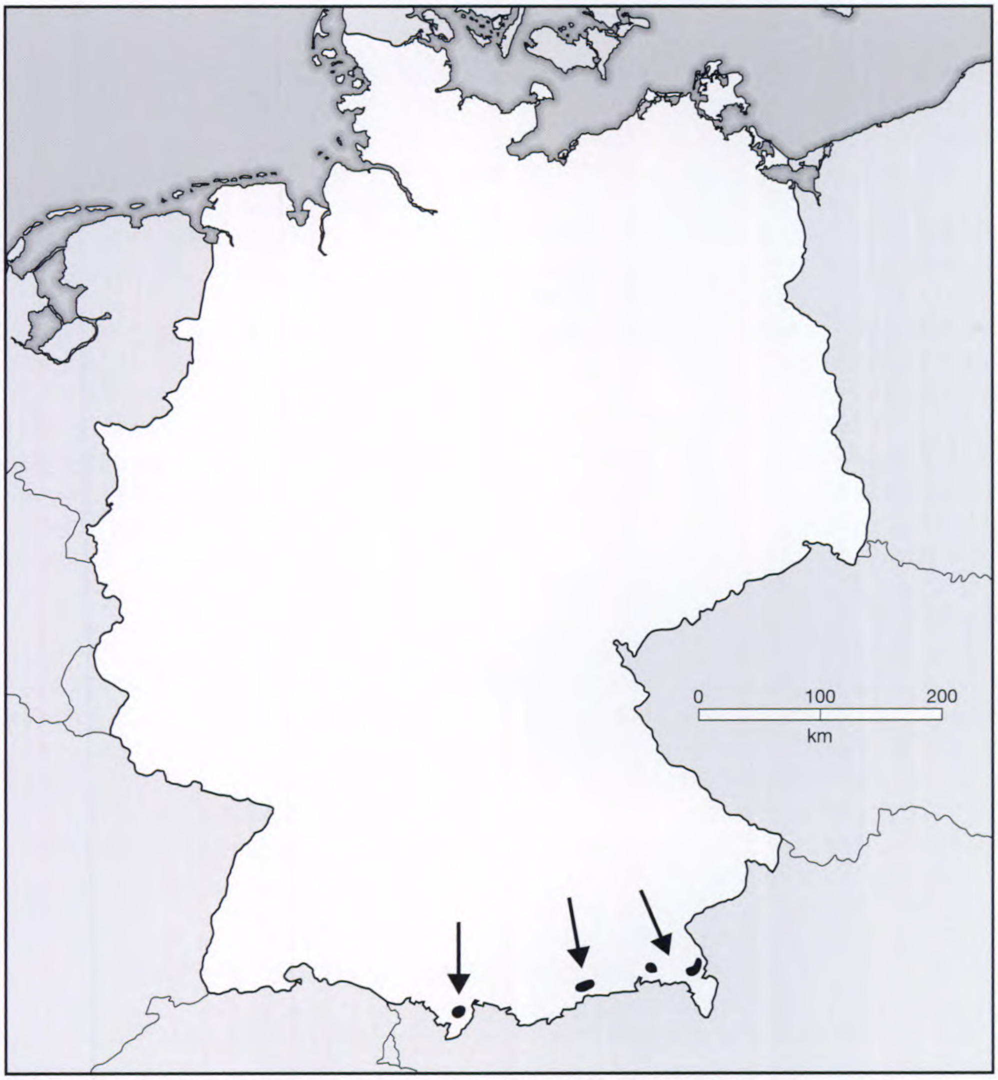
Population: The total number of ibex in Germany is between 200 and 300 individuals.

Threats: Like most small, isolated populations in restricted habitats, epizootics, stochastic events and inbreeding depression are usually potential threats. Each of the four populations shows very slow rates of increase and little tendency, or potential, to expand. None of the four populations has much potential for long term viability.

Conservation measures taken: The Alpine ibex is fully protected by German law. Three of the current populations are the result of re-introductions of animals descending originally from Italian populations. A fourth, small population has established itself by natural dispersal from Kleines Walsertal, Austria.

Status within country: Vulnerable.

Conservation measures proposed: According to studies by Wiersma and Schröder (1985) and by Graf and Schröder (1978), there are only limited sites in Germany suitable for future ibex introductions, so the potential for increasing the number of populations is very small. Existing populations should be closely monitored. Although they are poor colonisers, ibex are capable of increasing relatively rapidly. This leads to high local population densities (Nievergelt 1966; Kofler and Schröder 1985), competition with other species (Kofler 1981), over-exploitation of food resources, and susceptibility to diseases and parasites.



Map 6.6.2. Distribution of Alpine ibex (*Capra ibex ibex*) in Germany.

6.7 Greece

T. Adamakopoulos, Ch. Hablützel and V. Hatzirvassanis

Introduction

The Hellenic Republic, covering 131,986km^2, accounts for most of the Balkan peninsula separating the Aegean and the Ionian seas. Greece also includes a great number of islands around its shores, the largest of which is Crete. About 55% of the country is above 800m asl. Seven orographic systems can be distinguished, four of which are on the mainland: the Pindus Range, the Peristeri range, the Pelagonian range and the Northeastern reliefs. These important highland networks run in parallel ridges and form the southern extent of the main Balkan ranges (Dinaric Alps and Pirin range). The Pindus range is the most important of the orographic systems of the country. The Pindus geotectonical zone extends all the way from the Greek-Albanian border to just northwest of the Peloponnese, though the highland network is cut by the Gulf of Corinth and in orographic terms the range comprises only the mainland reliefs. This flysch-limestone range comprises 38 massifs, and reaches a maximum elevation of 2,637m asl on Mount Smolikas. According to standard orographic criteria, the Pindus system is divisible into 37 limestone massifs characterised by steep walls, deep gorges and long crest-lines. The Peristeri range, comprised mainly of gneiss and limestone rocks, is made up of four distinct massifs of smooth relief reaching up to around 2,000m asl. The mainly limestone Pelagonian range runs southwards from Macedonia in the former Yugoslavia, attaining its greatest height on Mount Olympus, which at 2,917m is also the highest peak in Greece. The last major range on the mainland, the Northeast Reliefs, is formed on an old granite substrate and extends across the Greek-Bulgarian border. Peloponnese lie south of the Gulf of Corinth, and because of a short canal, is now technically an artificial island. The Peloponnese orographic system is formed by a limestone complex, with its large northern section rising to 2,374m asl, and its southernmost section extending to the edge of peninsula where the high point is Mount Taygetos (2,407m). The numerous Aegean islands are often extensions of the mainland mountain systems, forming regional clusters throughout the Aegean sea. At the entrance to this sea lies the island of Crete, itself dominated by rugged mountains running east-west along its length. The White mountains (Lefka Ori) form the western parts, the Idi (or Psiloritis) mountains the central region, followed by the Dikti (or Lasithi) mountains, and finally in the east, the Thrifti mountains. The highest mountain is Mount Idi at 2,456m asl. A fifth mountain range runs along the south central coast between the Mesara plain and the Lybian sea, these are the Asterousia (or Kofinos) mountains.

The climate is typically Mediterranean in coastal areas and continental in the highlands. In winter, cold winds, called the "noreas", originate from the east in Eurasia, and result in cold average temperatures in Thessalonika. Around Athens, higher winter temperatures are influenced by warm winds from the south known as "shilok". In general, most rain falls in the western part of the country, while the Pindus range creates a rainshadow on its eastern side. Annual rainfall varies from 500mm in the interior to almost 2,200mm in the Pindus. The vegetation varies in response to the complex climate and shows both altitudinal and latitudinal gradients. In the southern mountains the dominant vegetation includes Greek fir (*Abies cephalonica*) and Kermes oak (*Quercus coccifera*), in the northern Pindus it is black pine (*Pinus nigra*), beech (*Fagus sylvatica*), and deciduous oaks (*Q. cerris, Q. frainetto, Q. pubescens*, and *Q. petraea*), while in the Northeast Reliefs the dominant trees are Scots pine (*Pinus sylvestris*), spruce (*Picea abies*), silver fir (*Abies alba*), silver birch (*Betula pendula*), beech and black pine. Predators include golden eagle (*Aquila chrysaëtos*), lammergeier (*Gypaetus barbatus*), wolf (*Canis lupus*), brown bear (*Ursus arctos*), and feral dogs (*Canis familiaris*) (Adamakopoulos-Matsoukas 1992).

Current status of Caprinae

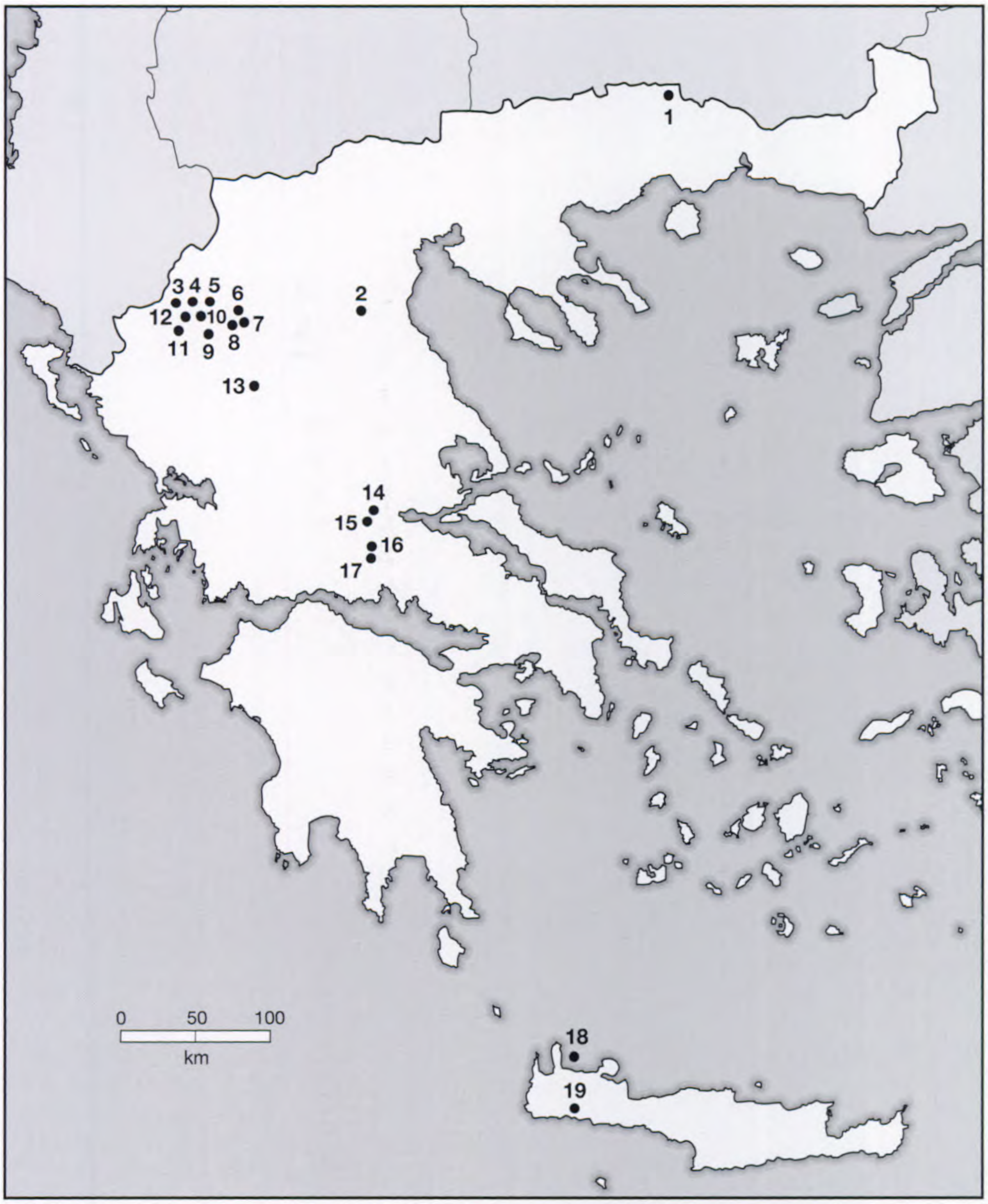
Balkan chamois (*Rupicapra rupicapra balcanica*), and Cretan wild goat or agrimi (*Capra aegagrus cretica*), are each critically low in numbers. The chamois is restricted to the mainland and occurs now only in very small, scattered and isolated populations, the result of poaching and habitat degradation. Typical chamois habitat in Greece is a forested valley with steep slopes extending to the alpine zone, and including cliffs and rock outcrops (Adamakopoulos-Matsoukas 1992). The total population is estimated to be no more than 500 individuals and believed to be decreasing, consequently the species is classed as Endangered in Greece.

Cretan wild goat are somewhat problematic not only due to their small total population size (around 500), but also because they hybridise readily with domestic goats (*Capra hircus*). Only on Crete is the population believed to be readily pure, and even there, hybridisation is a constant threat. The populations on Erimomilos in the Cyclades, and on Gioura in the Northern Sporades, are hybrids, although a control program against domestics and hybrids was started in 1963 on Erimomilos.

General conservation measures taken

Current conservation legislation began in 1958 with the Constitution of the Fifth Republic. The Forest Service controls hunting and is also responsible for the establishment of game refuges, game breeding stations and controlled hunting areas (IUCN 1987b, 1992a). Agrimi are fully protected by law. Both wildlife management and protected areas come under the Ministry of Agriculture, with the Ministry of Regional Planning, Housing and Environment also involved in the administration of protected areas. Legislation governing protected areas is currently being developed in the European Community, with new types of protected areas being proposed.

There are several types of protected areas offering varying degrees of protection for Caprinae in Greece; National Parks, Nature Reserves, Natural Monuments, Regional Natural Parks, Game Reserves and Controlled Hunting Areas (IUCN 1987b). Between 1930 and 1974, 10 national parks were established, eight of them on mountains. Funding for the operation of national parks is limited and recreation is considered to be their main function (IUCN 1987b, 1992a). Game Reserves, where hunting is forbidden, are not necessarily permanent, and their borders are sometimes subject to change. The effectiveness of protected areas, and especially of national parks, cannot be related to their size or the effectiveness of their protection measures. Insofar as most large mammals survive today along the orographic axis and adjacent natural areas, their conservation in protected areas in terms of necessary habitat, resources and space, is insured only by their availability in surrounding areas (Adamakopoulos, in prep). At least 19 protected areas in Greece contain wild Caprinae (Map 6.7.1). Although most Balkan chamois populations in Greece occur in



Map 6.7.1. Protected areas with wild Caprinae in Greece.

1) Rodopi Virgin Forest Natural Monument (550ha; est. 1980); **2)** Olympos NP (3,996ha; est. 1938); **3)** Arenes-Gramos GR (3,200ha); **4)** Pades GR (2,080ha; est. 1989); **5)** Valia Kirna GR (2,100ha; est. 1986); **6)** Kira Kali GR (2,600ha); **7)** Kranias GR (1,800ha); **8)** Pindus NP (3,393ha; est. 1965); **9)** Vrissochori GR (3,900ha; est. 1985); **10)** Aoos Gorge GR (3,600ha; est. 1986); **11)** Papingo GR (840ha; est. 1977); **12)** Vikos-Aoos NP (3,300ha; est. 1973); **13)** Koziakas Controlled Hunting Area (46,400ha: est. 1975); **14)** Iti NP (3,010ha; est. 1966); **15)** Iti-Pay Ni GR (2,950ha); **16)** Lazorema GR (2,894ha; est. 1986); **17)** Reka Gorges GR (3,300ha; est. 1988); **18)** Theodorou Island Wildlife Reserve (68ha; est. 1963); **19)** Samaria NP (4,850ha; est. 1963). NP = National Parks; GR = Game Reserves.

areas where old or recent protected areas exist, the overall system represents only partially, the variety of habitats required for their survival and future recovery (Adamakopoulos, in prep).

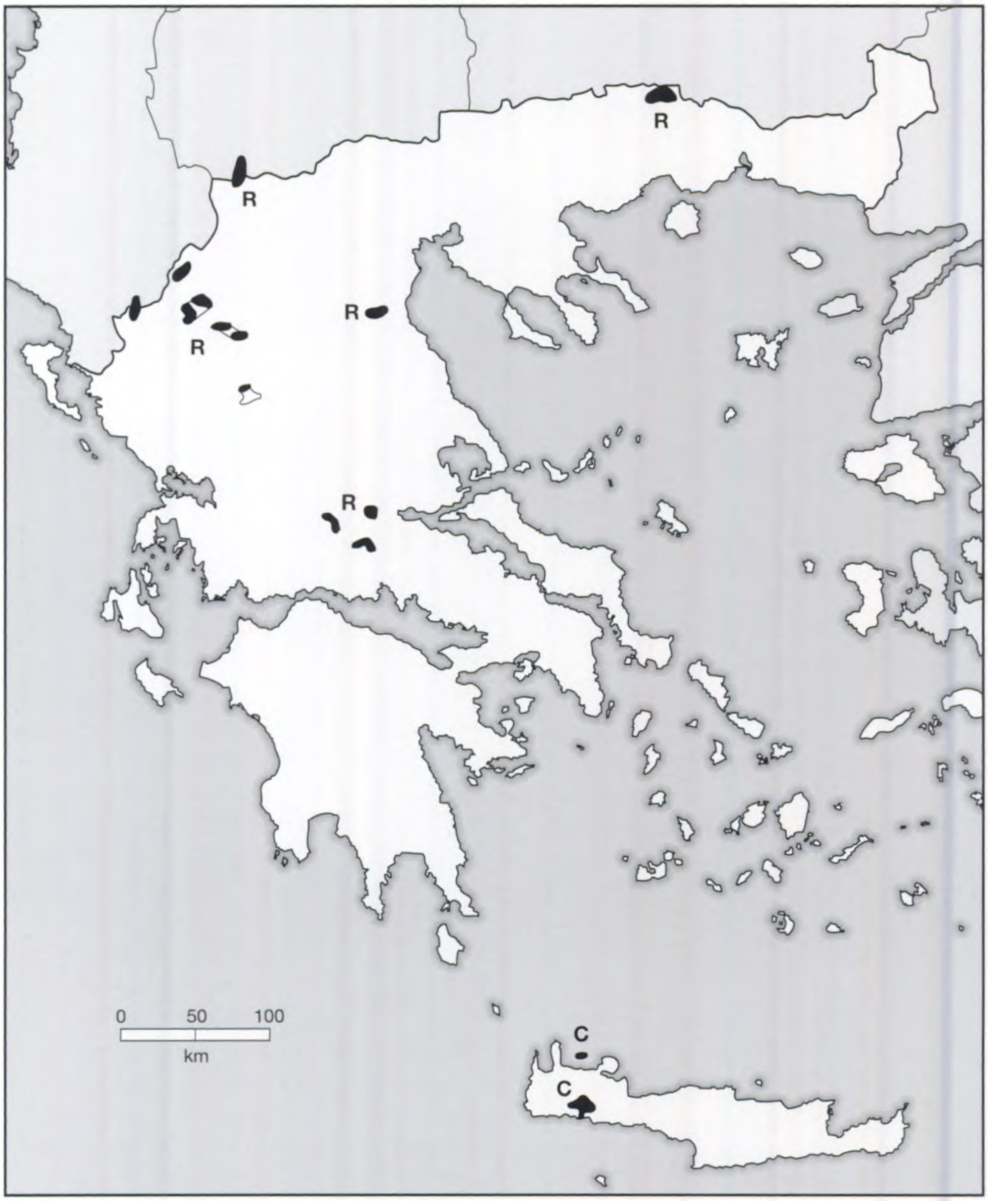
The most important conservation NGO's include the Hellenic Society for the Protection of Nature, WWF-Greece, the Goulandris Natural History Museum, and the Hellenic Ornithological Society.

Species accounts

Published information on the biology of Caprinae in Greece can be found in Adamakopoulos-Mastoukas (1992), Hatzirvassanis (1991), Husband and Davis (1984), Nicholson *et al.* (in press) and Papaioannou (1991).

Balkan chamois (*Rupicapra rupicapra balcanica*)

Distribution: Currently restricted to 11 mountains, and comprising at least six distinct and widely scattered population groups from Mount Rodopi in the northeast below the Bulgarian border, and from the Epirus mountains in the northwest, to Mount Giona in the Parnassos mountains in central Greece (Hatzirvassanis 1991; Papaioannou 1991) (Map 6.7.2). Chamois was believed extinct around Mount Varnous in northern Greece (Hatzirvassanis 1991), but recent reports suggest that some animals may still use the area seasonally, moving in from Mount Pelister in neighbouring Macedonia (Yugoslavia). Similarly, small numbers sometimes enter Greece from Albania around Mount Nemertsika (Papaioannou 1991).



Map 6.7.2. Distribution of R) Balkan chamois (*Rupicapra rupicapra balcanica*), and C) agrimi or Cretan wild goat (*Capra aegagrus cretica*), in Greece.

Population: The total number of animals in Greece is estimated to be between 300 and no more than 500 individuals, with individual populations having between 10 to 100 members (Hatzirvassanis 1991). Numbers are believed to be declining in all populations.

Threats: Poaching facilitated by road developments, and predation by feral dogs, are the main threats to chamois survival in Greece (Hatzirvassanis 1991). Another serious threat is domestic livestock grazing which creates ecological competition and habitat loss, and all three threats occur both within and outside national parks (Hatzirvassanis 1991; Tsunis 1988). Forestry and tourist developments are the main causes of increased road construction, which in turn create access for poachers. In some areas, recreation activities may significantly disturb chamois (Adamakopoulos, in prep.).

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It is fully protected by law in Greece. Approximately 60% of all Balkan chamois in Greece occur in at least 17 protected areas (Map 6.7.1) although their effectiveness is limited.

Status within country: Endangered.

Conservation measures proposed: The main conservation issues identified for chamois in Greece are: a) populations are isolated; b) population sizes are very small; c) animals cannot naturally disperse to new sites; d) poaching and predation levels are high; and e) competition with grazing domestic livestock is heavy. Together, these create a difficult task for conservation. Consequently, five nuclei have been identified in a proposal for chamois conservation to overcome inadequacies of existing protected areas for the chamois' survival. The proposals call for: **1)** specific studies of chamois, ranging from population censuses and estimates, studies of population dynamics, and research into the effects of long-term isolation (e.g. the Mount Olympos population); **2)** the education and sensitisation of local people and hunters to the threats from poaching and livestock; and **3)** integrated land-use planning, and international co-operation. All these should be implemented in co-operation with the Forest Service, the Game Management Section and local NGO's.

Agrimi or Cretan wild goat (*Capra aegagrus cretica*)

Distribution: There are major problems due to agrimi × domestic goat hybrids. On Crete, where the Agrimi was formerly found throughout the Island's mountainous regions, it is probably reasonably pure. Since about 1945, it has been restricted to an area of approximately 72km² in the Lefka mountains at the western end of Crete (Map 6.7.2). Samaria National Park is located in the centre of this area (Map 6.7.1). There is a small, semi-captive population of about 70 to 100 agrimi on the small (68ha) island of Theodorou off the north coast of the western part of Crete (Husband and Davis 1984), which originated from animals captured in Samaria National Park (A.I. Sfougaris, *in litt.* 1993). Populations on the islands of Dia, Agii Pantes (Agii Apostoli), Erimomilos (Antimilos),

An adult male Cretan wild goat or Agrimi (*Capra aegagrus aegagrus*) in Munich Zoo, Germany.

F. Vollmar (WWF)

Samothrake, Gioura and others, are all considered hybrids of wild and domestic goats.

Population: The 1985 Cretan population was estimated to be around 500 agrimi, and together with those on Theodorou island, make a total population of at least 570 to 600 agrimi. The reproductive rate and age structure suggest that the population on Crete is slowly increasing (Hablützel, in prep.).

Threats: The greatest threat is hybridisation with recently feral domestic goats that are common even within Samaria National Park. Other problems arise from increased road accessibility, which in turn increases tourism and poaching problems.

Conservation measures taken: Listed as Vulnerable (D1+2) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and fully protected by law, which is well enforced. Part of the agrimi's distribution on Crete falls within Samaria (Lefka Ori or White Mountains) National Park (Map 6.7.1). There are no current management plans in operation other than an attempt to control poaching. Agrimi inhabiting Theodorou island (Map 6.7.1) also receive protection.

Status within country: Rare.

Conservation measures proposed: Several proposals can be made for agrimi on Crete: **1)** Establish a strict control program to eliminate feral goats inside Samaria National Park to remove the threat of hybridisation with the agrimi. Only reducing or eliminating the herds of domestic goats from the surrounding areas will prevent their immigration into the Park. **2)** Continue improving the control of poaching by regularly patrolling the Park during winter, and by allowing no further increases in access. **3)** Impose greater controls on tourism developments in the Park. These should include banning the development of major tourist facilities (chair/ski lifts, hotels, restaurants, roads, etc.) in the mountain regions of the Park and its surroundings, and strictly controlling visitor use (e.g. specific hours of use enforced, no overnight use of the Park). **4)** The population should be censused and the area surveyed regularly throughout the Lefka mountains, paying special attention to the degree of hybridisation and human encroachment. **5)** Overall, it may be desirable to eradicate domestic × wild goat hybrids, unfortunately F1 hybrids are difficult to distinguish from agrimi in either external appearance or behaviour. (However, compared to agrimi, the hybrid's coat appears to be slightly longer and interspersed with black hairs, the horns are curved outwards a little more and are more robust, and the resting tail is held more horizontal than downwards.) **6)** Determine the degree of hybridisation of the goats found on the various islands (see **Distribution** above) to help direct conservation management decisions.

6.8 Greenland (Denmark)

H. Thing

Introduction

Greenland's total area of 2,184,700km^2 makes it the world's largest island. As much as 1,799,850km^2 is covered in perennial ice and only around 384,850km^2 is ice-free land. The southernmost point of Greenland, Cape Farewell, is situated at 59°47'N, and the northernmost Oodaap Qeqertaa, at 83°40'N, is the most northerly of all land areas. Greenland thus has a latitudinal span of 2,653km, hosting both sub-Arctic, low Arctic, and high Arctic environments, including the extreme habitat of high Arctic desert in North Greenland.

Current status of Caprinae

The white-faced muskox (*Ovibos moschatus wardi*) is the only wild caprin within the Danish realm. Muskox has been indigenous to Greenland for at least 4,500 years. Most probably it immigrated to North Greenland across the 25km wide Kennedy Channel – Robeson Channel from neighbouring Ellesmere Island, NWT, Canada. The whole of North Greenland and the northern half of East Greenland were the natural haunts of muskoxen, however, since the 1890s it disappeared from the western half of North Greenland, most likely due to the limited populations being overhunting by expeditions.

Today, muskox occupy the high Arctic tundra habitats, and has in recent times been introduced into the sub-Arctic and low Arctic environments of west Greenland where it previously did not occur. Populations in northeast Greenland are subject to dramatic fluctuations in size and distribution depending upon recurrent adverse climatic winter conditions. By contrast, west Greenland populations have been increasing at very high rates during the last 25 years thanks to a stable, continental and relatively luxuriant climate.

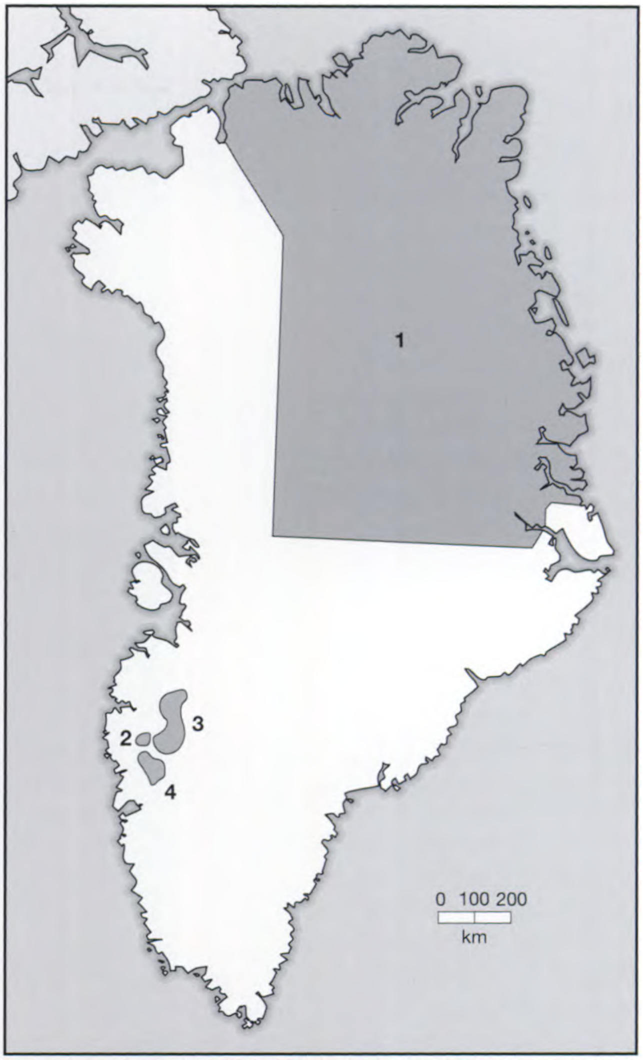
There are no immediate threats to the survival of muskox in Greenland as a whole. The animals are, however, distributed among many populations that are often topographically separate, and thereby more susceptible to local or regional adverse environmental conditions. Small, local populations are sensitive to an unbalanced hunting pressure, but the present legislative measures counteract any risk of eliminating muskox populations by overhunting. However, climate changes or temporary alterations of precipitation or temperature regimes can always jeopardise the continued survival of muskoxen over significant areas.

General conservation measures taken

The responsibility for wildlife conservation and management in Greenland rests with two Home Rule departments in the capital Nuuk. The Section for Renewable Resources, under the Department of Fisheries, is responsible for mammals and birds, and the Section for Nature Management, under the Department of Health and Environment, has responsibility for the National Park and nature reserves.

The first legislative measures regulating muskox harvesting and conservation in part of northeast Greenland, date from the 1930s. The first executive order dealing with strictly regulated harvest by the Inuit hunters of northeast Greenland dates from 17 June 1957. The existing legislation was passed in 1988 by the Greenland Parliament (Executive Order No. 8, 5 May 1988, on the Conservation of Muskoxen in Greenland). This legislation provides for an annual quota to be harvested by local residents who are full-time subsistence hunters, but only from the muskox population on Jameson Land (Ittoqqortoormiit Municipality, northeast Greenland) and another near Kangerlussuaq (Maniitsoq Municipality, West Greenland). Quotas are set each year in June by the Section for Renewable Resources after consultation with municipal boards, and are based on the current status of the two populations. In 1991, the quotas totalled 520 from an estimated total population of about 5,000 animals. The open hunting seasons are 1 August to 25 September in Maniitsoq Municipality, and 20 August to 20 September and 20 November to 20 December in Ittoqqortoormiit Municipality.

Since 1974, almost the entire indigenous range of muskox in North and East Greenland has been protected by the establishment of the National Park covering an impressive 972,000km^2 (Map 6.8.1). Within this, the world's largest national park, muskox hunting is prohibited. Muskox cannot be harvested in any Caribou Reserve or Wildlife Refuge in West Greenland. Conservation measures beginning in 1962, have also included introductions and re-introductions (Klein 1988). In July 1986, 27 yearlings were transplanted from Kangerlussuaq to three sites in the species' former natural range in Avanersuaq (Thule) in westernmost North Greenland. However, prospects for these herds are bleak due to limitations of suitable land and forage conditions. Reproduction appears to be low and the present total population is between 25 and 30 animals. Populations introduced to West Greenland have fared better. Between 1963 and 1965, a total of 27 muskox from northeast Greenland were released into central West Greenland near Kangerlussuaq, and due to an exceptionally high annual reproductive rate of ca. 28%, numbered 3,000 by 1992. Fifteen yearlings from the introduced Kangerlussuaq population were used to establish a population in the sub-Arctic Ivittuut Area (61°10'N) in south Greenland in 1987, which by 1991 had increased to around 60 individuals. The third introduced population which has become established, is the result of 30 yearlings, again from Kangerlussuaq, released in August 1991 into the new range of Nunavik (Svartenhuk) peninsula (71°45'N) in the high Arctic part of West Greenland. Forage conditions suggest the future of this most recently created population is assured.



Map 6.8.1. Protected areas with muskox (*Ovibos moschatus*) in Greenland.

Natural populations of muskox inhabit **1)** Northeast Greenland National Park (972,000,000ha; est. 1974, Biosphere Reserve est. 1977); and introduced populations occur in: **2)** Arnangarnup Qoorua Nature Reserve (60,000ha; est. 1976); **3)** Kangerlussuag Caribou Reserve (5,000,000ha; est. 1980); and **4)** Maniitsoq Caribou Reserve (2,000,000ha; est. 1980).

The Association of Greenland's Hunters and Fishermen (KNAPK) is an NGO with a professional interest in wildlife conservation issues. It plays an active role each year in the allotment of annual muskox harvest quotas which are important for those members who are full-time subsistence hunters. To date, no programs have been established for educating the public on conservation issues relating to muskox.

Species account

Published accounts of muskox ecology are available for Greenland (Thing *et al.* 1987) and for North America (see Klein *et al.* 1984; Tener 1965; Canadian Journal of Zoology 1989).

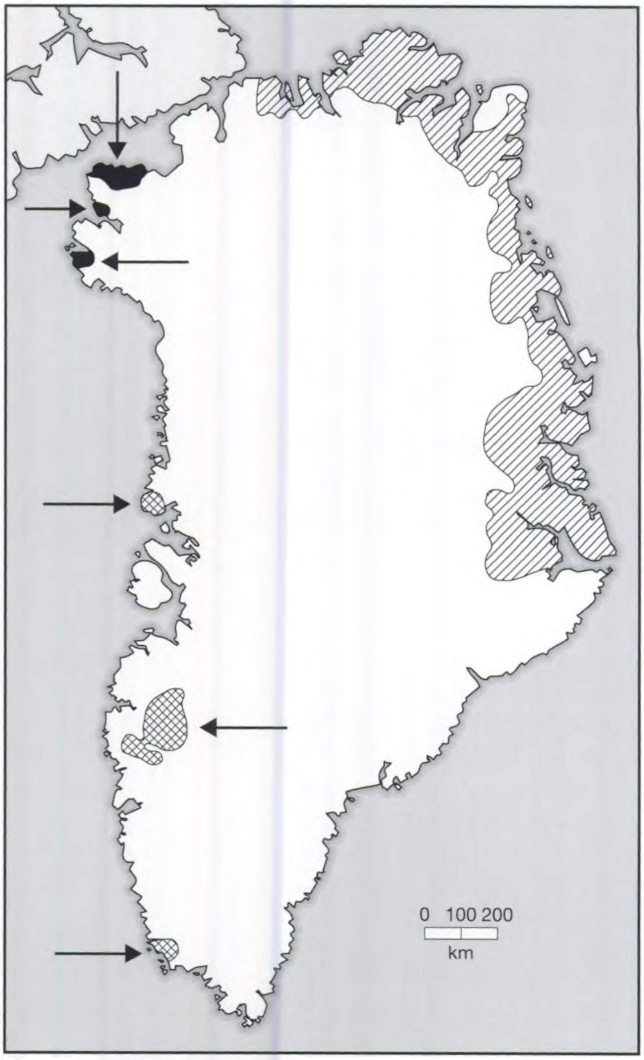
White-faced muskoxen (*Ovibos moschatus wardi*)

Distribution: The muskox is restricted to the areas of ice-free land at the brim of the Inland Ice. Natural populations extend along the northern coast from 82°N, 55°W eastwards to Nordostrundingen (81°21'N, 11°20'W), and southwards to the fjord of Scoresby Sund (70°N) (Map 6.8.2).

Population: The total native population in North and East Greenland is estimated to be between 9,000 and 12,000 animals. Of this total, 1,000 to 1,500 inhabit North Greenland between Newman bight (82°N, 55°W) and Nioghalvfjerdfjorden (79°N), around 35 animals occur in the northern East Greenland region between 79°N and Jokelbugten (78°N), 450 to 550 live between 78°N and Ardencable fjord (75°N), 2,900 to 4,600 occur in the areas between 75°N and Kong Oscar fjord (72°N), and 4,600 to 5,000 inhabit the southernmost part of the species' natural range in East Greenland, between 72°N and Scoresby Sund (70°N) (Boertmann *et al.* 1992). Approximately 3,000 animals also exist in three introduced populations in West Greenland.

Threats: No major threats, although the fact that populations are often small in size and scattered, make them vulnerable to local or regional fluctuations in climate.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Muskox occur in four protected areas, with indigenous populations in the vast Northeast Greenland National Park, and three introduced populations in Arnangarnup Qoorua Nature Reserve, and Kangerlussuag and Maniitsoq Caribou Reserves (Map 6.8.1). Within these protected areas, muskox receives full protection. Most muskox in natural populations live within Northeast Greenland National Park. Outside protected areas, controlled hunting is allowed in two areas; on Jameson Land in East Greenland, and near Kangerlussuaq in West Greenland. In both, quotas are determined annually and hunting is permitted only by full-time subsistence hunters.



Map 6.8.2. Distribution of **natural (hatched)**, reintroduced (solid) and **introduced (cross-hatched)** populations of muskoxen **(*Ovibos moschatus*)** in Greenland.

Since 1963, additional populations have been established by translocations of animals, and by 1991 a total of four herds had been founded. Three populations were introduced to areas in the south-west previously uninhabited by muskox (near Kangerlussuaq, central West Greenland; Nunavik Peninsula, West Greenland; and Ivittuut, south Greenland), and a fourth population was reintroduced into former muskox range in Avanersuaq (Thule) in north-western North Greenland (Map 6.8.2).

Status within country: Not threatened.

Conservation measures proposed: A proposal for development of a long-term management plan for existing muskox populations in West Greenland, is presently being considered by the Home Rule administration. A new system of game wardens in the West Greenland region, between Disko bay (68°30'N) and Paamiut icecap (62°30'N), is being established to strengthen the enforcement of renewable resource legislation, and to control the performance of hunters in general.

6.9 Italy

G. Tosi and S. Lovari

Introduction

The Republic of Italy is a mountainous country with around 35% of its 301,000km² lying above 700m elevation. There are two major mountain regions, the Alps and the Apennines. The Italian alps lie in an arc forming the country's northern border with France, Switzerland, Austria and Slovakia, and are actually comprised of three sections. The Western alps run south from Aosta almost to the Gulf of Genoa, while the Central alps stretch east from Aosta as far as the Brenner Pass between Italy and Austria. These latter include Italy's highest mountains, Monte Bianco (4,808m), Monte Cervino (4,478m) and Monte Rosa (4,634m). Finally, the Eastern alps extend east beyond the Brenner to Trieste, and include the Dolomites. The Apennines, running down the centre of the Italian peninsula, form the country's second major mountain range, stretching about 1,200km to reach as far south as the tip of Calabria and beyond to the island of Sicily. The third major geographic feature is the plains which account for about 23% of Italy. The largest of these, the Po valley, covers 44,000km² of northern Italy extending from 550m asl to sea level. This valley is separated from the Alps by the Italian foothills which rise to 2,500m. The island of Sardinia, lying 160km off the west central coast near Piombino, has two mountain regions. Those in the northwest reach up to >1,800m on Punte la Marmora north of Gennargentu, the second in the lower southwest corner of the island, are lower and are separated from the northwest group by the Campidano plains.

The general climate is temperate but varies significantly because of the varied topography and the length of the Italian peninsula. Four meteorological conditions prevail; the Atlantic autumnal cyclone, the Siberian autumnal anticyclone, and the winter cyclone and summer anticyclone of the Mediterranean. Italy's range of topography and meteorological conditions combine to produce at least seven main climatic zones, ranging from the Alpine Zone in the north to the warm south where the hot and humid sirocco wind blows from Africa and the Near East. Complex geomorphological and palaeo-geographical features have also contributed to Italy's great biodiversity (Cassola and Lovari 1976; Lovari and Cassola 1975), and allowed the survival of relict populations from the Pleistocene in localised areas (e.g. Apennine chamois (*Rupicapra pyrenaica ornata*), Marsican brown bear (*Ursus arctos*)).

Current status of Caprinae

Three species are definitely native to Italy: Apennine chamois, Alpine chamois (*Rupicapra rupicapra rupicapra*) and Alpine ibex (*Capra ibex ibex*). Alpine chamois and ibex occur across northern Italy, while Apennine chamois is restricted to a small mountain area in central Italy. Ibex

An adult male Apennine chamois (*Rupicapra pyrenaica ornata*) in the rut. Abruzzo National Park, Italy.

live mainly above treeline in the Alps, visiting lower elevations only in winter and spring, whereas both species of chamois are more adaptable and range in winter from submontane, mixed broad-leaved woodlands around 500m or lower, to the alpine zone mainly in summer (Lovari and Cosentino 1986). Ibex and Alpine chamois overlap substantially, but because the former tends to keep at higher altitudes, competition between them is unlikely to occur (Pfeffer and Settimo 1973). Exceptions would be ibex colonies introduced into atypical locations when the two species may overlap during winter (Kofler and Schröder 1985).

After centuries of active extermination, ibex disappeared from several regions of the Alps, and after 1800, no more than about 100 individuals survived in Gran Paradiso massif. Re-introductions began in 1920 along the Italian Alpine arc but have been vigorous only in the last 15–20 years. These efforts, together with spontaneous migration from adjoining countries (Peracino and Bassano 1986; Tosi *et al.* 1986a), have increased the number of areas with ibex, though the distribution is still rather discontinuous. About 70% of ibex in Italy still live inside Gran Paradiso National Park (see Durio *et al.* 1988; Peracino and Bassano 1990). Gran Paradiso was also the last area with ibex in western Europe, and animals from this population have been used for re-introductions in other countries.

The European or Sardo-Corsican mouflon (*Ovis orientalis musimon*) is found in Sardinia and on the mainland where it prefers rocky, warm and dry areas, with dense cover. Believed to be introduced to the island of Sardinia by the Phoenicians a thousand years ago, it was once widespread over the Island (Cassola 1985). Heavy hunting and poaching caused a rapid decline (Ghigi 1911), but numbers have since increased (Cassola 1985) and are now probably stabilised or possibly slowly increasing. Mouflon was first introduced to mainland Italy by Grand Duke Leopold of Toscana in 1780. Animals were released into the area that is now Foreste Casentinesi National Park, but disappeared later. This was also the oldest known introduction of the species in Europe. Today, it is found in many areas in northern and central Italy, and reasonable sized colonies in the Italian Alps (Rossi *et al.* 1988; Tosi *et al.* 1986b) live sympatrically with Alpine chamois which may react negatively to the presence of mouflon (Pfeffer and Settimo 1973; Rossi *et al.* 1988; Lanfranchi *et al.* in press).

A fifth caprin in Italy, the Montecristo goat, inhabits Montecristo island (Toscana) off the west coast near Piombino. The origin was probably an introduction of domestic goats (*Capra [aegagrus] hircus*) in ancient times (Spagnesi *et al.* 1986). Repeated introductions continued up to the second half of this century (Bruno and Sauli 1976), and appear confirmed by the high degree of morphological and genetic variability on Montecristo (Spagnesi *et al.* 1986; Randi *et al.* 1990). Since 1971, the Island has been a Natural Reserve under the direction of the Ministry of Agriculture and Forests, effectively guaranteeing protection for the population. Culling for research and population control has been done periodically since 1975 by the National Forestry Corps in collaboration with the National Wildlife Institute (Istituto Nazionale per la Fauna Selvatica). Numbers from 1975 to 1976 were estimated to be between 270 to 350 (Spagnesi *et al.* 1986), and 400 to 450 in 1989 (Randi *et al.* 1990). A thorough census in June 1992, gave a total of ca. 800, with about an equal sex ratio (S. Toso, pers. comm.). Whatever its origin, the population of Montecristo goats is an asset of marked faunal, scientific, and aesthetic value well worth conserving. However, the current density (80 goats/km^2) places strong pressure on the Island's vegetation, and population control is important (Randi *et al.* 1990). Animals are also culled on the basis of phenotypic (pelage) criteria (Spagnesi *et al.* 1986).

Table 6.9.1. The major protected areas with Caprinae in Italy (see also Map 6.9.1).

Protected Area[1]	Size (ha)	Date est.	Species[2]
National Parks			
1) Gran Paradiso	700,000	1922	c,i
2) Stelvio	1,346,000	1935	c,i
3) Abruzzo	400,00	1923	a
4) Val Grande[3]	96,000	1991	c
5) Dolomiti Bellunesi[3]	310,000	1990	c,(m)
6) Maiella[3]	350,000	1991	a
7) Gennargentu-Asinara[3]	1,000,000	1991	m
Natural (Regional) Parks			
8) Alta Valle Pesio	40,000	1978	c
9) Argentera	259,000	1980	c,i,(m)
10) Val Troneca	33,000	1980	c,i
11) Gran Bosco di Salbertrand	20,000	1980	c
12) Orsiera-Rocciavrè	109,000	1980	c,(m)
13) Monte Avic	35,000	1989	c,i
14) Alta Valsesia	64,000	1979	c,i
15) Veglia	41,000	1978	c,i
16) Devero	66,000	1990	c,i
17) Orobie Valtellinesi	440,000	1989	c,i,(m)
18) Orobie Bergamasche	840,000	1989	c,i
19) Adamello	481,000	1983	c
20) Adamello-Brenta	619,000	1967	c,(m)
21) Alto Garda Bresciano	383,000	1989	c,(m)
22) Gruppo di Tessa	334,000	1976	c,i
23) Vedrette di Ries	206,000	1988	c,i
24) Dolomiti di Sesto	116,000	1981	c
25) Fanes-Sennes-Braies	257,000	1980	c,i
26) Dolomiti d'Ampezzo	110,000	1990	c,i
27) Puez-Odle	92,000	1977	c
28) Sciliar	58,000	1974	c
29) Paneveggio - Pale San Martino	191,000	1967	c
30) Prealpi Caniche	259,000	1990	c,i,(m)
31) Alpi Giulie	111,000	1990	c,i

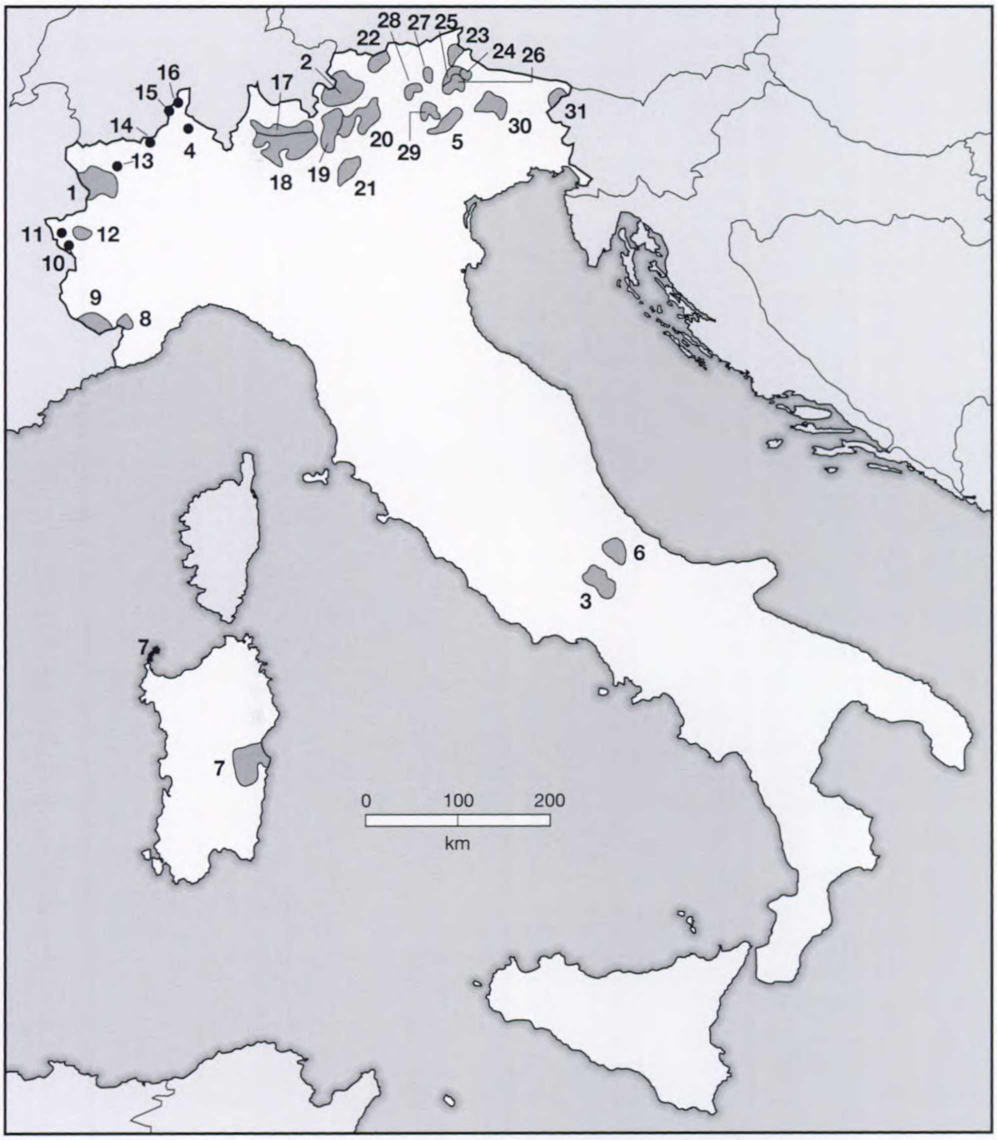
[1] numbers refer to Map 6.9.1;
[2] a = Abruzzo chamois; c = Alpine chamois; i = Alpine ibex; m = mouflon; (m) = introduced mouflon.
[3] National Parks in progress or proposed

General conservation measures taken

The legal basis for Caprinae conservation in Italy is Statute No. 157 of 11 February 1992, "Regulation for protection of homeothermic wild animals and for hunting". This statute partly modifies the restrictions placed on Caprinae in the earlier Statute No. 968 of 27 December 1977, "General principles and rules for protection of fauna and controlling hunting". In the new law, the Apennine chamois is still listed among the specially protected species, and although the ibex is excluded, it is still not included in the list of species that can be hunted. The penalty for shooting, capturing or keeping illegally in captivity an ibex, an Apennine chamois or a Sardinian mouflon, is 3 to 12 months in jail and a fine of from 2 to 12 million lire. Except for the Sardinian mouflon, Alpine chamois and mouflon can be hunted. There are also indirect conservation regulations for Caprinae in Statute No. 394 of 6 December 1991, "Law for protected areas". This legislation provides for the establishment of new national parks. The number of protected areas has increased since 1921 when the first Italian national park was established and Caprinae are found in many of them (Map 6.9.1, Table 6.9.1).

On the national level, the Ministry of Agriculture and Forests and the Ministry of the Environment are responsible for management and protection of wildlife. There are also local agencies responsible for regions set up under ordinary or special laws, provincial services, regional forestry agencies and national and regional park agencies. The consulting agency for all of these is the National Wildlife Institute at Ozzano dell'Emilia (Bologna). Within its wider programs of animal monitoring, the Institute is currently setting up systematic data collection on the size and the structure of Caprinae populations.

Several autonomous groups have limited interests in Caprinae conservation, including the European Ibex



Map 6.9.1. Main protected areas with Caprinae in Italy (see also Table 6.9.1).

***National Parks*: 1)** Gran Paradiso; **2)** Stelvio; **3)** Abruzzo. ***National Parks in progress or proposed*: 4)** Val Grande; **5)** Dolomiti Bellunesi; **6)** Maiella; **7)** Gennargentu-Asinara. ***Natural (Regional) Parks*:** **8)** Alta Valle Pesio; **9)** Argentera; **10)** Val Troneca; **11)** Gran Bosco di Salbertrand; **12)** Orsiera-Rocciavrè; **13)** Monte Avic; **14)** Alta Valsesia; **15)** Veglia; **16)** Devero; **17)** Orobie Valtellinesi; **18)** Orobie Bergamasche; **19)** Adamello; **20)** Adamello-Brenta; **21)** Alto Garda Bresciano; **22)** Gruppo di Tessa; **23)** Vedrette di Ries; **24)** Dolomiti di Sesto; **25)** Fanes-Sennes-Braies; **26)** Dolomiti d'Ampezzo; **27)** Puez-Odle; **28)** Sciliar; **29)** Paneveggio-Pale San Martino; **30)** Prealpi Caniche; **31)** Alpi Giulie.

Group and the Group of Friends of the Rhaetian Ibex. Research programs and conservation of Apennine chamois have been undertaken by Abruzzo National Park and WWF-Italy, and recently in collaboration with the Italian Alpine Club (Milano). The National Hunters Union of the Alpine Zone (Cuneo) have developed some programs to improve Alpine chamois hunting. Other wildlife and game agencies in several Alpine provinces give training courses for game wardens and hunters. The Lombardia Region has carried out a widespread education program in local communities as part of an ibex re-introduction project (Tosi *et al.* 1991a).

General conservation measures proposed

Although the general status of Caprinae in Italy is satisfactory, problems remain that require attention. Hunting controls have improved recently, but hunting still has considerable effects on the distribution, composition and dynamics of Alpine chamois populations. Overhunting or culling, both centred mostly on adult males, have led to several populations having skewed sex ratios and lower densities than their potential. Large differences also exist between populations in and outside protected areas (Pedrotti and Tosi, in press); the latter having lower population densities and sometimes better body condition (De Meneghi *et al.* 1986; Gagliardi *et al.* 1985; Meneguz *et al.* 1987). Under present conditions, the overall usefulness of protected areas as centres of conservation and potential emigration is reasonably good. However, if a more homogeneous distribution of populations is desired, more rational hunting harvests are needed (Perco 1985). These should be carried out in hunting management units under the direction of professional wildlife managers. Such a system essentially does not yet exist.

An increase in hunting management units, with direct involvement of the hunters, might help control poaching of both chamois and ibex. This is still considerable in some Alpine valleys, as it is for introduced mouflon in areas of the Apennines ridge. It should be emphasised that better organisation and greater development of the game warden services are essential. Currently, both are inadequate to meet the environmental and social conditions found in the Italian mountains and Alpine areas. At least one warden is required for every 1,000 to 2,000ha.

The average level of the hunters' understanding of the criteria for selective hunting based on the ecology and ethology of the different species must be raised. For example, in some sectors of the Alps, an assumed incompatibility of chamois and ibex, together with the ban on ibex hunting, have been used by some hunter groups as their rationale to oppose ibex re-introductions.

Finally, the various organisations responsible for wildlife and game management, captive breeding programs, and tourist-recreational areas, must co-ordinate efforts to develop a common land-use plan. Such a plan should attempt to: **1)** decrease any further interference between domestic and wild Caprinae which is still considerable in some sectors of the central and western Alps and in the area of Abruzzo National Park; **2)** consider wild Caprinae when evaluating the environmental impacts of building new ski resorts; and **3)** limit the use of vehicles in the more important Caprinae summer ranges, while also strictly limiting disturbances caused by recreational tourism (e.g. Alpine skiing, especially use of helicopters) on and adjacent to Caprinae winter ranges.

Species accounts

There is a relatively large body of literature on the biology of Caprinae in Italy. ***Apennine chamois***: Bruno and Lovari 1989; Ferrari *et al.* 1988; Locati and Lovari 1990, 1991; Lovari 1985; Lovari and Cosentino 1986; Lovari and Locati 1991, 1993; Lovari and Rosto 1985. ***Alpine chamois***: Balbo *et al.* 1978; Colle *et al.* (1971–1974); Genchi *et al.* 1985; Rossi *et al.* 1985; Tolari *et al.* 1990; Tosi and Perco 1981a; Tosi *et al.* 1987. ***Alpine ibex***: Apollonio and Grimod 1984; Balbo *et al.* 1978; Bassano and Peracino 1990; Colle *et al.* (1971–74); Durio *et al.* 1982, 1988; Francisci *et al.* 1985; Meneguz *et al.* 1986; Pfeffer and Settimo 1973; Rossi *et al.* 1985; Terrier and Rossi 1991; Tosi *et al.* 1986a, 1991a. ***European mouflon***: Arru *et al.* 1987; Lanfranchi *et al.*, in press; Manfredi and Lanfranchi 1990; Perco 1977, 1987.

Apennine chamois (*Rupicapra pyrenaica ornata*)

Distribution: During the Holocene, the Apennine chamois ranged from the Sibillini mountains (Marche Region) down to the Pollino massif (Calabria Region) (Masini 1985; Masini and Lovari 1988). It now survives only in a narrow area of the Abruzzo National Park (Map 6.9.2).

Population: Numbers probably remained low during the last centuries, only starting to increase in the second decade of this century as a result of increased protection. However, numbers plummeted again to just several tens of individuals during World Wars I and II (Lovari 1989), and the current populations is estimated at about 400 individuals (Lovari 1989).

Threats: The species may be vulnerable to many factors because the total number is small, there are only two populations, and genetic variability is very low (Nascetti *et al.* 1985). Some poaching occurs but does not seem to impair the viability of the chamois population in Abruzzo National Park. Space and food competition with livestock, especially domestic caprins, seem to be the main limiting factors. A slowly increasing number of alpine meadows in the species' range have been forbidden to livestock grazing to reduce competition. This action may generate cautious optimism about the species' future.

Conservation measures taken: Listed as Endangered (D1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix 1 of CITES, and as a "specially protected species" in the present Italian hunting law. The autochthonous population inhabits Abruzzo National Park (Map 6.9.1), and all recent and planned re-introductions are into protected areas. A group of 22 chamois was released in the Majella massif between 1991 and 1994, and more recently, 26 were reintroduced into the Gran Sasso massif in co-operation with local villagers. At least 25 are kept in two large breeding enclosures (near Bisegna in Abruzzo National Park, and at Lama dei Peligni in the Majella massif), and a third is to be built at Pietra Camela in the Gran Sasso massif. No studbook has been kept; a major shortcoming in the captive breeding program.

Status within country: Vulnerable.

Conservation measures proposed: 1) Consider more re-introductions for a number of areas in the Central and Southern Apennines, once their suitability has been adequately assessed. **2)** When selecting individuals for transplants and captive breeding, consider Nascetti's *et al.*'s (1985) finding of an alarming lack of genetic variability in the surviving nucleus of the Abruzzo National Park (see also **6.17 Regional summary**). This was most likely a result of living at low density for a long time and of the bottlenecks occurring at World Wars I and II. **3)** Keep detailed breeding records, genetic profiles, and develop a stud-book, for each of the captive breeding populations.

Map 6.9.2. Distributions of p) Apennine chamois (*Rupicapra pyrenaica ornata*), and r) Alpine chamois (*R. rupicapra rupicapra*), in Italy.

In addition to the conservation of this species, new chamois colonies could promote the protection of new areas because the presence of a valuable species would enhance habitat protection. New national parks, presently established only on paper, could in the future, also host populations of the Apennine chamois (e.g. National Parks of Pollino, Gran Sasso-Laga, Majella, and Sibillini). **4)** It is important to avoid releasing Alpine chamois into areas of potential (re)introduction of Apennine chamois. If such an action was carried out, it would prevent the subsequent release of the latter species.

Alpine chamois (*Rupicapra rupicapra rupicapra*)

Distribution: Although population densities vary, Alpine chamois is now relatively evenly distributed through the Italian Alps (Map 6.9.2).

Population: Census techniques are considered sufficiently precise to show that numbers are increasing. In 1980, a total of 62,500 was estimated (Tosi and Perco 1981a), 65,000 in 1987 (Perco 1987), and ≥70,000 in 1992. Most are found in the autonomous provinces of Trento and Bolzano, and in Piemonte. The highest densities occur in some protected areas or in areas selectively culled; e.g. 17 to 18 chamois/km^2 in some central sectors of Argentera Natural Park (Tosi *et al.* 1986b) and in hunting reserves in Aosta Valley. The highest levels at 23 chamois/km^2 occur in protected areas of the province of Torino (De Meneghi *et al.* 1986), and 28/km^2 in hunting reserves managed by the province of Belluno (Apollonio and Grimod 1984).

Threats: Competition with introduced mouflon may cause problems for Alpine chamois in some parts of its range.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Hunting is controlled by law and Alpine chamois are in many protected areas (Map 6.9.1, Table 6.9.1). Prohibition of hunting and the extension of areas protected have made it possible to maintain sufficiently natural population structures in Argentera Natural Park and Gran Paradiso National Park. In both parks, spring densities are between 10 to 11 chamois/km^2, probably coincident with the carrying capacity. The male:female ratio is 1:1.1 to 1.2 (Meneguz *et al.* 1987; Peracino and Bassano 1987; Tosi *et al.* 1986b). Recent re-introductions have been made in some isolated Alpine regions with documented historic presence of chamois, and restocking operations in areas from which chamois had almost completely disappeared.

Status within country: Not threatened.

Alpine chamois is currently widely distributed and generally increasing throughout the Italian Alps. Factors favouring the increase include a progressive decrease in agriculture and domestic livestock numbers in large areas of the middle and high mountains, creation of protected areas (parks, natural reserves and no-hunting areas), and some degree of biological reasoning in developing hunting regulations, especially in the eastern Alpine zone (Perco 1985) and, more recently, in Piemonte, Aosta Valley and Lombardia (Rossi *et al.* 1988).

Conservation measures proposed: 1) Improve hunting management, especially in the central and western sectors of the Alpine arc, both in application of correct census methods (Madonna *et al.* 1989; Tosi and Scherini 1989), and in planning culling programs (Lovari and Tosi 1987). Official guidelines for these have been issued by the National Wildlife Institute (Tosi and Toso 1992). A valid model for environmental analysis is useful for these purposes in order to estimate potential densities. At present, Felettig's (1976) model is used, but is not completely applicable to areas of the central-western Italian Alps. There are some rather simple protocols that are essentially valid but apply only locally (Apollonio and Grimod 1984). **2)** Consider local re-introduction for some circumscribed and isolated areas of the Alps that are suitable for chamois but not suitable for its spontaneous colonisation.

Alpine ibex (*Capra ibex ibex*)

Distribution: Re-introductions, combined with some spontaneous migration from adjoining countries (Peracino and Bassano 1986; Tosi *et al.* 1986a), have increased areas with ibex, but its distribution is still rather discontinuous in the Alps (Map 6.9.3).

Population: The total current estimate is about 7,000 ibex (Peracino 1990, in Giacometti 1991), compared with 4,400 in 1980 (Tosi and Perco 1981b) and 5,100 in 1985 (Tosi *et al.* 1986a). Over 70% of the total population inhabits Gran Paradiso National Park (Durio *et al.* 1988; Peracino and Bassano 1990).

Threats: Hybridisation can threaten where populations are small and sympatric with high densities of domestic goats (Randi *et al.* 1990).

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). The ibex is a "protected species" under the present Italian hunting law. It survived in the Italian Alps because of the protection it received beginning in 1821, when the first laws for protection of the population in the Gran

Paradiso were issued. These were followed in 1836 by additional laws, the Royal Patents, which set up the Royal Hunting Reserve in the Gran Paradiso. This was the first step in the creation of the park of the same name. Ibex could be killed legally only in this park until 1969, and in the former Hunting Reserve of Valdieri-Entracque (Piemonte) until it was transformed to the present-day Argentera Natural Park. There was a modest decrease in poaching and in illegal sale of trophies following regional regulations concerning taxidermy preparation and the keeping of specimens. Today Alpine ibex is found in several protected areas (Map 6.9.1, Table 6.9.1).

Ibex re-introductions began in 1920, but considerably more effort has been made in the last 20 years. Recent re-introductions to the Italian alps use ibex from both Gran Paradiso and Canton Grigioni. They are based on environmental and demographic factors (Apollonio and Grimod 1984; Meneguz *et al.* 1986; Tosi *et al.* 1986a), and most recently, also on genetic factors (Nascetti *et al.* 1990; Randi *et al.* 1990; 1991; Tosi *et al.* 1991b). A similar strategy has been used for planning ibex re-introductions into the Orobian Alps (Tosi *et al.* 1990, 1991a).

Status within country: Not threatened.

Conservation measures proposed: The discontinuity of the areas and concomitant isolation for many colonies, along with generally lower densities relative to carrying capacities in the Italian Alps, encourage development of re-introduction program incentives. **1)** Use environmental evaluation models (Meneguz *et al.* 1986a; *et al.* 1986b) for selecting areas for reintroducing ibex, in conjunction with **2)** a conservation strategy that aims to make the separate colonies part of a single metapopulation (Tosi *et al.* 1991b). **3)** Give priority to protected areas, or to other areas capable of guaranteeing efficient surveillance against

Map 6.9.3. Distributions of C) Alpine ibex (*Capra ibex*), in Italy, and O) European mouflon (*Ovis orientalis musimon*) on Sardinia, Italy.

poaching and disturbance. However, this does not mean that controlled hunting areas should be *a priori* excluded if the transfer is made after hunters are adequately educated and if regular monitoring is used (Tosi *et al.* 1991a). **4)** Select founding individuals for new colonies according to specific criteria (see Nascetti *et al.* 1990; Randi *et al.* 1990; also **6.17 Regional summary**). Electrophoretic analysis could be used to determine whether founding individuals show traces of hybridisation with domestic goats (Randi *et al.* 1990). **5)** Strictly limit domestic sheep and goat grazing in re-introduction areas to decrease the possibility of parasite (Balbo *et al.* 1978; Genchi *et al.* 1985) and disease transmission, resource competition, as well as the possibility of hybridisation. Interbreeding has been reported in both the western and central parts of the Italian Alps where goat densities are high and where ibex had recently been reintroduced (e.g. the Ossola valley in Piemonte, and the Chiavenna Valley in Lombardia). **6)** Improve classified counts and censuses by use of standardised techniques (Tosi and Scherini 1989).

European mouflon (*Ovis orientalis musimon*)

Distribution: Populations of mouflon are found on the island of Sardinia and there are recently introduced populations at various localities on the mainland. On Sardinia (Map 6.9.3), the animals are divided into several local populations including Monte Albo, the northern, central and southern parts of Supramonte, Dorgali-Baunei, Monte Fenalbu-Monte Orosei, Monte Gennargentu, and the mountains south of the Flumendosa river and intermediate areas (Cassola 1985).

Population: The total number of mouflon on Sardinia is around 2,000 animals. There are an additional 5,500 introduced mouflon on the mainland (Perco 1987).

Threats: At present, it has no important predator on the island. Fox (*Vulpes vulpes*) may prey on newborn lambs, and free-ranging dogs may kill animals of any age. Endoparasites seem to be the main factor that regulates mouflon numbers when they are at high densities. Poaching is still heavy, but births seem to exceed losses (Cassola 1985). Mouflon introduced to the Italian peninsula are also subject to a number of other limiting factors such as heavy snowfalls and predation by lynx, which may lead to local extinctions (Perco 1987).

Conservation measures taken: Mouflon is protected by the present Italian hunting law and is listed as Vulnerable (A2cde,D1+2) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) for Sardinia and Corsica. Cassola (1985) has reviewed the conservation of mouflon on Sardinia. There, the species appears to have benefited from increased public awareness and from more effective legal protection which provides heavy penalties for poachers. Two protected areas have been established on Sardinia (the two Regional Forests of Montarbu and Montes, totalling about 7,300ha). However, only the National Park of Gennargentu (about 100,000ha) recently proposed by the State, and long awaited by the Italian conservation movement, will, if it is ever established, ensure the Sardinian mouflon's long-term survival.

Status within country: Rare.

Conservation measures proposed: 1) Establish the National Park of Gennargentu recently proposed by the State. This will play a crucial role in conservation of mouflon on Sardinia. **2)** Initiate studies on the biology of the Sardinian population. **3)** Limit domestic sheep use of areas with mouflon because the two species can interbreed freely, leading to a loss of the genetic identity maintained during millennia of isolation on Sardinia and Corsica. **4)** Develop a system to more effectively control the spread of mouflon along the Alpine arc (Lanfranchi *et al.* in press) to prevent it from occupying areas of current or potential chamois habitat, and to avoid competition, spatial incompatibility and transmission of gastrointestinal and pulmonary parasites between the two species (Lanfranchi *et al.* in press; Manfredi and Lanfranchi 1990; Rossi *et al.* 1988). **5)** Wildlife managers should take a similar position on the desirability of mouflon introductions to Prealpine areas of northern Italy and along the Apennine chain. However, it would be acceptable to create new colonies in marginal mountain areas and foothills to enrich wildlife and increase hunting revenues. Suggestions for hunting management of the species have been given by Rossi *et al.* (1988) and by Tosi and Toso (1992).

6.10 Poland

T. Zajac

Introduction

The Republic of Poland has a land mass of 312,683km^2 and is characterised by lowlands. It has an overall mean elevation of only 173m asl, with more than 75% lying below 200m. These lowlands form a major part of the Central European plain, and are comprised of relatively recent geological deposits dating from the Pleistocene. Mountains are found only along Poland's southern border with Slovakia, the most important of which are the Carpathian mountains.

The climate is transitional and highly variable due to interactions among the oceanic air masses from the west, the cold polar air from Scandinavia and Russia, and the warmer subtropical air masses from the south. Mean annual precipitation is around 600mm, but as low as 470mm in the central lowlands and up to 940 to 1,200mm in the Tatra mountains. Poland represents the northern limit for many tree species such as beech (*Fagus sylvatica*), fir (*Abies alba*) and pedunculate oak (*Quercus sessilis*). Most forests are mixed, but a fragment of the forest-steppe vegetation zone can be found in the southeast, and eastern European sub-taiga occur in the northeast. The montane vegetation occurs in five zones; the lower montane zone (beech-fir) up to 1,200m asl, followed by the upper montane spruce (*Picea excelsa*) forest up to 1,550m, next the sub-alpine with dwarf pine (*P. mughus*), the grasslands of the alpine, and finally the supra-alpine or subnival zone.

Current status of Caprinae

Only one indigenous Caprinae species occurs in the country, the Tatra chamois (*Rupicapra rupicapra tatrica*). It is restricted to the Tatra mountains which give the subspecies its name. These mountains run along part of Poland's southern border with Slovakia, and Tatra National Park is an internationally managed park operated in co-operation between the two countries. Besides this autochthone there are two other caprin species. Alpine chamois (*R. r. rupicapra*) moved into Snieznik massif (East Sudetes) in 1972–73 from the Jeseníky mountains of northern Moravia (Czech Republic). These chamois in turn originated from animals introduced from the Alps in the winter of 1913–14. They appear not only to be few in number (ca. 8) but are not permanent residents (Silski 1979). European mouflon (*Ovis orientalis musimon*) was introduced into Lower Silesia in 1901, and currently occurs in East and West Sudetes, and in the Świętokrzyskie (Holy Cross) Mountains of central southeast Poland (Pucek and Raczyński 1983).

General conservation measures taken

Hunting laws go back as far as the 11th Century in Poland, but effective protection of specific natural objects started with the decree of 1918, and culminated in the Laws of Nature Conservation of 1934 and 1949. This last decree, supplemented in 1972 and again in 1975, governs the organisation of nature conservation and introduced three categories of protected areas (National Parks, Nature Reserves, and Natural Monuments). The first national park (Białowieża) was created in 1947. Two other types of protected areas (Landscape Parks and Areas of Protected Landscape) began to be created in the 1970s. The Law on Nature Conservation enacted on 16 October 1991, brings Polish legislation to world standards. Government agencies responsible for wildlife conservation were created following the Law on Nature Conservation of 1949, and the State Council for Conservation of Nature was established in 1950. Following this in 1969, offices of Conservators of Nature were created in each of the administrative regions, and subordinated to the regional authorities, to the Chief Conservator of Nature within the Ministry of Environmental Protection, Natural Resources and Forestry (EPNR&F; Ministerstwo Administracji, Gospodarki Terenowej i Ochrony Srodowiska), and to the Minister of EPNR&F.

Species account

A limited number of studies have been made of Tatra chamois in Poland (Łomnicki 1964; Podobiński 1976; Urbanik 1985).

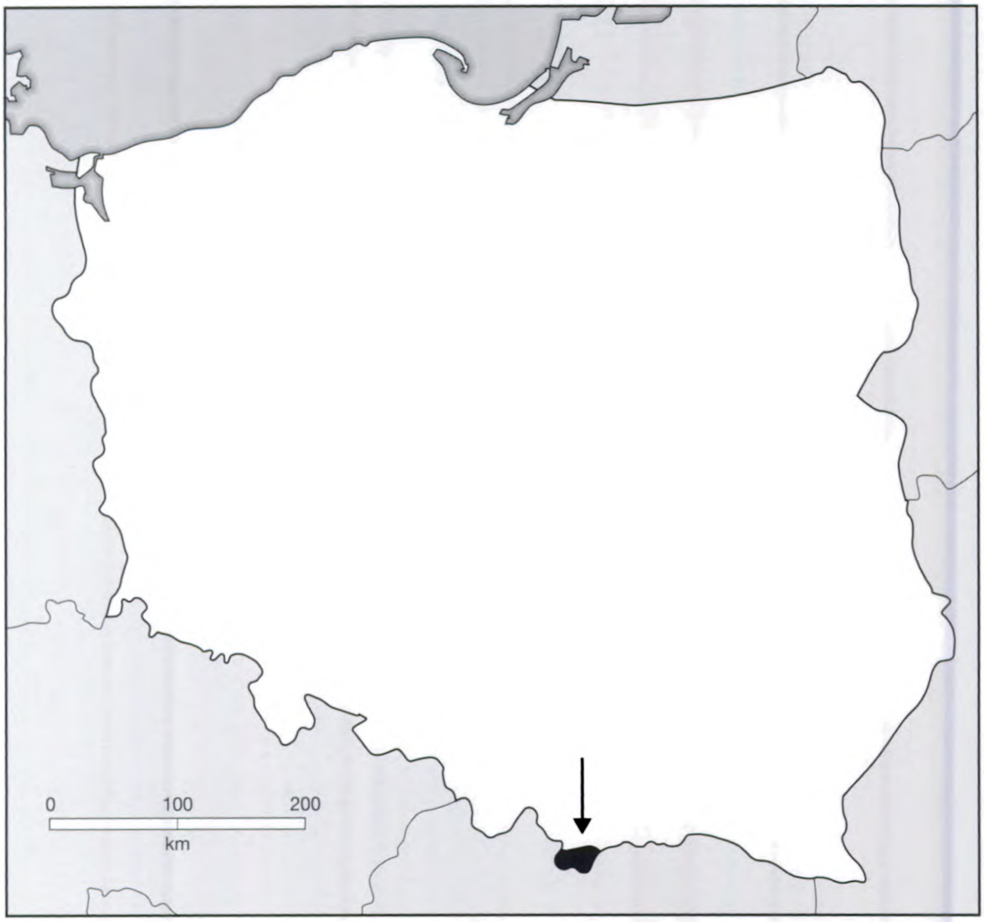
Tatra chamois (*Rupicapra rupicapra tatrica*)

Distribution: Restricted to a single autochthonous population in the Tatra National Park in the Tatra Mountains along Poland's southern border with Slovakia (Map 6.10.1).

Population: Numbers declined in both World Wars, but since establishment of Tatra National Park, the population in the Polish section increased beginning in 1956 (Gąsienica-Byrcyn 1987; Podobiński 1971) and by 1986 was estimated to be >270 individuals. However, numbers have since declined. The latest estimates, made in autumn, were 191 animals in 1990, and 140 in 1992 (Gąsienica-Byrcyn, pers. comm. 1992).

Threats: Poaching, because access to firearms is now relatively easy, and disturbance and habitat loss caused by tourists. An estimated three million people visited Tatra National Park in 1990.

Conservation measures taken: The subspecies is included in the Polish Red Data Book (Gąsienica-Byrcyn 1992) and listed as Endangered (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). It is also protected by the decree of the Ministry of Forestry and Timber Industry, 30 December 1983, on Protection of Animal Species (Dz. U. nr 2., poz. 11., 1954), based on the Law on nature Protection article 15, 7 April 1949 (Dz. U. nr 25, poz. 180). Tatra National Park (Map 6.10.1) is the only protected area with the species, and is managed in co-operation with the Slovakian Park authorities. An earlier increase in numbers and distribution was probably a response to the



Map 6.10.1. The location of Tatra National Park (21,169ha; est. 1954); **this** area also describes the distribution **of Tatra** chamois (*Rupicapra rupicapra tatrica*) **in** Poland.

control of sheep grazing and improved staffing conditions within the Park. However, the cause of the recent decline in chamois numbers is unknown, though poor weather conditions and poaching may be involved (Łomnicki 1960).

Status within country: Vulnerable.

Conservation measures proposed: 1) Found new, separate populations to remove the risk of stochastic catastrophes. However, the potential for additional populations in Poland is restricted to only two localities because there is no other suitable habitat left in the country. In the Śnieżnik, there would be danger of introduced Tatra chamois interbreeding with Alpine chamois that have dispersed into Poland from the Czech Republic. In the second area, the Babia Góra mountains, Alpine chamois do not appear to be present, but the suitable habitat falls within an existing National Park and Biosphere Reserve, and it is not certain that park authorities would permit the Tatra chamois to be introduced because they probably never occurred there naturally. Either area would have only limited value because they each can support only a very small population (<10) that would mostly probably incur inbreeding depression. **2)** Eliminate poaching and **3)** restrict harassment by tourists and skiers in Tatra National Park. **4)** Develop a public education program, aimed especially at park visitors, to reduce harassment and habitat destruction. **5)** Initiate a long-term ecological study of the population in the Park to determine the specific factors affecting population dynamics. **6)** Maintain the joint management strategies between the Polish and Slovak authorities, on which the survival of this subspecies of chamois will continue to depend. Other problems of wildlife protection in mountain parks in Poland have been discussed by Makomaska-Juchiewicz *et al.* (1988), along with some potential solutions.

6.11 Romania

P. Weber

Introduction

Romania is centred on the Transylvanian plateau and covers 237,500km^2. Its southern border with Bulgaria is formed by the Danube river, and the Carpathian mountains dominate much of its topography, forming a ring of mountain ranges in central and northwestern Romania.

These mountains can be divided into the Eastern (Carpatii Orientali), the Southern (Carpatii Meridionalis, also the Transylvanian alps), and the Western (Carpatii Occidentali) Carpathians. The Eastern Carpathians run south in a series of parallel ridges through central Romania from the border with Ukraine and Moldavia, to the northern edge of the Prahova river valley. They reach a maximum of 2,303m asl on Pietrosul in the Rodna mountains in the north. The east-west aligned Southern Carpathians rise from the southern riverine plains of the south, to form massive mountains of volcanic and hard crystalline rocks, quite different in character from the other parts of the Carpathian mountain systems. They also include the highest peaks in the country, Moldoveanu (2,544m asl) and Negoiu (2,535m asl), both in the Fagaras massif (Muntii Fagarasului) towards the eastern part of the Southern Carpathians. The Western Carpathians extend discontinuously north-eastwards from the Mures river valley to the Somes river. The Subcarpathians, a band of rolling hills 3 to 30km wide and between 400 and 1,000m asl, surround the Carpathians and extend from the Moldova river in the north to the Motru river in the southwest. The plains of the southern part of the country form a third of Romania's area and are bounded by the Southern Carpathians to the North and the Danube river to the south. The huge Danube delta covers about 4,530km^2 in the extreme southeast corner of the country, and south of the delta is the coastal region bordering the Black Sea.

Climate is a transition between temperate regions and harsher extremes of the continental interior, everywhere modified by local relief. Forest cover is extensive, accounting for about 27% of the country, and is especially common in the mountain regions. Here, oaks (*Quercus* spp.) dominate up to around 800m, followed by beech (*Fagus* spp.) between 800 and 1,400m, and finally conifers from 1,400 to 1,800m asl. The western part of the Carpathians is generally less forested than the rest of this mountain chain, and human habitation and agriculture also reaches to higher elevations there.

Current status of Caprinae

The Carpathian chamois (*Rupicapra rupicapra carpatica*), known locally as "capra neagra", is Romania's only native caprin, although both Alpine ibex (*Capra ibex*) and European mouflon (*Ovis orientalis musimon*) have been introduced as game animals in some hunting territories. Fortunately, these introductions have been made into areas without chamois. Several successful introductions and re-introductions of Carpathian chamois have been made, especially in the southern and eastern Carpathian mountains. The subspecies is out of danger and surviving well.

General conservation measures taken

Protected areas legislation was first introduced in 1930, and was soon followed by the establishment of two nature reserves and a national park. These and other subsequent conservation laws have been since superseded by the Environmental Law passed in 1973. There are two categories of protected areas in Romania, National Parks (Parcul National) and Nature Reserves (Rezervatii Naturale), although within nature reserves there are further subdivisions. These include Game Reserves and Special Hunting Territories. All are administered by the Commission for Natural Monuments within the Romanian Academy of Science. Protection is provided to forests by the 1954 and 1962 Forest Codes, and a national forest protection and development program was initiated in 1976. Approximately 14% of forest cover is fully protected, especially those on steep slopes, and there is an additional approximately 36% classed as "protective forests" (IUCN 1992a).

Although 12 have been proposed, currently only two national parks have been established; Retezat and Rodna National Parks. Like several other protected areas, both these contain Carpathian chamois (Map 6.11.1). Grazing domestic livestock is permitted during summer in some protected areas including parts of the national parks. Hunting under special licence is permitted in nature reserves, but not in the scientific reserves of the national parks. Some tourism and hiking access is permitted in the national park, but they are allowed only under special permit in most nature reserves (IUCN 1992a).

Carpathian chamois are listed as a game species in Romania, and hunting by guns only is permitted under licence between 1 September and 30 October each year. Until 1990, the number of legally harvested animals was well below the recruitment rate, and most populations have been increasing in numbers.

Species account

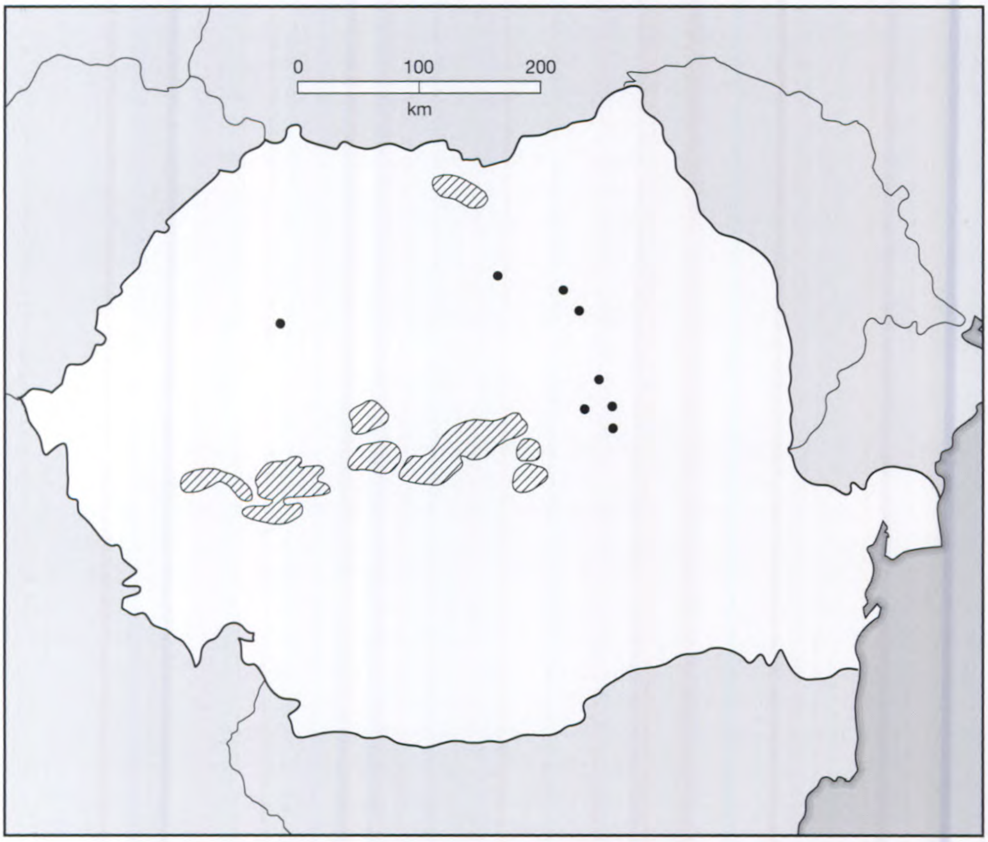
References to Carpathian chamois in Romania can be found in Cotta and Bodea (1969), Koubek *et al.* (1985), and in Hrabě *et al.* (1986).

Carpathian chamois (*Rupicapra rupicarpa carpatica*)

Distribution: Carpathian chamois occurs in many populations throughout the Transylvanian alps and the Carpathian mountains (Map 6.11.2). The main populations occur in the Southern Carpathians and in the mountain massifs of Bucegi, Piatri Craiului, Fagaras, Lotru, Paring and Retezat. It has been successfully reintroduced into the Rodna mountains, from where it naturally repopulated the Ineu and Piatra Rea mountains of the Eastern Carpathians. It has also been re-established in the Hasmas

Map 6.11.1. Locations of protected areas with Carpathian chamois (*Rupicapra rupicarpa carpatica*) in Romania.

1) Retezat NP (54,000ha; est. 1935, Biosphere Reserve 1979); **2)** Iezerele Cindrelului NR (45,000ha; established 1961); **3)** Bilea Lake NR (120ha; est. 1932); **4)** Arpasal Valley GR (736ha; est. 1961); **5)** Piatra Craiului NR (145,920ha; est. 1958); **6)** Bucegi NR (6,700ha; est. 1962); **7)** Cheile Bicazului NR (3,241ha; est. 1955); **8)** Ceahlau NR (5,424ha; est. 1955); **9)** Rodna Mountains NP (5,865ha; est. 1932; Biosphere Reserve 1979). NP = National Park; NR = Nature Reserve; GR = Game Reserve.



Map 6.11.2. Distribution of Carpathian chamois (*Rupicapra rupicarpa carpatica*) in Romania. • indicate (re)introduced populations.

and Ceahlau mountains, and the middle of the Eastern Carpathians. Re-introductions into Caliman and Ciucas mountains were not as successful, although a few chamois are still found there.

Population: In 1990, the total population was estimated to be around 9,000 animals.

Threats: Grazing by domestic sheep in summer tends to disturb chamois causing them to be more dispersed. In some areas, high densities of these domestic animals, create intense grazing pressure.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Although Carpathian chamois occurs in nine main protected areas in Romania (Map 6.11.1), many are small. It is also found in many, even smaller areas which afford them some level of protection. Many successful re-introductions have been made (see **Distribution** above). Chamois is classed as a game animal with hunting strictly controlled.

Status within country: Not threatened.

Conservation measures proposed: Determine hunting quotas based on more scientific biological management, with attempts to adjust harvests such that local carrying capacities and population reproductive rates are accounted for. If chamois hunting is continued only under special licence, no other conservation measures will be required.

6.12 Slovakia

V. Hrabě

Introduction

Until 1993, Slovakia was part of Czechoslovakia, a central European country of about 127,900km^2, consisting of the Czech and Slovak Republics. Today these two republics are separate nations. Geographically, Slovakia can be divided into the Bohemian massif in the west and the Carpathian mountains in the east. The Bohemian massif consists of the Bohemian plateau, a large elevated basin, surrounded by mountains up to 900m asl. Southwest of the plateau lie the Southern Bohemian highlands, while to the west are the Berounka River highlands. The northern edge of the plateau is bounded by the Sudetes (Sudety) mountains along the border with Poland and including the highest peaks of the Bohemian massif (1,602m asl). Slovakia is dominated by the Carpathian mountains which are a system of east-west running mountain ranges separated by valleys and intermontane basins. These mountains can be divided into two regions, the Outer Carpathians to the north and the Inner Carpathians in the south. The Low Tatras which range up to 2,043m on Mount Dumbier, and the High Tatras with Gerlachovsky peak (2,655m), are the highest ranges of the Inner Carpathians.

The climate is essentially continental but affected greatly by topography and distance from the nearest ocean. Annual precipitation runs from 450mm in the central Bohemian basin to more than 1,500mm on the windward sides of mountains in the Krkonoše mountains, on the border with Poland. Zoogeographically, the Slovak Republic belongs to the Euro-siberian subregion of the Palearctic. Remains of the original mixed and coniferous forests have been preserved only in the higher marginal mountain ranges, and in those of the Carpathian arch. Warm forest steppes and steppes have been preserved in the warmest areas of central Bohemia, southern and central Moravia, and southern Slovakia. In spite of long term impacts of human activities and the present high population density, the country has retained a rich and diverse fauna, however most species are threatened to varying degrees.

Current status of Caprinae

(Author's note: This report was written in 1990 and most data represent conditions until this time). The single autochthonous species is *Rupicapra rupicapra*, which is represented by the endemic subspecies *tatrica*, the Tatra chamois (Hrabě and Koubek 1985). An additional three species of Caprinae have been introduced. Mouflon (*Ovis orientalis musimon*) is now widely distributed, four populations of alpine chamois (*R. r. rupicapra*) were established, and a single population of wild goat (*Capra aegagrus*) was introduced in southern Moravia not far from the border with Austria.

The autochthonous occurrence of the Tatra chamois covers a single, very small area in the Slovak Republic. The area it inhabits lies above the upper limit of the mountain spruce forests, from about 1,550m asl, up to the highest peaks in the rugged subalpine, alpine and often subnival zones. According to available historical data, the maximum number of animals in the population was believed to be around 1,500. During the 20th Century numbers have fluctuated considerably due to uncontrolled hunting mainly during the two World Wars. At the end of World War II, the population numbered 230 and then increased to around 850, after which a decline was reported in association with increased pressure from tourism. For this reason, management in Tatra National Park had to include protective measures, closing several extensive areas year round, and most high mountain habitats of the Park from 1 November to 30 June each year, to minimise stress during winter and during the birth season.

General conservation measures taken

The first concrete steps to protect nature occurred as early as the middle of the 19th Century. The first legal steps to protect chamois were taken during the Austro-Hungarian monarchy, and after establishment of Czechoslovakia, hunting was controlled by law and two reserves for its permanent protection were created in the High Tatra mountains. The Slovak and Czech Republics had separate conservation laws (IUCN 1989b, 1992a) even before their recent division. Following the long-term efforts of many individuals that began in the 19th Century to protect the fauna and flora of the Tatra mountains, the Slovak National Council passed Act No. 11/1949 Zb. in December 1948 which created the area as the country's first national park. The State Nature Conservancy Act No. 1/1955 Zb. of the Slovak National Council, valid for the territory of the Slovak Republic, soon followed. This second act was the basis for Regulation No. 125/1965 Zb. of the Council. It was concerned with the protection of free-living animals and contained a list of protected species. This legislation affords the Tatra chamois and their environment complete protection.

In Slovakia, Tatra chamois is found only in two protected areas (Map 6.12.1). The last remaining, original population inhabits Tatra National Park (TNAP), a protected area which includes the High, Belianske and Western Tatra mountains. The Park contains a protected area of 76,883ha, surrounded by a 56,116ha protective zone. Tatra National Park is continuous with Tatrzanski Park Narodowy (Tatra National Park) covering 21,546ha on the Polish side of the Tatra mountains. The Polish park was created five years after the one in Slovakia, and was the first bilateral national park in Europe. Close co-operation exists between these two Parks which are subject to unified regulations. A second population in Low Tatra National Park was founded by introductions between 1969 and 1976. This park contains a protected area of 81,095ha, with a 123,990ha protective zone. Both these Slovakian parks contains many other large mammalian species besides the chamois, including brown bear, wolf, lynx, wild cat (*Felis silvestris*), and red and roe deer.

Species account

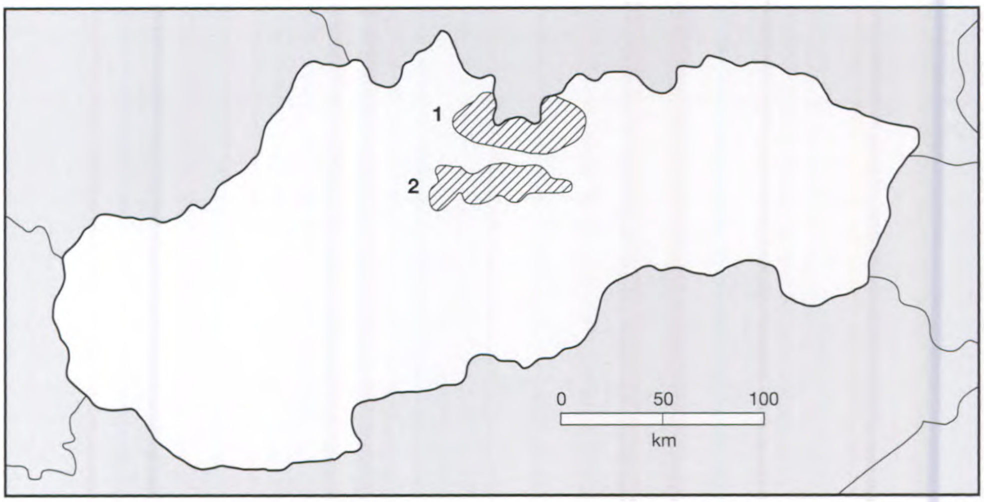
Tatra chamois (*Rupicapra rupicapra tatrica*)

Distribution: Tatra chamois was always restricted in Slovakia to the High, Belianske and Western Tatra mountains. It remains there today in what is now High Tatra National Park, and also has been introduced to the Low Tatra National Park to the south (Map 6.12.1). The population in the High Tatra is part of the larger population which extends into Tatra National Park (Poland).

Population: Numbers in Slovakia have varied during the 20th Century and now may be stable or possibly declining slightly (Hrabě *et al.* 1985). In 1989, the total number was estimated to be 725 individuals, but by 1993, numbers appeared to have decreased to between 600 and 640 individuals (P. Hell, unpubl. data).

Threats: In the recent past, tourism was held to be a cause of the subspecies' decline. Today, interbreeding with animals from introduced populations of Alpine chamois threaten one of the two remaining populations of *R. r. tatrica*. Both populations are relatively small and their effective population sizes may make the maintenance of genetic diversity and adaptability limited over the long-term.

Conservation measures taken: Listed as Endangered (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and previously classed as Rare in the Red Data Book of Czechoslovakia (Baruš *et al.* 1988, 1989). The subspecies receives total legal protection. All Tatra chamois



Map 6.12.1. Protected areas with Tatra chamois (*Rupicapra rupicapra tatrica*) in Slovakia.

1) Tatra National Park (76,883ha; est. 1948); **2)** Low Tatra National Park (81,095ha; est. 1969) in the Slovak Republic. These areas also represent the distribution of Tatra chamois (*Rupicapra rupicapra tatrica*) in Slovakia.
1) Autochthonous range; **2)** range of introduced population.

in Slovakia occur in two protected areas. A single indigenous population occurs in High Tatra National Park (contiguous with Tatra National Park, Poland), and a second population was introduced just south of this area in Low Tatra National Park (Map 6.12.1). Each park includes a protected area to which public access is strictly controlled to eliminate potential disturbance during winter and during the birth season.

Status within country: Rare.

Conservation measures proposed: Current legislation appears sufficient to protect the Tatra chamois. For the future, it may be necessary to **1)** improve protective regulations, and if appropriate, **2)** take further measures to regulate visits to the protected areas, or **3)** create additional strict reserves. What actions are taken will depend in part on the future development of tourism in the country. **4)** Complete eradication of two neighbouring populations of introduced Alpine chamois is necessary to maintain the integrity of the Tatra chamois' gene pool in the Low Tatra National Park, as suggested by scientists at the scientific symposium at Banska Bystrica in 1981. This action would also reduce any similar threat to the autochthonous population of *R. r. tatrica* in the High Tatra National Park separated from the introduced population only by a single valley; a distance of only about 30km.

6.13 Spain

C.L. Alados

Introduction

Spain, covering 504,782km^2, accounts for approximately 85% of the Iberian peninsula. The Meseta, a central plateau with an average height of around 600m asl, dominates the country's physiography. This plateau, divided by the Sistema Central (Cordillera Carpetovetonica) running southwest-northeast to the north of Madrid, is surrounded on all sides by mountains. To the north, lie the Cantabrian mountains (Cordillera Cantabrica), whose peaks rise more than 2,000m asl, while along the eastern side is the Iberian System (Sistema Iberico) reaching over 2,100 and with a mean altitude of 1,600m asl. The Sierra Morena in the south is lower, with altitudes frequently around 900m, and in the northwest are a series of low mountains, the Leon mountains and Macizo Galaico, along the border with Galicia. The Pyrenees, a major mountain system ascending to over 3,600m, run along Spain's northern border with France, while along its southeastern coast are the Baetic Cordillera (Sistema Betico), with Mulhacén rising to 3,478m as the highest peak on the Iberian peninsula.

Generally, the climate is typical of the western Mediterranean and is affected by the westerly winds from the North Atlantic which blow for much of the year, and by the less frequent, warm dry winds from the Sahara. These factors together with topography result in three main climatic regions; the coastal areas of the Atlantic and Mediterranean seas, the central plateau and valleys of the Elbro and Guadalquivir, and the mountain regions above 900m asl. Except for the northwest side from Galicia to Navarra, which has a warm oceanic climate, the more important characteristics are the summer drought and annual precipitation of 500mm. In the north, annual precipitation fluctuates around 1,000mm with no summer drought. The southeastern part of the Peninsula is, however, very dry. The natural vegetation of northern Spain is "cadulifolo" forest with beech (*Fagus sylvatica*) and oak (*Quercus faginea*). Over the remainder of the country, the most frequent natural cover is the scleriphillous forest with evergreen oaks (*Q. ilex, Q. rotundifolia*), except in the higher elevations of the mountain ranges where *Pinus* spp. and *Juniperus* spp. are found, and in the arid areas of the southwest, where instead of forests, brushland dominates.

Current status of Caprinae

Two subspecies of the Southern chamois (*Rupicapra pyrenaica*) (Pyrenean chamois (*R. p. pyrenaica*) and Cantabrian chamois (*R. p. parva*)) and three subspecies of Spanish ibex (*Capra pyrenaica*) (Spanish ibex (*C. p. hispanica*), Pyrenean ibex (*C. p. pyrenaica*) and Gredos ibex (*C. p. victoriae*)) are found in Spain today. Southern chamois are considered Rare, and the original woodlands they inhabited in winter have been replaced by grassland or *Ulex* spp. communities. Poaching also poses a serious threat to Caprinae and other wildlife where adequate controls are not established nor maintained.

The current status of Spanish ibex is generally satisfactory, apart from the Pyrenean ibex (*C. p. pyrenaica*) or "bucardo" which now remains in one small isolated population in the Pyrenees Region. A research program is currently studying the population dynamics of this subspecies and the causes of its decline. The status of the remaining subspecies of ibex, or "monteses", could deteriorate rapidly if such factors as overgrazing and disease transmission by domestic animals occurs. This recently occurred in the Cazorla and Segura ibex populations where the density dropped more than 90% as a consequence of scabies transmitted by domestic goats (*Capra hircus*).

In the past, the Iberian peninsula supported a fourth subspecies, the Portuguese ibex (*C. p. lusitanica*), an inhabitant of the Sierra de Geres, Portugal that had become extinct by 1890 (Alados 1985). However, recent questions

A male Gredos (Spanish) ibex (*Capra pyrenaica victoriae*) in the Sierra Gredos National Reserve, Spain.

G. Van Tienhoven (WWF)

have been raised as to the subspecific divisions of *Capra pyrenaica*, and to the validity of it as a species separate from *C. ibex* (Hartl in press; Hartl *et al.* in press).

General conservation measures taken

Nature conservation began in Spain in 1905 to preserve the last remaining population of 12 *C. p. victoriae*, through establishment of the National Refuge of Sierra de Gredos. However, until after the Civil War, little more was done to protect caprins. The main legal basis of wildlife conservation is Law 4/1989 (Ley de Conservación de Espacios Naturales y de la Flora y Fauna Silvestre). This act established four categories of protected areas: Strict Nature Reserves, National Parks, Nature Places of Natural Interest, and Natural Parks. The first two provide significant protection for wildlife, but the latter two are concerned almost exclusively with preserving traditional ways of life. The Ministry of Agriculture is the main government agency responsible for nature conservation and it acts through the Instituto Nacional para la Conservación de la Naturaleza (ICONA) and through the Autonomous Governments in different environmental agencies. National parks depend exclusively on ICONA, while natural parks and other protected areas also depend on the Environmental Agencies of the Autonomous Governments. Each protected area has a committee responsible for it, consisting of government officials together with representatives of local councils, hunting associations, farmers, environmental groups, universities, etc. The committees meet two to four times each year to plan the area's management according to the legislative guidelines. The Environmental Agency is in charge of executing the management plan.

Both Southern chamois and Spanish ibex are protected species which may be hunted or captured only under special licence. The Royal Act 439/1990 (30 March 1990) is an extension of an earlier law that regulates the National Catalogue of Threatened Species. This catalogue includes *C. p. pyrenaica* as being threatened with extinction. Southern chamois occur in 16 and Spanish ibex in 13 protected areas in Spain (Map 6.13.1).

General conservation measures proposed

The future of all wild Caprinae in Spain depends on the allocation of sufficient facilities and personnel to develop active, effective conservation programs, and to consolidate the existing protected areas. There are two main threats to caprins today: domestic livestock, which can transmit diseases (particularly brucellosis and scabies by domestic goats) and compete for forage; and pressure from tourism, which can create social disruptions and disturbance (as can livestock) (Alados 1985). In turn, these factors increase stress levels and reduce disease resistance.

To combat the threats, it is necessary to establish the following measures:

1) Impose greater restrictions on access to mountain areas with caprins, particularly restricting tourist access for hiking and riding.
2) Remove all domestic goat grazing in protected areas and, at the same time, reduce sheep and cattle numbers.
3) Larger areas within the protected areas must be forbidden

Map 6.13.1. Locations of protected areas with Caprinae in Spain.

1) Sierras de Cazorla y Segura y Las Villas NrP[b] (214,000ha; est. 1960); **2)** Sierra Magina NrP (19,900ha; est. 1989); **3)** Sierra Nevada NrP (140,200ha; est. 1960); **4)** Sierra del Castril NrP (12,265ha; est. 1989); **5)** Sierra de Huetor NrP (12,428ha; est. 1989); **6)** Sierra de las Nieves NrP (16,564ha; est. 1970); **7)** Sierra de Grazalema NrP[b] (51,695ha; est. 1977); **8)** Sierra de Tajada y Almijara NrP (40,100ha; est. 1973); **9)** Puertos de Tortosa y Beceite HR (30,418ha; est. 1968); **10)** Muela de Cortes HR (30,009ha; est. 1973); **11)** Sierra de Gredos HR (27,200ha; est. 1905); **12)** Batuecas HR (21,500ha; est. 1977); **13)** Ordesa Np[b] (15,700ha; est. 1918); **14)** Alta Pallars-Aran HR (94,231ha; est. 1966); **15)** Benasque HR (23,750ha; est. 1966); **16)** Cadi HR (27,202ha; est. 1966); **17)** Cerdaña HR (19,437ha; est. 1966); **18.** Fresser y Setcasas HR (20,200ha; est. 1966); **19)** Los Circos HR (22,844ha; est. 1966); **20)** Los Valles HR (28,765ha; est. 1966); **21)** Viñamala HR (49,230ha; est. 1966); **22)** Mampodre HR (28,300ha; est. 1973); **23)** Picos de Europa HR (30,858ha; est. 1966); **24)** Saja HR (180,186ha; est. 1966); **25)** Somiedo HR (87,900ha; est. 1966); **26)** Sueve HR (8,300ha; est. 1966); **27)** Reres NrP (114,700ha; est. 19890; **28)** Montana de Covadagna NP (16,925ha; est. 1918). NP = National Park; NrP = Natural Park; HR = Hunting Reserve; [b] Biosphere Reserve.

from hunting except when population size becomes too high and selective harvesting may be considered. It would be best if large, core areas are changed to permanent no-hunting zones, and that any hunting which does take place, occur only in peripheral areas.

4) Monitor populations using adequate, standardised annual censuses.

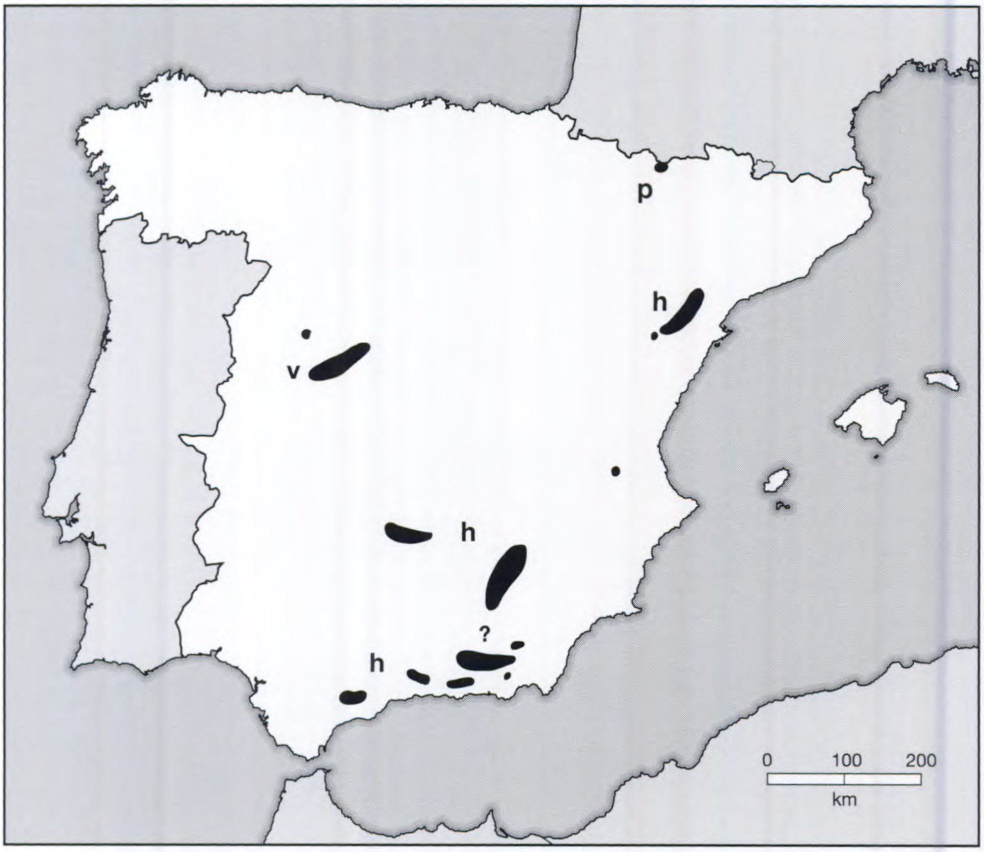
Species accounts

Published information is available on the biology and ecology of Southern chamois (Fernandez-López and García-Gonzales 1986; García-Gonzales 1985; García-Gonzales *et al.* 1985; Pérez-Barbería and Nores 1994), and of Spanish ibex (Alados 1985, 1986; Alados and Escós 1988; Clos 1985; Clouet 1979; Escós and Alados 1991, in press; Labarere 1971; Martinez 1988; Martinez *et al.* 1985, 1987; Pascual 1981; Pérez *et al.* 1994; Vericad 1970).

Southern chamois (*Rupicapra pyrenaica*)

Distribution: Restricted to northern Spain, Pyrenean chamois (*R. p. pyrenaica*) inhabits the Pyrenees, and Cantabrian chamois (*R. p. parva*) occupies the Montaña de Covadogna National Park located on the western

Map 6.13.2. Distribution of Southern chamois (*Rupicapra pyrenaica*) in Spain.



Map 6.13.3. Distribution of Spanish ibex (*Capra pyrenaica*) in Spain. **p)** *C. p. pyrenaica*; **v)** *C. p. victoriae*; **h)** *C. p. hispanica*.

flank of the Picos de Europa, the highest part of the Cantabrian mountains (Map 6.13.2).

Population: The total population of Southern chamois is estimated to be >19,000 animals, with 8,000 on Picos de Europa and 7,000 in Reves Natural Park. Somiedo Natural Park also contains an important population, but no estimate is available. It is not known whether the species as a whole is increasing, stable or declining.

Threats: Competition with domestic livestock is quite intense when chamois use the lower elevations of their range, even in protected areas.

Conservation measures taken: Both subspecies are listed as Lower Risk (cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Legally protected, most Southern chamois occur in three protected areas and 13 hunting reserves: Montana de Covadogna and Ordesa National Parks; Reres Natural Park; ***Hunting Reserves*** – Alta Pallars-Aran, Benasque, Cadi, Cerdaña, Fresser y Setcasas, Los Circos, Los Valles, Viñamala, Mampodre, Picos de Europa, Saja, Somiedo, and Sueve (Map 6.13.1).

Status within country: Not threatened.

Conservation measures proposed: A study of the population dynamics of Southern chamois is urgently required before more suitable management plans can be developed (see also **General conservation measures proposed** above).

Spanish ibex (*Capra pyrenaica*)

Distribution: Originally, *C. p. pyrenaica* was distributed in the Spanish Pyrenees on Monte Perdido and Maladeta massif, but is now restricted to Ordesa National Park in the Aragon District of the Pyrenees (Map 6.13.3). Gredos ibex (*C. p. victoriae*) is limited to a single population in the Sierra Gredos Hunting Reserve, which encompasses the central area and highest elevations of a mountain chain in the Central Orogenic System, west of Madrid (Map 6.13.3). Spanish ibex (*C. p. hispanica*) was previously more widespread throughout southern Spain, but is now found in six main concentrations from Gibraltar to the mouth of the Ebro river, including Sierra Morena (Map 6.13.3).

Population: *C. p. pyrenaica* – the last published report gave 30 individuals (Pascual 1981), but recent official figures indicate only 10 animals. Numbers are decreasing, and have never risen above 40 individuals since the beginning of the century. *C. p. victoriae* – numbers in the Reserve are believed to be stable, with the last official census in 1990 recording 3,300 ibex. *C. p. hispanica* – the total population was estimated to be >15,880 individuals (Alados 1985), although it suffered a serious reduction in numbers by about 8,000 individuals from a scabies *Sarcoptes scabei* infection in the Cazorla and Segura mountains in 1988–89. Today, the total estimate is ca. 7,900 and a mean density of 7.69 ± 0.50 ibex/km^2 was found in Sierra Nevada Natural Park (Pérez *et al.* 1994).

Threats: Causes of *C. p. pyrenaica*'s demise are unknown, but there are a number of hypotheses including competition for food with chamois, inbreeding depression, parasitic infections from domestic livestock, climatic conditions, poaching, and low fertility due to plant secondary compounds. Although all but *C. p. hispanica* are no longer in danger, they may become threatened in the near future. Three of the most important populations (Cazorla and Segura, Gredos, and Tortosa y Beceite) are either close to large human populations or are visited by large numbers of tourists each year. The potential for disturbance is therefore very great and includes forms (e.g. molesting, separation of mothers and young) to which the ibex may be unable to habituate (Alados 1985).

Conservation measures taken: Pyrenean ibex is listed as Critical (D) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and the total population is fully protected within Ordesa National Park (Map 6.13.1). A research project on this population (census, habitat distribution, taxonomic position) was commissioned by ICONA in 1989, and is being carried out by the Instituto Pirenaico de Ecologia (Jaca) and the Estacion Experimental de Zonas Aridas (Almeria). All except the taxonomic section of the project is complete. The Gredos ibex listed as Vulnerable (D4) is found only in Sierra di Gredos Hunting Reserve, while Spanish ibex, listed as Lower Risk (cd) in the 1996 IUCN Red List (IUCN 1996), occurs in 10 protected areas: ***Natural Parks*** – Sierra Magina, Sierra del Castril, Sierra de Huetor, Sierra de las Nieves, Sierra de Grazalema, Sierra Nevada and Sierra de Tajada y Almijara; ***Hunting Reserves*** – Puertos de Tortosa y Beceite, Muela de Cortes, and Batuecas (Map 6.13.1). A total of 5,100 of the Spanish subspecies is protected in Puertos de Tortosa y Beceite Natural Park, where numbers are stable or increasing slowly. At least 600 are also protected in Muela de Cortes Natural Park, and 800 (1989–90 census) in the Sierras de Cazorla y Segura y Las Villas Natural Park but the population is declining. Finally in the south, in the Sierra Nevada Natural Park, 5,400 animals were counted in the 1989–90 census.

Status within country: *C. p. pyrenaica* is Endangered, *C. p. victoriae* is Rare, and *C. p. hispanica* is not threatened.

Conservation measures proposed: 1) Until basic studies have been made, it is difficult to determine the most appropriate conservation measures for *C. p. pyrenaica*. Some managers have suggested capturing animals and attempting captive propagation. This may be the only viable alternative, although the stresses associated with capture could become a greater threat. Certainly Ordesa National Park is too small to provide adequate protection for ibex during their migration from the north face of the canyon to warmer areas during winter, without them being disturbed by tourists and domestic livestock. **2)** Establish additional populations of *C. p. victoriae* in other areas to strengthen its conservation status by reducing the possibility of an epizootic or some other catastrophe wiping out, or severely depleting, the present single population in Sierra Gredos Hunting Reserve.

6.14 Switzerland

M. Giacometti

Introduction

Switzerland lies in south-central Europe and encompasses an area of 41,293km². It has a population of about 6.9 million inhabitants and is divided politically into 26 cantons and half cantons (Bär 1989). It is a mountainous country with 60% of its land area located in the Alps. The Swiss alps comprise about a 300km long portion of the Alpine range, and the highest peak is Monte Rosa (4,634m asl). The transition from subalpine to alpine levels occurs from 1,800–2,300m, while the range above which precipitation predominantly falls as snow is from 2,500 to 3,200m. The Midlands, a hilly region north of the Alps, includes about 30% of the country's area. The Jura, comprising the remaining 10% of the land area, is located in the northwest part of the country. This area is characterised by a much lower, arc-shaped, limestone mountain range with the highest altitude of 1,718m. The upper subalpine, alpine and snow-influenced levels are missing here.

Current status of Caprinae

Alpine chamois (*Rupicapra rupicapra rupicapra*) and Alpine ibex (*Capra ibex ibex*) are the two autochthonous Caprinae of Switzerland. Alpine chamois occupy habitats around timberline mainly in the Alps and are not typical inhabitants of high alpine meadows. However, they can be found in high altitude habitats up to 3,000m, as well as in the lower montane forest of the alpine foothills and the Jura mountains. There are an astonishingly large number of isolated colonies scattered throughout the Midlands. Chamois, as well as ibex, were introduced into the Jura region after 1950. Both species occurred here until the end of the Pleistocene. Topographically, good chamois habitat is steep and rocky, and north slopes are colonised as well as other aspects. Open shrubby heaths, clearings, and alpine meadows bordering forests, or rocky areas that provide cover, are preferred foraging sites (Meile 1983, 1985, 1986; Schröder 1971).

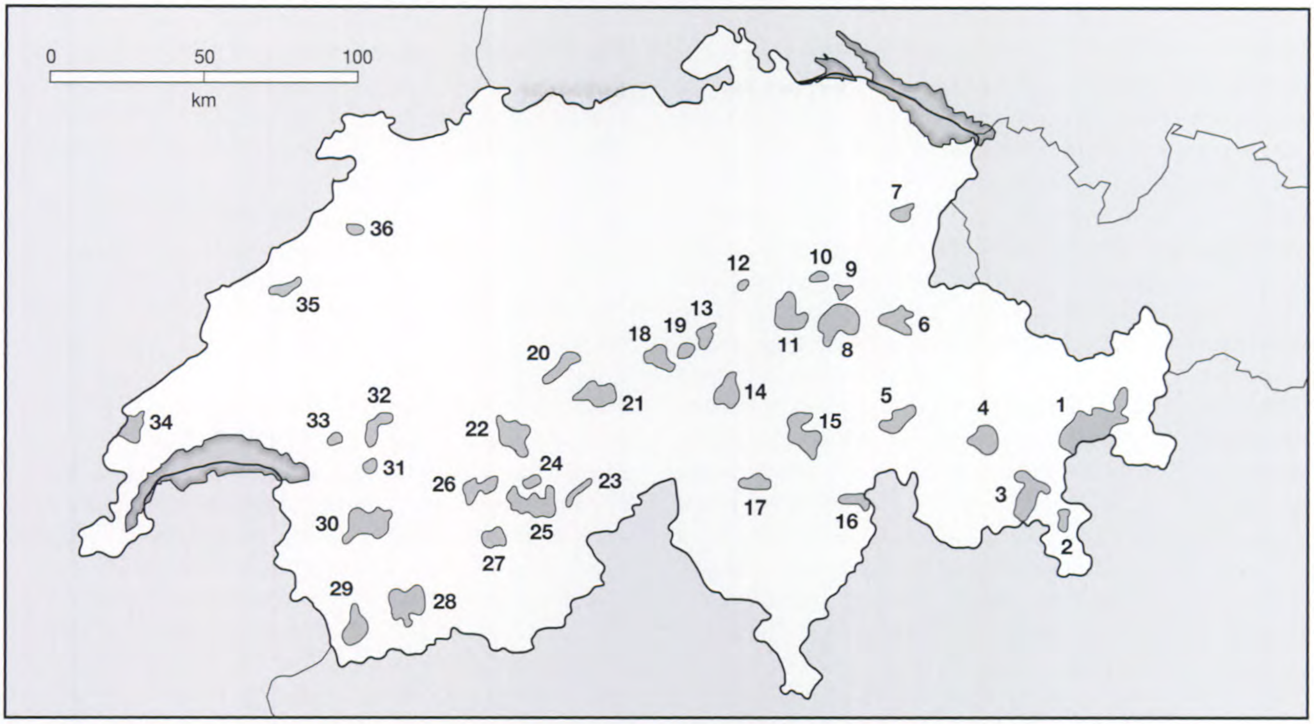
Alpine ibex became extinct in Switzerland around 1850. The main reason for their disappearance was intensive hunting with efficient weapons. They were reintroduced in 1906 following costly breeding and release trials, and the original animals for the captive program came from Gran Paradiso, Italy (Giacometti 1991). In contrast to chamois, ibex prefer to colonise the upper subalpine, alpine, and lower primary snow precipitation zone between 1,600 and 3,200m. The natural distribution of ibex colonies follows those mountain ranges having steep, rocky slopes with south or southwest aspects. Sheer valleys separate the colonies. The average annual precipitation should not exceed 2,000mm, and the availability of vegetation above timberline during the winter is an important aspect of a good ibex habitat (Nievergelt 1966; Ratti 1981; Tosi *et al.* 1986).

The distributions and population sizes of both species of Caprinae will probably remain relatively unchanged in Switzerland in future years. It may be assumed that neither disease, hunting pressure nor other population endangering, mortality factors will decrease the sizes of the present populations of either species. In Switzerland, the danger of reducing wild ruminant populations by poaching has been eliminated for decades.

General conservation measures taken

Former government laws concerning hunting, dating from the years 1875, 1904, and 1925, had the objective of increasing the populations of wild ruminants because these were greatly decimated in previous centuries. As a result of these laws, populations of red deer, roe deer, chamois and ibex increased so much, that the negative effects of excessive numbers were evident with large populations in certain regions (BUWAL 1988).

The protection and hunting of ibex and chamois are federally regulated by the Federal Law for the Hunting and Preservation of Wild Mammals and Birds (JSG) from June 20, 1986; by the ordinance applying to this law (JSV) of February 29, 1988; by the ordinance concerning the confederated hunting areas (VEJ) of September 30, 1991; and by the ordinance on the regulation of ibex populations (VRS) from April 30, 1990. The protection of habitat, a prerequisite for the protection of wildlife, has its foundation in the Federal Law for the Protection of Nature and Natural Habitats (NHG) of July 1, 1966. According to federal law, the cantons must plan and regulate hunting within their boundaries. Hence, each canton has its own hunting laws



Map 6.14.1. Locations of the main protected areas important for Caprinae conservation in Switzerland.

1) Swiss National Park (16,700ha; est. 1914); ***Confederated protected hunting areas*: 2)** Campasc (1,380ha; est. 1991), **3)** Bernina-Albris (6,680ha; est. 1881/1926), **4)** Piz Ela (3,860ha; est. 1906), **5)** Beverin (3,180ha; est. 1886), **6)** Graue Hörner (5,550ha; est. 1901), **7)** Säntis (2,590ha; est. 1876), **8)** Kärpf (10,200ha; est. 1569/1876), **9)** Schilt (1,260ha; est. 1926), **10)** Rauti-Tros (970ha; est. 1916), **11)** Silbern-Jäger-Bödmerenwald (7,660ha; est. 1876), **12)** Mythen (840ha; est. 1926), **13)** Urirotstock (2,550ha; est. 1881), **14)** Fellital (4,010ha; est. 1936), **15)** Greina (6,020ha; est. 1946) and Pez Vial (2,240ha; est. 1971), **16)** Trescolmen (1,930ha; est.1966), **17)** Campo Tencia (3,460ha; est. 1896), **18)** Hutstock (4,530ha; est. 1901), **19)** Hahnen (2,090ha; est. 1936), **20)** Augstmatthorn (2,010ha; est. 1941) and Tannhorn (1,160ha; est. 1944), **21)** Schwarzhorn (7,100ha; est. 1886), **22)** Kiental (8,390ha; est. 1891), **23)** Aletschwald (1,510ha; est. 1876/1936/1991), **24)** Bietschhorn (1,340ha; est. 1876/1936/1991), **25)** Alpjuhorn (5,790ha; est. est. 1876/1936/1991) and Wilerhorn (3,030ha; est. 1876/1936/1991), **26)** Leukerbad (4,160ha, est. 1876/1956), **27)** Turtmanntal (3,670ha; est. 1951) **28)** Dixence (4,530ha; est. 1991) and Mauvoisin (5,020ha; est. 1876/1936/1991), **29)** Val Ferret/Combe de l'A (7,530ha; est. 1921), **30)** Grand Muveran (5,010ha; est. 1896) and Haut de Cry/Derborence (5,820ha; est. 1886), **31)** Pierreuse-Gummfluh (1,010ha; est. 1966), **32)** Hochmatt-Motélon (2,950ha; est. 1876) and Les Bimis-Ciernes Picat (1,290ha; est. 1971), **33)** Dent de Lys (950ha; est. 1936), **34)** Le Noirmont (3,430ha; est. 1971), **35)** Creux-du-Van (1,420ha; est. 1971), and **36)** Combe-Grède (1,060ha; est. 1976) (from the Ordinance concerning the confederated protected hunting areas (30 September, 1991) and the Confederation Hunting Inspection Agency).

and other regulations in accordance with the confederate legislation.

The goals of the actual laws governing the hunting and protection of wild mammals and birds are primarily of a regulatory nature. The aims of the legislation are to preserve species diversity and wildlife habitat, protect endangered species, minimise game damage to forests and farmlands, and efficiently utilise game populations. Hunting plans, as administrated by the cantons according to federal laws, are based on inventories of the vegetation (comparison of actual and optimal conditions) and of the game populations (population density, structure, condition, health). Uniform methods still have to be developed for the collection and implementation of some of this planning information (e.g. evaluating the extent of game damage). In relation to the management of chamois and ibex, the preservation of wildlife habitat includes specific measures concerning the protection of the animals from human disturbances (e.g. measures to reduce the impacts of recreation and sports, measures minimising the decrease in available habitat). Major disturbances will cause chamois to retreat into inaccessible ranges (see Ingold *et al.* in press).

Both ibex (a protected species according to federal law) and the chamois are hunted in Switzerland. Hunting serves a dual purpose by maintaining healthy populations and preventing, and minimising game damage to forests and agricultural areas. Hunting permits are allocated by the patent system in 17 cantons, and by the district system in nine cantons. In 1990, totals of 17,981 chamois and 1,068 ibex were legally killed by hunters in Switzerland (BUWAL 1991). Departments responsible for hunting are the federal and canton hunting administrations, the federal and canton forestry administration, and the environmental protection agencies.

A list of all the protected areas in Switzerland would be too lengthy for this report; for example, there are more than 300 in Graubünden alone. However, the most important for Caprinae (Map 6.14.1), include the Swiss National Park in the east ($167km^2$) and over 40 confederated protected hunting areas (8 to $102km^2$ in size), as well as countless, usually small, canton wildlife refuges.

For the preservation of the ibex in Switzerland, neither the National Park nor the protected areas play a major role today. Hunting ibex is permitted in the confederated, as well as the cantonal, protected areas. The annual quotas for ibex to be culled (proposed by Canton Hunting Inspection Agencies and fixed by the Federal Department of the Interior) are divided between a corresponding number of hunters, and the population structure is taken into consideration when planning hunting quotas (age classes and sex ratio). For chamois, however, protected areas do help maintain the species-specific population structure, especially in those cantons where hunting permits are allocated by the patent system. In both the confederated and the cantonal protected areas, hunting chamois is not permitted. In the remaining hunting areas, there is no fixed global quota for chamois to be culled. Here, the quantity of chamois shot depends primarily on the number of hunters and their preferences, thus the number of aged, male chamois shot is often disproportionately high.

Scientific research, in conjunction with the management of wild ruminant populations, is mainly conducted by members of the Swiss Association for Game Research. At present, university research institutes are only marginally concerned with this practical application of environmental ecology. Various non-government organisations are also involved in wildlife management, including the four hunting associations (Schweizerischer Patentjäger Verband [SPV], Allgemeiner Schweizerischer Jagdschuntzverband [ASJV], Diana Suisse, and Federazione Cacciatori Ticinesi [FACTI]), the Swiss Forestry Association (SFV), the Swiss League for Nature Protection (SBN), WWF-Switzerland, the Swiss Animal Protection Agency (STS), regional farming and tourist organisations, as well as the Foundation for the Swiss National Park.

To promote public education, the federal government has established the Swiss Documentation Office for Wildlife Research which periodically publishes reports on the biology of native wildlife. Publications of the Swiss League for Nature Protection (SBN), and WWF-Switzerland, which are widely distributed, are also important contributions to public information.

General conservation measures proposed

Neither chamois nor ibex are presently threatened in Switzerland. Relative to the availability of suitable habitats, both species are widely distributed with consistent populations. Hunting legislation, providing the basis for the management of wild ruminants, is up to date and permits the application of appropriate and differentiated measures. The creation of additional national parks or game reservations to maintain ibex and chamois populations is unnecessary.

The most important problem concerning the preservation of game populations in Switzerland is the multiple use of, and human population pressure on, wildlife habitat (Onderscheka *et al.* 1990; Reimoser 1984, 1988). Solutions to problem that do not adequately consider the complex interactions among plants, wild animals, living space, and humans, will continue to decrease the availability of habitats essential to the survival of wildlife. Consequently, future environmental planning must not only consider property development, forestry, or tourism, but also protection of wildlife habitat. Technical plans should only be realised within the framework of an integrated overall environmental plan, which also necessitates an adaptive approach in administrative and decision making (see Leser 1991). Designated wildlife habitat should not, however, be regarded as protected reserves in which human use or substantive change is prohibited. Populations of large herbivores may be capable of self-regulation, but in an intensively used country like Switzerland, it would be unacceptable for wild ruminant populations to be allowed to reach carrying capacity. Ibex and chamois populations, together with their habitats, can only be preserved over the long-term in Switzerland, by comprehensive management planning.

Species accounts

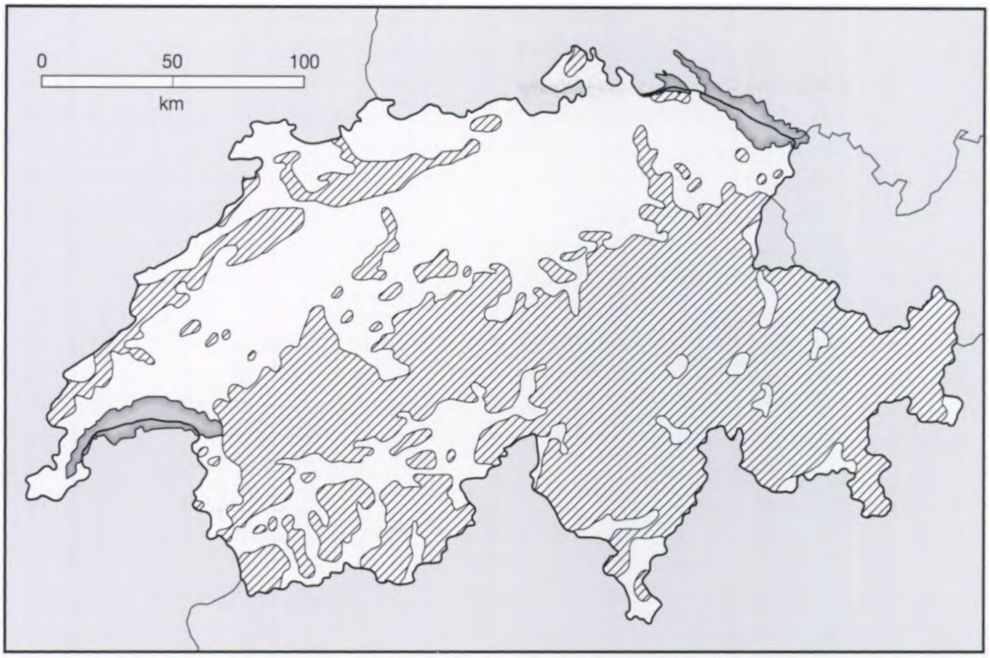
Information on the biology of Caprinae in Switzerland has been published by Brüllhardt (1983), Couturier (1938; 1962), Giacometti (1991), Hartl (1986), Meile (1985), Nievergelt (1966), Ratti (1981), Salzmann (1977) and Tataruch *et al.* (1991).

Alpine chamois (*Rupicapra rupicapra rupicapra*)

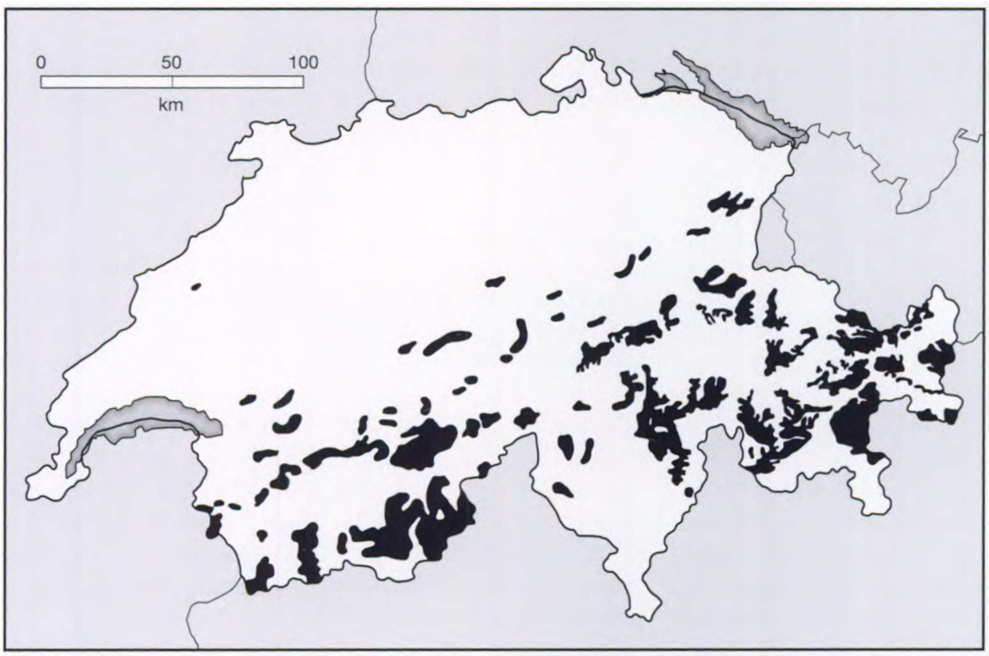
Distribution: Widely distributed throughout the Swiss alps and well represented in the forested regions of the Jura, and even in the hilly forest area of the Midlands. It appears to have colonised all available and suitable habitat in Switzerland (Map 6.14.2).

Population: Chamois populations are not systematically censused throughout the country. Regionally, attempts are made to count as many animals of a population as possible, while in other areas, populations are assessed by sampling or by individual observations, and the total extrapolated. The total population of chamois estimated in Switzerland for 1990 was 94,447 animals (BUWAL 1991), but the total probably exceeds 100,000.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Many protected areas contain chamois throughout its range in Switzerland (Map 6.14.1). Chamois



Map 6.14.2. Distribution of Alpine chamois (*Rupicapra rupicapra rupicapra*) in Switzerland.



Map 6.14.3. Distribution of Alpine ibex (*Capra ibex ibex*) in Switzerland.

management and hunting are regulated by a Federal law and by two ordinances. Further information on how annual quotas are determined is given in **General conservation measures taken** above.

Status within country: Not threatened.

Alpine ibex (*Capra ibex ibex*)

Distribution: Present throughout the Alpine ranges, and especially concentrated in the Bern and Wallis alps in the west and the Glarn and Graubünden alps in the east (Map 6.14.3). The Central alps (Gotthard) provide relatively poor ibex habitat due to their geological, topographical, and climatic conditions. A single colony of ibex, numbering 20 individuals, exists in the Jura. All available, suitable habitats for ibex in Switzerland are occupied.

Population: All ibex colonies are censused annually by direct observation as stipulated in the federal ordinance for the regulation of ibex populations. The counts of colonies living on the borders of cantons are co-ordinated between adjacent jurisdictions. This procedure also applies to populations that straddle the Swiss borders. In spring 1990, a total population of 14,451 ibex was reported (BUWAL 1991).

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Ibex was reintroduced into Switzerland in 1906 (Giacometti 1991) and is fully protected by a Federal law and two ordinances. Strict hunting quotas for ibex are set each year and the continued survival of the species is assured under present conditions. However, the significance of the low genetic variability within ibex colonies in certain areas has not been sufficiently evaluated (Hartl 1986). Many protected areas contain ibex (Map 6.14.1).

Status within country: Not threatened.

Acknowledgements: The Confederation Hunting Inspection Agency provided important data and processing costs, which are greatly appreciated. The distribution map for chamois was made available by the Swiss Association for Game Research (an Atlas of the Mammals of Switzerland edited by this Association, under the direction of J. Hausser and J-D. Bourquin, is in press). Also, I thank Joseph Zandl for drawing the ibex distribution map, and Phyllis Kasper for the translation.

6.15 Turkey

A. Kence and M.S. Tarhan

Introduction

Covering approximately 780,000km^2, the Republic of Turkey falls at the cultural, geographical and political cross-roads of Europe and Asia. It is a mountainous country with an average elevation of around 1,097m asl, bordered to the north by the Black sea and along half its southern edge by the Mediterranean. The Central Anatolian plateau is bounded on all sides by mountain ranges. The Pontic mountains stretch along the northern rim of the Plateau, just south of the Black sea, increasing in height eastward until they reach their maximum on Kaçkar Dagi at 3,932m asl. To the south of the Plateau lie the higher Taurus mountains, which rise to a maximum of 4,116m on Çilo Dagi. These southern mountains, comprised of a series of ranges, run in a broad arch along the Mediterranean coast and continue inland along the border with Syria. A series of parallel mountain ridges run along the western edge of the Plateau, while to the east are found high, volcanic peaks. These latter form the eastern Anatolian mountains, including Agri Dagi (Mount Ararat) at 5,137m, near the Iranian border. The Central plateau itself is a semi-arid region formed by several basins and containing a number of large, shallow lakes.

The varied topography has obvious effects on the country's climatic conditions. Coastal regions are generally humid, receiving >690mm rainfall annually. By contrast, the interior experiences semi-arid conditions because its encircling mountain ranges intercept most of the precipitation. Regions in the west, south and northwest are dominated by a Mediterranean vegetation of dense shrublands at lower elevations, and by coniferous and deciduous forests up to timberline at around 1,830 to 2,130m asl. The most densely forested areas occur in the northern part of the country, along the Black Sea coast, becoming sub-tropical towards the eastern regions.

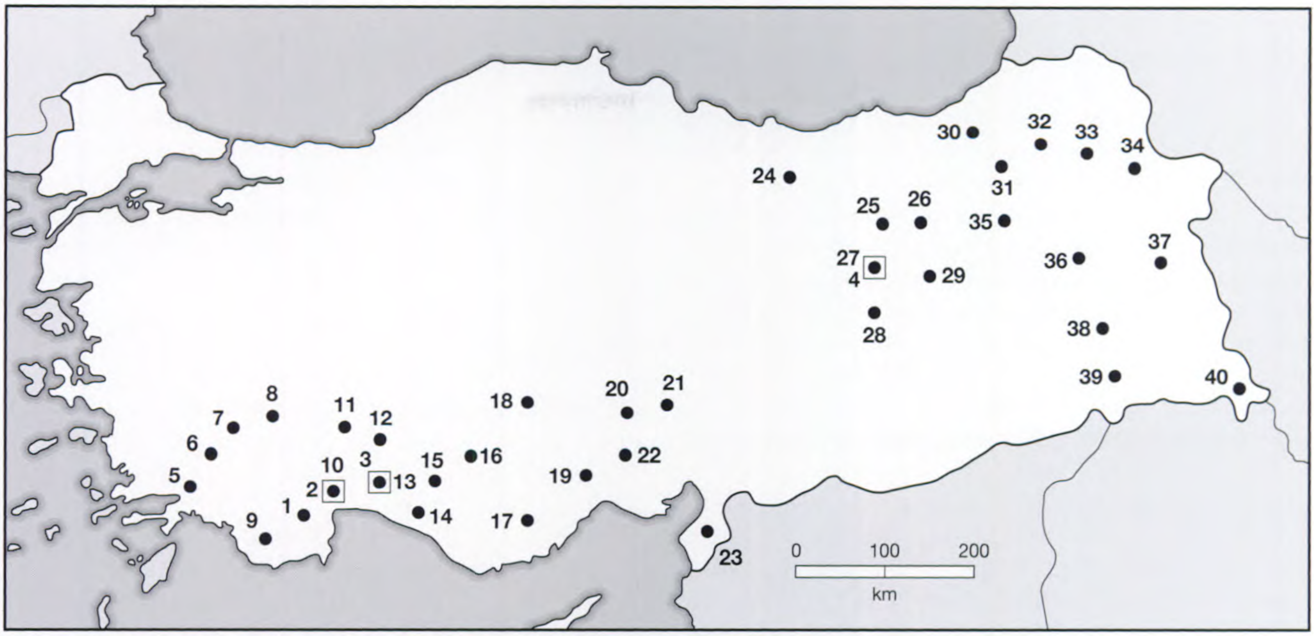
Current status of Caprinae

Turkey represents the southeastern limit of chamois (*Rupicapra*) and the current western, mainland limit of wild sheep (*Ovis*). As such, it forms a modern transition zone between Europe and Asia for Caprinae distributions. The most easterly subspecies of chamois is the Anatolian or Turkish chamois (*Rupicapra rupicapra asiatica*). Its range has decreased significantly in historical times, but it is not considered threatened even though no estimate of numbers is available. Limited hunting has been permitted since 1981 in the Kaçkar mountains. The Persian wild goat (*Capra aegagrus aegagrus*), also called the "bezoar ibex", is presently considered to be in sufficient numbers that the Turkish authorities allow them to be hunted.

Armenian or Anatolian mouflon (*Ovis orientalis gmelinii*) has been so greatly reduced in both range and numbers from its recent historical distribution, that it is now considered vulnerable. Breeding stations have been established and re-introductions are planned. A second subspecies of mouflon is recognised by Turkish biologists, the Central Anatolian mouflon (*O. o. anatolica*) (Ellerman and Morrison-Scott 1966), although others include these sheep in *O. o. gmelinii*. Once much more widespread, it is now restricted to the Bozdag and Nuras mountains, with a few (ca. 20) on the Bozdaglar region northeast of Konya. A controlled breeding program has been established for the re-introduction of this sheep which is considered rare.

General conservation measures taken

Forest laws dealing with conservation go back to the mid-1800s, but were superseded in 1937 by the Forest Law No. 3116 and by Hunting Law No. 3167. Legal establishment of protected areas began in 1956 under Forest law No. 6831, which divides ownership of forests into state forests, forests of public institutes, and private forests. These in turn have been subdivided into Protection Forests,



Map 6.15.1. Locations of protected areas with Caprinae in Turkey.

National Parks: **1)** Olimpos-Beydaglari (69,800ha; est. 1972); **2)** Termessos (6,736ha, with outer zone of 6,702ha; est. 1970); **3)** Köprülü Kanyon (Gorge) (36,614ha; est. 1973); **4)** Munzur (42,000ha; est. 1971). ***Reserves:*** **5)** Marmaris-Karadag Yarimadasi (2,684ha; est. 1967); **6)** Mugla-Yilanli-Esekderesi; **7)** Merkez Honaz Dagi (14,400ha; est. 1976); **8)** Çardak Maymundagi (6,000ha; est. 1975); **9)** Kas-Kibris Cayi (7,000ha; est. 1981); **10)** Antalya-Düzelerçami (14,000ha; est. 1966); **11)** Aglasun-Çamova (est. 1989); **12)** Kovada Gölu Protected Landscape (6,534ha; est. 1970); **13)** Manavgat-Tasagil (est. 1982); **14)** Alanya-Dimçayi (7,200ha; est. 1974); **15)** Akseki-Üzümdere (6,922ha; est. 1979); **16)** Cevizli-Gidengelmez Daglari; **17)** Mersin-Mut Kestel Dagi (1,961ha; est. 1987); **18)** Konya-Bozdag (42,000ha; est. 1966); **19)** Tarsus-Çoak-Cehennemderesi (27,00ha; est. 1969); **20)** Nigde-Demirkazik Dagi (42,686ha; est. 1988); **21)** Yahyali-Aladag (24,178ha; est. 1978); **22)** Pozanti-Karanfildag (14,750ha; est. 1982); **23)** Iskenderun-Arsuz; **24)** Mesudiye (est. 1979); **25)** Siran-Kuluca; **26)** Kelkit; **27)** Ovacik-Munzur Vadisi (15,000ha; est. 1968); **28)** Çemisgezek-Yilanlidag (11,000ha; est. 1981); **29)** Kigi-Seytandaglari (22,600ha; est. 1979); **30)** Çamlihemsin-Kaçkar (41,425ha; est. 1973); **31)** Ispir Verçenik Dagi (50,458ha; est. 1980); **32)** Yusufeli-Çoruh Vadisi (8,700ha; est. 1971); **33)** Oltu; **34)** Sarikamis-Kagizman (18,600ha; est. 1988); **35)** Çat-Gölköy (59,100ha; est. 1981); **36)** Süphan Dalgari (29,400ha; est. 1981); **37)** Özalp (5,500ha; est. 1971); **38)** Pervari-Botan Vadisi (76,500ha; est. 1972); **39)** Sirnak Cudi Mountain (25,400ha; est. 1979); **40)** Semdinli-Rubaruh (15,000ha; est. 1976).

National Parks, and Production Forests. The current National Park Law No. 2873 was enacted by the General Directorate of the Ministry of Agriculture, Forestry and Rural Affairs in 1983, along with the Environment Law No. 2872 by the General Directorate of the Environment. Besides protected areas, there are three types of game forest sites; breeding and protection areas (Hunting Law No. 3167) for the conservation of game and endangered wildlife, game re-introduction areas, and biogenetic or nature conservation areas to protect endemic, endangered or internationally important fauna and flora on Forestry Defense property (IUCN 1992a). Caprinae are found in a number of protected areas throughout Turkey (Map 6.15.1).

The first activity oriented towards the conservation of mammals during the period of the Republic, was Land Hunting Law No. 3167 enacted in 1937. Hunting wild sheep, wild goat and chamois was prohibited throughout the year by Article 2, paragraph 3, item A of this law. Article three of the law also invested the Hunting Commission with the power to decide whether species not specifically mentioned in the law could be hunted. Based on the authority of this law, still in effect today, the Central Hunting Commission, appointed annually by the Ministry of Agriculture, has prohibited the hunting of male and female deer, and wild goat every year since 1945, finally making this prohibition permanent in 1955. However, because of increases in the numbers of wild goat, controlled hunting of males began in Düzlerçami (Antalya) in 1981, and in additional areas in 1986. Despite regulations, hunting is considered to be one of the major, pressing environmental problems in the country.

Studies aimed at the protection of mammals have their basis in Land Hunting Law No. 3167 currently in force. Items A and C, Article 17, have introduced such provisions as "taking the necessary measures for beneficial game animals, whose numbers have declined", and "taking measures to breed game animals". The first effort in this direction began with the founding of a red deer breeding station in 1959. Then in 1966, the first two conservation and breeding areas were set aside, one for fallow deer (*Dama dama*) in Antalya, and one for wild sheep in Konya Bozdag. Founding such stations has continued. Since 1973, efforts have begun to reintroduce these game animals bred at the stations into their natural habitats. As a result of these projects, initiated in 1955 and maintained since, several valuable Turkish fauna have been saved and re-established.

The main conservation groups active in Turkey include the Environmental Problems Foundation of Turkey (Türkiye Çevre Sorunlari Vakfi) concerned mainly with environmental issues and legislation, the Society for the Protection of Wildlife (Dogal Hayati Koruma Dernegi – DHKD) involved with conservation education, the Environment and Woodlands Protection Society (Çevre Koruma ve Yesillendirme Dernegi), and the Turkish Association for Conservation of Nature and Natural Resources (Türkiye Tobiatini Koruma Dernegi) (IUCN 1992a).

General conservation measures proposed

The most important Caprinae conservation issues are poaching and predation pressure exerted by wolves, lynx and caracals (*Felis* (*Caracal*) *caracal*). In addition, legislation, funding and personnel are inadequate for the conservation of these animals. Reliable population estimates and research on ecology and genetics of Caprinae species are also essential for applying effective conservation measures.

The Land Hunting Law No. 3167 is obsolete and cannot meet the needs of current conservation issues. What is required first, is to modernise the Land Hunting Law. A bill on the Land Hunting and conservation is on the agenda of the Turkish Grand National Assembly. This proposes that fines for poaching become heavier and more dissuasive, and includes provisions for training hunters, funds for conservation, and personnel to be employed in conservation. This bill is still waiting on the agenda of the Türkiye Grand National Assembly.

Species accounts

Recently, two articles on the biology and behaviour of Anatolian wild sheep have been published (Kaya, 1991; Kaya and Aksoylar 1992).

Anatolian or Turkish chamois (*Rupicapra rupicapra asiatica*)

Distribution: The main concentrations are found in northeastern and eastern Anatolia, in the mountains south of the Black sea, west from Artvin to just south of Trabazon (Map 6.15.2). Lower density populations are believed to extend as far west as Kastomonu, and scattered populations are also found around Biltis and Hakkari, between Agri, Bingol, Tungeli and Erzincan (Lovari and Scala 1984) (Map 6.15.2).

Population: No reliable population estimates are available.

Threats: Poaching and competition with livestock, coupled with natural predation.

Conservation measures taken: Listed as Data Deficient in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). A law giving total protection to this chamois has been in existence since a decree was issued by the Central Hunting Commission in 1967, but it is difficult to enforce. Controlled hunting of chamois in the Kaçkar mountains began in 1981, but the number hunted by 1991 did not exceed 30 individuals. Turkish chamois is found in Munzur National Park, and in 10 other protected areas: Çamlihemsin-Kaçkar (Rize), Bitlis (Süphan Mountain), Çat-Gölköy (Erzurum), Ispir Vercenik Dagi (Erzurum), Kelkit (Gümüshane), Kigi-Seytandaglari (Bingöl), Mesudiye (Ordu), Ovacik-Munzur vadisi (Tinceli), Siran Kuluca (Gümüshane), Yusufeli-Çoruh Vadisi (Artvin) (Map 6.15.1). Hunting is strictly forbidden in these areas, and fines for poaching are double those outside protected areas. Food is supplied to animals during severe winters, and predators are controlled. A breeding station for Turkish chamois was established at Trabzon (Maçka, Meryem Ana) in 1986, but attempts to breed them have been unsuccessful so far.

Status within country: Insufficiently Known.

Map 6.15.2. General distribution of Anatolian chamois (*Rupicapra rupicapra asiatica*) in Turkey.

Conservation measures proposed: Undertake reliable censuses of population numbers and distributions to determine the status of this chamois (see also **General conservation measures proposed**).

Persian wild goat (*Capra aegagrus aegagrus*)

Distribution: Occurs east from the Datça peninsula, through the Taurus and Anti-Taurus mountains in the mountainous regions of southeastern, eastern and northeastern Anatolia (Kence 1987) (Map 6.15.3).

Population: No total estimates, but numbers are believed to be increasing slowly (Kence, unpubl.).

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Females and young have been protected since 1937, and males since 1955. When the number of wild goats in the Antalya Düzlerçami Reserve had reached 6,000, controlled hunting of males was permitted in 1981. This was followed in 1986 by hunting being permitted in Gidergelmez Cevizli (Antalya), Arsus (Hatay), Demirkazik, Pozanti (Adana), Cehennemdersi, Tarus (Mersin).

Wild goat occur in the following National Parks: Köprülü Kanyon (Gorge), Munzur Valdisi, Olimpos-Beydaglari, Sipildag and Termessos. They also inhabit Kovada Gölu Protected Landscape (6,534ha; est. 1970), and another 32 protected areas: Pozanti-Karanfildag (Adana); Akseki-Gidengelmez mountains, Akseki-Üzümdere, Alanya-Dimçayi, Düzelerçami, Kas-Kibris Çayi, Manavgat-Tasagil and Sivridag (Antalya); Yusufeli-Çoruh Vadisi (Artvin); Kigi-Seytandaglari (Bingöl); Aglasun-Çamova (Burdur); Çardak Maymundagi and Merkez Honaz Dagi (Denizli); Çat, Ispir Verçenik Dagi and Oltu (Erzerum); Semdinli (Hakkari); Iskernderun-Arsuz and Iskenderun-Yaylacik B serisi (Hatay); Egirdir-Gökdere Köyü (Isparta); Mut-Kestel Dagi and Tarsus-Çoak-Cehennemderesi (Içel); Sarikamis-Kagizman (Kars); Yahyali-Aladag (Kayseri); Marmaris-Karadag Yarimadasi (Mugla); Nigde-Demirkazik Dagi (Nigde); Çamilhemsin-Kaçkar (Rize); Pervari-Botan vadisi and Sirnak-Cudi Mountain (Siirt); Çemisgezek-Yilandag and Ovack-Munzur vadisi (Tunceli); and Özalp (Van) (Map 6.15.1). Four breeding stations have been established for wild goat: Duzercami (Antalya) (14,000ha; est. 1966), Cameiyayla, (Tarus, Içel), Kestel (Mut, Içel) (1,961ha; est. 1987), and Pozanti (Adana).

Status within country: Not threatened.

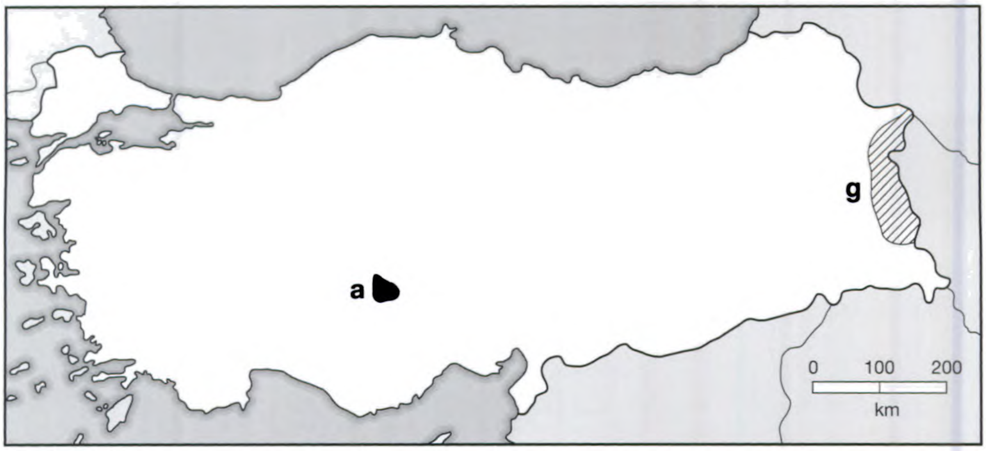
Armenian or Anatolian mouflon (*Ovis orientalis gmelinii*)

Distribution: These mouflon are found from south of Mount Agri, east of Lake Van as far as Karadag, and in the Mordaglar mountains north and east of Hakkari in the south (Map 6.15.4). Some populations migrate seasonally, moving to Iran in autumn and returning to Turkey in spring. A second subspecies is recognised in Turkey, Central Anatolian mouflon (*O. o. anatolica*). Until the 1950s, it was found from Nallihan, Sivrihisar, Konya and Karaman as far as the Central Tarsus. It has since declined with the loss of the Nallihan-Sivrihisar and Taurus populations, so that there were only about 20 animal in the Bozdaglar region west of Konya and a group of 2,000 in a protected area in the Bozdag and Nuras mountains (Kence 1987) (Map 6.15.4).

Population: The total population was estimated ca. 5,000 animals, of which 3,000 are considered *O. o. gmelinii* (Kence 1987) with numbers declining for the last six years, and ≥2,000 *O. o. anatolica*.

Threats: Poaching in general, although grazing by domestic sheep is the main threat on the Konya-Bozdag Reserve.

Map 6.15.3. General and specific distribution of wild goat (*Capra aegagrus aegagrus*) in Turkey.



Map 6.15.4. General distribution of mouflon (*Ovis orientalis*) in Turkey. a) *O. o. anatolica*; g) *O. o gmelinii.*

Conservation measures taken: Armenian mouflon is listed as Vulerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Van-Özalp Protection and Breeding Area, east of Özalp, is an extensive area (about 150,000ha) established in 1971 for the protection and breeding of this species (Kence 1987). The 42,000ha Konya-Bozdag Reserve (Map 6.15.1) was created in 1966 for Central Anatolian mouflon, and the area includes Bozdag and Nuras mountains. However, conservation efforts are hampered by the presence of over 50,000 domestic sheep belonging to the surrounding villages. A breeding station was established in this reserve in 1980, and plans were made to re-introduce wild sheep into the Nallihan area (Kence 1987).

Status within country: Vulnerable.

Conservation measures proposed: 1) Enforce anti-poaching laws. **2)** Determine cause(s) of declining numbers (see also **General conservation measures proposed** above). **3)** Reintroduce mouflon into habitats formerly occupied by Central Anatolian mouflon, such as Nallihan, Sivrihisar and Karaman (see also **General conservation measures proposed** above).

6.16 Former Yugoslavia

B. Kryštufek, M. Milenković, Z. Rapaić and N. Tvrtković

Introduction

The former Socialist Federated Republic of Yugoslavia is now comprised of five independent states: Bosnia and Herzegovina, Croatia, Macedonia, Slovenia, and the Federal Republic of Yugoslavia (the latter includes the Republics of Serbia with autonomous provinces and Montenegro). Together, they form the northeastern shore of the Adriatic sea mostly on the Balkan peninsula, covering an area of 255,800km^2. The terrain is predominantly mountainous, accounting for almost 75% of its surface, while 18% of it is above 1,000m asl. Five main mountain systems are recognised in this region. The northern and northwestern parts of Slovenia belong to the Alps, and include the area's highest peak (Triglav, 2,864m). South of the Alps, and running parallel to the coast as far south as Montenegro, is an irregular area of limestone plateaus ranging from 300 to 1,500m asl. These are the Dinaric alps whose highest peak, Djeravica (2,656m), lies in the Pokletije mountains. This area's characteristic topography of steep limestone crags and numerous cavern systems gave the name "karst" to similar limestone formations found in many places throughout the world. The Dinaric mountain chain separates the narrow, lowland belt along the Adriatic coast from the hilly, continental regions and the Pannonian plain further to the northeast. Western Macedonia (west of the Vardar river) belongs to the Šara-Pindos massif, while eastern Macedonia belongs to the Rhodope mountains. The highest peaks in western Macedonia are well above 2,000m, with Golemi Korab reaching 2,753m asl. The bedrock in these regions is of older Palaeozoic and metamorphic material. The mountains of eastern Serbia, connecting with the Carpathian chain from the north and with the Balkan mountain massif in the east, are mainly metamorphic rock with some limestone. Along the Sava and Danube rivers, and to the north of them, lies the Pannonian Plain, the largest flat lowland in the region. It is centred along the floodplains of the Drava and Tisza rivers, from which it extends across the northern border into Austria and Hungary. The lowlands occupy about 30% of Yugoslavia and are below 200m asl. Towards the south, the Pannonian plain passes through a hilly region leading into mountain massifs. The prevailingly narrow Adriatic coastal zone is dominated by the steep slopes of the Dinaric mountains. Its geography is unique, with numerous lateral ranges and valleys that were inundated by the post-Pleistocene rise in sea-level, to form a complex topography of numerous island chains and peninsulas along the coast.

The mountain systems have a major impact on climate, restricting Mediterranean influences to the coastal regions. Inland, the mountains experience a generally continental climate, although the northeast is exposed to extreme conditions affected by central Europe. Winds have a major impact, again due to topographic features. Cold winds include the "bora" along coastal areas in winter, the "vardarac" blowing in the Vardar Valley (Macedonia), and finally the "košava" in the northeast. Rainfall is low on the coast (between 650 to 900mm), but the mountains running just inland intercept clouds resulting in the highest rainfall (>2,000mm/year) in the western Alps, northwestern Dinaric Alps, and the mountains of Montenegro. The Macedonian mountains are dry (generally <700mm/year), which is true also for the Macedonian lowlands and the northeastern plains. The vegetation of the coastal region is typically Mediterranean, but has been badly degraded by humans. Forest cover of oak, hornbeam and beech, and conifers at higher elevations, dominates much of the native flora in the rest of the area. In the northeastern lowlands the natural vegetation is steppe.

Current status of Caprinae

Only one autochthonous species occurs in this region, the chamois (*Rupicapra rupicapra*), represented by two subspecies. Alpine chamois (*R. r. rupicapra*) accounts for about 44% of all chamois in the former Yugoslavia, and inhabit the Alps and northwestern Dinaric alps. Although alpine and subalpine habitats have provided its most secure refuge, it also occupies the rocky canyons of the Iščica and Sava Rivers between 250 and 1,000m asl, and is found in the beech and spruce forests of the hilly pre-Alp and pre-Dinaric Alp regions. At the beginning of this century it was limited mainly to the high mountains in the Alps and several small, isolated rocky areas of the pre-Alps and Dinaric area. As a result of introductions and natural colonisation in the northwest Dinaric Alps, this subspecies now occurs where previously there had been only a few small colonies. Today, the Alpine chamois is not threatened.

The Balkan chamois (*R. r. balcanica*) is found throughout the mountain ranges of the central, west-central and southwest regions. In Bosnia and Herzegovina it ranges between 120 and 2,385m asl, and in the Drina river canyon (border of Bosnia and Herzegovina with Serbia) lives between 230 and 900m asl. It is also found in the dry, karst limestone ranges of Dalmatia, Herzegovina and Montenegro. Due to numerous re-introductions and introductions over the last decades, the Balkan chamois has also extended its distribution into areas it was not present before World War II. The subspecies was not threatened prior to the beginning of the civil war in Bosnia and Herzegovina in 1992, but its future is now uncertain.

Populations of both subspecies were sufficiently high that neither was threatened in most major mountain regions before 1992. Following rapid increases between 1946 and 1975, the total chamois population (>25,500) was believed to be relatively stable. However, as there were several areas in which chamois historically occurred, there was potential for further increase.

In addition to chamois, three other caprin species have been introduced. Although none of the attempts for wild goat (*Capra aegagrus*) have been successful, those of Alpine ibex (*Capra ibex*) and European mouflon (*Ovis orientalis musimon*) have. Ibex were first introduced into the Karavanken Mountains (Slovene Alps) between 1890 and 1896, and the population had increased to 50 to 60 animals by 1918 before being badly decimated the same year due to military operations in the area. Prior to World War II, the colony rebounded only to be reduced once again, so that by the end of the war only 10 individuals survived. In the 1950s introductions began again and by 1989 a total of 237 ibex were counted. Today it is found in the Slovene alps, primarily in the Karavanken mountains, the Kamnik alps, and in Triglav National Park in the Julian alps.

Since the 1950s, a large number of mouflon have been introduced into hunting districts throughout most areas. Some herds are kept in enclosures while others are free-ranging. In Slovenia, where a major part of the total population occurs, the number was estimated to be around 2,200 animals in 1990. Local populations are managed and thriving.

General conservation measures taken

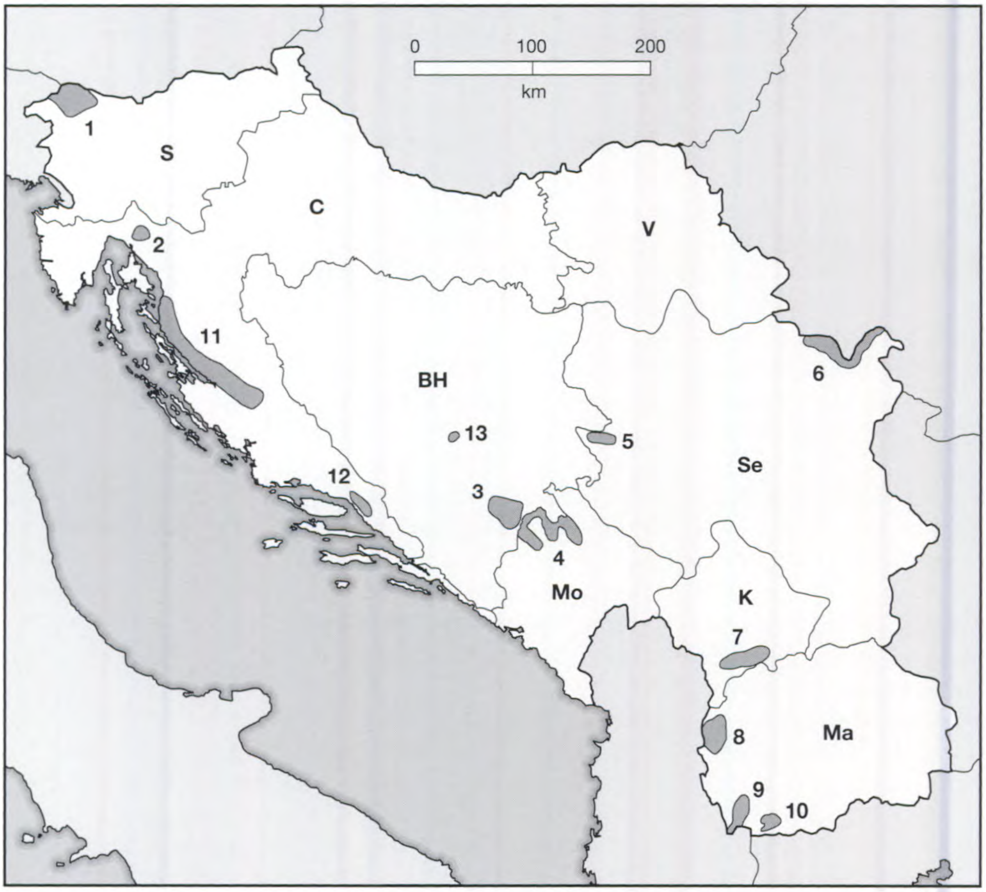
In Slovenia, the first legal provisions and restrictions were enforced in 1849, in Croatia in 1882 and 1893, and in Bosnia and Herzegovina in 1893. The Kingdom of Serbia passed a law in hunting in 1898 and Montenegro in 1910. However, already between 1876 and 1878, King Nikola of Montenegro forbade hunting of certain game animals, including chamois, in some regions. Hunting was legally regulated by the State, since the formation of Yugoslavia in 1918, with varying efficiency until 1991. Until 1991, environmental protection was included in the 1974 Federal Constitution (Ustav Socialističke Federativne Republike Jugoslavije). Within its general framework, specific regulations governing environmental protection were enacted by the assemblies of each republic and autonomous province, and varied throughout the country (IUCN 1987b, 1992a). However, the various environmental agencies were federated together in the "Yugoslav Union for Conservation and development of Human Environment" (Jugoslavenski Savez za zaštitu i unapredjivanje čovekove sredine) which advised on conservation issues (IUCN 1992a). Chamois were referred to in the hunting acts of all federal republics it inhabited. Legislation which existed for the protection of about 75 plant and about 370 animal species (IUCN 1992a) did not directly include chamois, which instead come under hunting laws.

Legal hunting was controlled throughout the country and the annual harvest was certified by hunting inspection authorities of each republic or of communal assemblies. The annual harvests were generally based on the numbers of animals estimated in the spring populations. Even though some estimates were possibly subjective, experience showed that hunters usually underestimate the numbers of ungulates. Legislation thus ensured the survival of chamois, although problems did occur in enforcement of the laws, particularly the control of poaching.

At least until 1991, there were nine types of protected areas in Yugoslavia, each for a specific purpose. These included National Parks, Regional Nature Parks, Nature Reserves, Special Nature Reserves, Natural Monuments, Biosphere Reserves, World Heritage Areas under UNESCO, Landscape Parks, and Historical Sanctuaries (Republički zavod za zaštitu prirode SR Srbije 1989). Of these, the first eight are of significance for nature conservation. Chamois occur in 10 national parks and three regional nature parks (Map 6.16.1), however, protection is not complete and hunting is allowed. The Parliament of Slovenia is currently dealing with an act which will provide complete protection for the central area of Triglav National Park (Map 6.16.1), with provision for a year-round ban on chamois hunting. All nature reserves which contain chamois are part of national parks. Finally, chamois are found in numerous game reserves which are managed by professional hunting organisations.

Introductions and re-introductions have been an integral part of chamois management. Alpine chamois introductions were attempted in the northwest Dinaric Alps as early as 1872, either to improve existing herds or to create new ones (Map 6.16.2). Between 1963 and 1987, 256 Balkan chamois, mostly from Sutjeska National Park (Map 6.16.1) have been successfully introduced or reintroduced into 13 areas in Croatia, Bosnia and Herzegovina, and Serbia (Map 6.16.2). By 1989–90, their numbers had increased to just over 2,500 animals. Not all introductions are successful, for example, the animals moved to Stolovi in central Serbia were quickly eliminated by poachers. Until 1908, an autochthonous population of chamois (subspecies not determined) occurred in the Velebit mountains (Croatia; Map 6.16.2). Following their extermination, several attempts were made to reintroduce chamois starting before 1941. Two introductions (1974 and 1978) were successful but included both Balkan and Alpine chamois, consequently the current (1992) population of 50 animals are hybrids.

Besides hunting organisations, several other non-government organisations were involved in nature



Map 6.16.1. Locations of protected areas with chamois (*Rupicapra rupicapra*) in the former Yugoslavia.

***National Parks*:**
1) Triglav (84,805ha; est. 1924);
2) Risnjak* (3,014ha; est. 1953);
3) Sutjeska (17,250ha; est. 1965);
4) Durmitor (33,000ha; est. 1952);
5) Tara (19,175ha; est. 1981);
6) Đerdap (82,000ha; est. 1974);
7) Šar planina (39,000ha; est. 1986);
8) Mavrovo (73,088ha; est. 1949);
9) Galicica (22,750ha; est. 1958);
10) Pelister (12,500ha; est. 1948).
***Regional Nature Parks*:**
11) Velebit** (200,000ha; est. 1978);
12) Biokovo (19,550ha; est. 1981);
13) Jahorina (2,000ha; est. 1954).
(* no chamois counted in 1990;
** hybrid population).
Some boundaries of the following borders are currently (1994) unstable:
***Republics*: S)** Slovenia; **C)** Croatia; **BH)** Bosnia and Herzegovina; **Ma)** Macedonia; **Mo)** Montenegro; **Se)** Serbia;
***Autonomous provinces*:**
V) Voivodina and **K)** Kosovo.

conservation in Yugoslavia (e.g. associations for nature conservation, biological and ecological societies in individual federal units), but none were directly involved in chamois conservation. Trying to improve management of chamois populations, the Hunting Association of Slovenia promoted the translation of the book "Chamois" (Knaus and Schröder 1978) into Slovene and provided copies to ca. 22,000 hunters in the Republic. In 1989, the Hunting Association of Yugoslavia initiated a research project titled "Distribution Area, Density and Possibilities of Introducing Chamois in Yugoslavia."

In 1991, the Socialist Federative Republic of Yugoslavia ceased to exist and was replaced until 1992 by five independent states. The political reality is reflected in drafts of new legal acts on nature conservation and hunting. However, as of September 1992, the political circumstances in some countries are chaotic and nothing definitive can be stated here. As a result of the civil war occurring in Croatia, and in Bosnia and Herzegovina, a great number of firearms have passed into civilian hands. In parts of Croatia (e.g. Velebit Mountains), and the entire area of Bosnia and Herzegovina, hunting is virtually uncontrolled. Balkan chamois in this latter region are at risk, although the population of about 1,500 animals of this subspecies in the Biokovo Mountains may be relatively safe. Because of the uncertainty of conservation legislation, we have maintained the description of the situation prior to 1991.

General conservation measures proposed

The taxonomic status of chamois in Yugoslavia, as well as the whole Balkan Peninsula, is uncertain. As many as three subspecies have been described and recognised (*R. r. rupicapra; R. r. balcanica* and *R. r. olympica*) (Bolkay 1925; Djulić and Mirić 1967; Koller 1929; Martino 1934; Mirić 1970). The latter subspecies is now accepted as a con-subspecific of *R. r. balcanica* (Ellerman and Morrison Scott 1966; Lovari 1987; Masini and Lovari 1988; Sägesser and Krapp 1986). Balkan and Alpine chamois are currently separated on the basis of difference in of maxillary tooth row and horn characteristics, however, the exact diagnostic characteristics of Balkan chamois need to be determined. Its morphology, karyotype and genetic profile should be studied and compared with those of other subspecies, especially with the Alpine chamois. It is also important to establish these parameters in the population from the Velebit mountains which originates from both subspecies.

Species accounts

Published information on the biology of chamois in the former Yugoslavia is available (Adamić 1974; Bavdek *et al.* 1974; Martino 1935; Valentinčič *et al.* 1971, 1974, 1976).

Alpine chamois (*Rupicapra rupicapra rupicapra*)

Distribution: This subspecies is found throughout the Alps, northwest Dinaric alps, and the hilly regions of the pre-Alpine and pre-Dinaric areas of Slovenia, from where the distribution extends into Gorski Kotar in northwest Croatia (Map 6.16.2). Small isolated populations are also found in the low mountains (Donačka gora, 882m and Boc, 978m) in eastern Slovenia bordering the Supannonian plain.

Population: The total population was estimated in 1990 at just over 11,000 animals, with the highest density populations occurring in the higher areas of the Alps along the northern border of Slovenia.

Threats: The small population (20 to 30) alive in Risnjak National Park (Map 6.16.1) in 1985, had been lost by 1990, most probably as a result of poaching. The subspecies is to be included in the Croatia Red Data Book (in press). Poaching was a problem in some areas especially in Croatia, and may have escalated significantly since 1991. Periodic outbreaks of sarcoptic mange are known to cause significant mortality in the Alps (Bidovec 1977). In Slovenia, where hunting is strictly controlled, the legal harvest was 1,580 animals in 1988 (13.8% of the spring population), and 1,710 in 1989 (15.8% of the spring population).

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). The earliest introductions from Alpine herds began in 1872 in the northwest Dinaric alps, with the purpose of creating new populations or improving existing ones. Alpine chamois are legally hunted, with an annual harvest based on numbers estimated during spring censuses. In 1990, a total of 1,462 were estimated to inhabit Triglav National Park (Map 6.16.1), which represents about 16% of the total population of this subspecies.

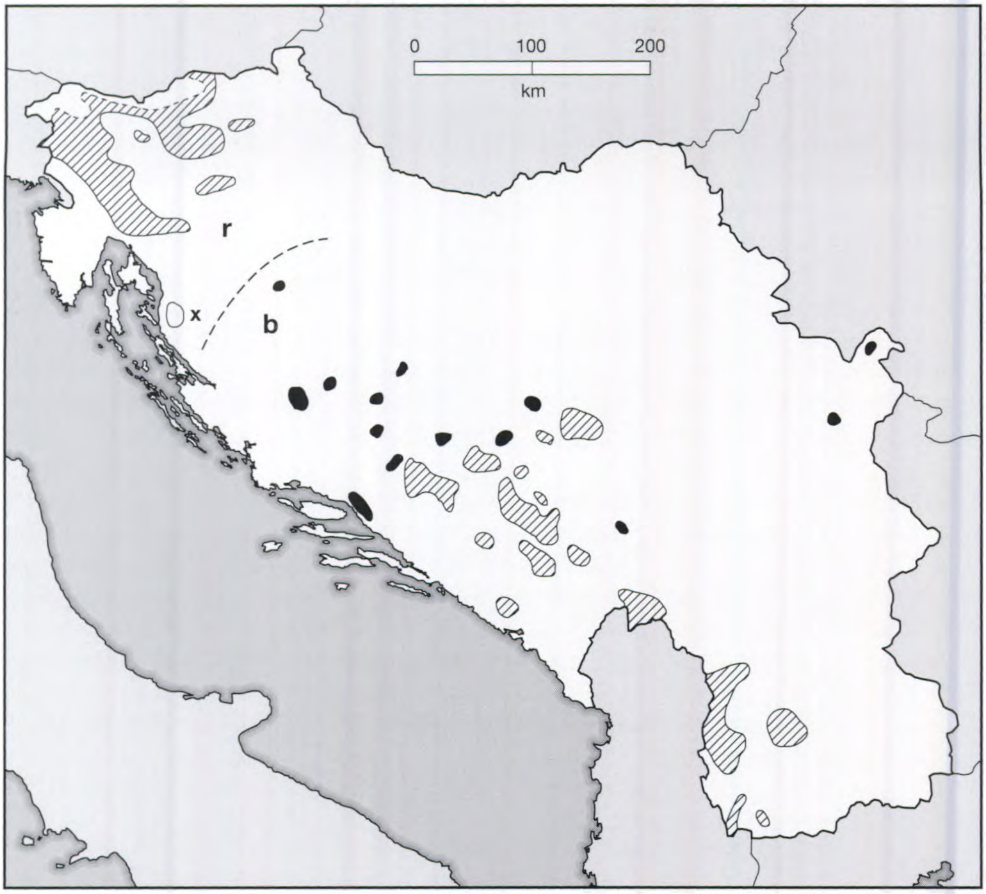
Status within country: Not threatened.

Although not threatened overall, animals in Croatia, representing their southern extent, are endangered.

Balkan chamois (*Rupicapra rupicapra balcanica*)

Distribution: Large autochthonous populations are found in the mountain massifs and river canyons of Bosnia and Herzegovina, Montenegro, Serbia, Kosovo and Macedonia (Map 6.16.2).

Population: The total number of Balkan chamois was estimated at almost 14,400 animals in 1989/90, of which about 11,860 were in autochthonous populations. However, some populations are very small (<50) and isolated (Map 6.16.2).



Map 6.16.2. Distributions of **r)** Alpine chamois (*Rupicapra rupicapra rupicapra*) and **b)** Balkan chamois (*Rupicapra rupicapra balcanica*) in Yugoslavia. Also shown are introduced populations of **Balkan** Chamois (solid) **and the** location of the hybrid population **X)** of *R. r. rupicapra* × *R. r. balcanica.*

Threats: Although the subspecies is not threatened overall, there are several small isolated populations that are vulnerable to poaching and other disturbance factors (e.g. habitat degradation, competition from livestock, etc.). Sarcoptic mange has not been reported in this subspecies. Since 1991, the entire population of Balkan chamois in Bosnia and Herzegovina was endangered because of military operations in many of the areas populated by this subspecies. In addition, a great number of firearms are in civilian hands in many other areas inhabited by Balkan chamois outside of Bosnia and Herzegovina.

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Introductions have been relatively frequent and successful. By 1990, more than 2,500 Balkan chamois occurred in areas previously unoccupied, with almost 60% in the Biokovo Mountains, but since 1990 conditions have deteriorated drastically and are completely unknown. Although Balkan chamois were legally hunted, in Montenegro there was a complete ban until 1995, and in Serbia two introduced populations are totally protected. Like Alpine chamois, the annual hunter harvest is based on estimates made during spring censuses. The annual harvest has been very low (ca. 35) over the last decade in Kosovo and Macedonia.

Censuses made between 1989 and 1990, showed that almost 6,400 or about 45% of Balkan chamois were in eight national parks and two regional nature parks (Map 6.16.1). Game reserves also play an important role in chamois conservation. The first of these ("Wild-Scongebeit") was created by the Austro-Hungarian occupation authorities in Bosnia and Herzegovina in 1893. By 1991, there were seven such special game reserves, totalling an area of 173,000ha, with Balkan chamois in Bosnia and Herzegovina. Special game reserves provide a similar level of protection to national parks, and are found also in Serbia, Montenegro and Macedonia.

Status within country: (prior to 1991) Not threatened.

Conservation measures proposed: The following proposals refer to conditions prior to 1991, and though additional strategies will have to be developed, some will probably still apply. **1)** Prevent poaching; this is of the utmost importance to the conservation and development of Balkan chamois populations. Surveillance is best performed by hunting organisations, therefore, hunters throughout the country should be educated the same way as has been done in Slovenia through distribution of the Knaus's and Schröder's (1978) book on chamois. **2)** Consider re-introductions to a number of geographic regions that

Balkan chamois used to inhabit in the 19th century, although care should be taken to ensure no other subspecies of chamois are introduced in the same areas.

6.17 Regional summary

M. Giacometti, G. B. Hartl and F. Völk

Regional picture

In Europe, conditions overall are moderate for Caprinae. Of 18 extant taxa (species and subspecies), two are considered Critical (*C. p. pyrenaica*, *R. r. cartusiana*), three Endangered (*R. r. tatrica, R. p. ornata, O. o. ophion*), and five Vulnerable (*C. p. victoriae*, *C. a. aegagrus*, *C. a. cretica*, *O. a. gmelinii, O. a. musimon*), the rest are Lower Risk, although the status of *R. r. asiatica* is Data Deficient (Table 6.17.1). It should be noted, however, that in some cases there is considerable disagreement in the literature about population numbers of some taxa from those in Table 6.17.1 [e.g. Weber (1994) gives a total estimate of 30,000 to 33,000 for all members of *Capra pyrenaica* compared to 11,210 in Table 6.17.1].

Major conservation issues

Ecosystems, attitudes towards wildlife, and agricultural and hunting practices, all vary within Europe. For example, hunting rights may be controlled by landowners, by government, or in some countries, are essentially unrestricted (Myrberget 1991). Not surprisingly, the status of Caprinae populations managed for hundreds of years is dependent on the actions of the countries they inhabit. Three broad conditions can be distinguished:

1) Countries where Caprinae populations tend to be large both in and outside protected areas.
2) Countries where populations of Caprinae tend to be large, but mainly only inside protected areas and game reserves.
3) Countries where (some) populations of Caprinae are low both in and outside protected areas.

Condition two is found in Albania, Cyprus, France, Greece, Italy, and Spain, because of the strong impact of poaching outside protected areas. In others, however, the presence of dense Caprinae populations causes considerable vegetation damage in, and especially outside, protected areas. Such diversity must be considered when interpreting differences in status and threats of Caprinae, and in proposals for conservation actions in Europe. Solutions to most conservation problems will require co-operative efforts if they are to be successful, because most Caprinae populations in Europe inhabit areas encompassing international borders.

Genetic depletion and alteration of autochthonous gene pools

Several taxa have suffered extensively from human activities. Alpine ibex and alpine chamois, have recovered from partially severe bottlenecks in population size within several decades, while the situation for others (e.g. Agrimi, and Tatra and Apennine chamois) is still problematic, and some (e.g. *C. p. lusitanica*) have been exterminated (Almaca 1992).

Dependent on recovery rate (cf. Nei *et al.* 1975) and mating system (cf. Apollonio and Hartl 1993), population bottlenecks are known to be associated with loss of genetic diversity. Though restocking populations of alpine ibex has been extremely successful, the small size of the founder population in Gran Paradiso National Park, and subsequent bottlenecks in the founding of new populations, resulted in low values of allelic variation (Hartl 1986, Randi *et al.* 1990, Scribner 1993, Stüwe and Scribner 1989). This is to be expected in other "bottlenecked" taxa, though data are scarce (see review in Hartl, in press). However, the lack of obvious inbreeding depression may be due to Caprinae adapting to bottlenecks during their evolution (cf. Hartl *et al.* 1990, Hartl, in press; see also **Chapter 2**). But, even if no negative short-term effects of genetic depletion have been observed in alpine ibex, the adaptability of populations may remain low for some time.

A related genetic problem arises from changes in the genetic integrity of locally well adapted populations by hybridisation with introduced animals from different taxa or very different habitats (e.g. some wild goat [*C. a. cretica* × feral *Capra hircus*] in Greece; chamois in France [*R. r. cartusiana* × *R. r. rupicapra*], Bulgaria and the former Yugoslavia [*R. r. balcanica* × *R. r. rupicapra*], and Slovakia [*R. r. tatrica* × *R. r. rupicapra*]). In general, the conservation goal of protecting co-adapted gene pools is hampered by uncertainties about subspecific and specific status in several taxa, as discussed below.

Taxonomic uncertainties

As stated in **Chapter 3**, the classification system used in this Action Plan is considered operational. In Europe, problems over subspecies or species status in *Capra*, *Ovis*, and *Rupicapra* are to be settled. For example, the current classification of ibex considers the alpine ibex (*Capra ibex*) and the Spanish ibex (*Capra pyrenaica*) separate species, and follows Cabrera's (1911) classical system in recognising four subspecies of Spanish ibex, three of which are extant (Alados 1985). However, based on alloenzyme electrophoresis, Hartl *et al.* (in press) found the genetic distance between alpine and Spanish ibex does

Table 6.17.1. Conservation status[1] and estimated numbers of Caprinae in European countries.

Taxon	Albania	Austria	Bugaria	Cyprus	France	Germany	Greece	Greenland	Italy	Poland	Romania	Slovakia	Spain	Switzerland	Turkey	Yugoslavia[2]	Red List[3]
Northern chamois *Rupicapra rupicapra*																	
Turkish chamois *R. r. asiatica*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	K	–	DD ?
Balkan chamois *R. r. balcanica*	V 1050	–	R >1600	–	–	–	E 400	–	–	–	–	–	–	–	–	S (K) ?	LR$_{lc}$ >3000
Chartreuse chamois *R. r. cartusiana*	–	–	–	–	E <150	–	–	–	–	–	–	–	–	–	–	–	CR$_{C2b,D1}$ <150
Carpathian chamois *R. r. carpatica*	–	–	–	–	–	–	–	–	–	–	S 9000	–	–	–	–	–	LR$_{lc}$
Alpine chamois *R. r. rupicapra*	–	S 157000	–	–	S 40000	S >10000	–	–	S >70000	–	–	–	–	–	–	S >11000	LR$_{lc}$ >225000
Tatra chamois *R. r. tatrica*	–	–	–	–	–	–	–	–	–	V 140	–	R 725	–	–	–	–	EN$_{C1}$ 865
Southern chamois *Rupicapra pyrenaica*																	
Appenine or Abruzzo chamois *R. p. ornata*	–	–	–	–	–	–	–	–	V 400	–	–	–	–	–	–	–	EN$_{D1}$ 400
Pyrenean chamois *R. p. pyrenaica*	–	–	–	–	S 15500	–	–	–	–	–	–	–	S >19000	–	–	–	LR$_{lc}$ >34500
Wild goat *Capra aegagrus*																	
Persian wild goat *C. a. aegagrus*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	S ?	–	VU$_{A2cde}$?
Cretan wild goat *C. a. cretica*	–	–	–	–	–	–	R 600	–	–	–	–	–	–	–	–	–	VU$_{D1+2}$ 600
Alpine ibex *Capra ibex ibex*	–	S 3300	–	–	S >1500	S 300	–	–	S 7000	–	–	–	–	S <14400	–	–	LR$_{lc}$ >26500
Spanish ibex *Capra pyrenaica*																	
Spanish ibex *C. p. hispanica*	–	–	–	–	–	–	–	–	–	–	–	–	S 7900	–	–	–	LR$_{cd}$ 7900
Pyrenean ibex *C. p. pyrenaica*	–	–	–	–	–	–	–	–	–	–	–	–	E 10	–	–	–	CR$_{D1}$ 10
Gredos ibex *C. p. victoriae*	–	–	–	–	–	–	–	–	–	–	–	–	R 3300	–	–	–	VU$_{D2}$ 3300
Mouflon *Ovis orientalis*																	
Armenian mouflon *O. o. gmelinii*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	V <5000	–	VU$_{A2cde}$ <5000
European mouflon *O. o. musimon*	–	–	–	–	R <800	–	–	–	R 2000	–	–	–	–	–	–	–	VU$_{A2cde,D1+2}$ <2800
Cyprian mouflon *O. o. ophion*	–	–	–	V 1200	–	–	–	–	–	–	–	–	–	–	–	–	EN$_{A1a}$ 1200
Muskoxen *Ovibos moschatus*	–	–	–	–	–	–	–	S 12000	–	–	–	–	–	–	–	–	LR$_{lc}$ 12000

[1] Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List of Threatened Animals (Groombridge 1993); S = not threatened.
[2] Yugoslavia = former Yugoslavia (Bosnia and Herzegovina, Croatia, Macedonia, Slovenia, and Federal Republic of Yugoslavia).
[3] Category of Threat according to 1996 IUCN Red List of Threatened Animals (IUCN 1996), followed by total number if known.

not exceed a value typical for that between ungulate subspecies (see review in Hartl, in press), nor do electrophoretic data support subspecies in the Spanish ibex. However, neither external morphological features nor genetic distances based on particular molecular characters, are alone suitable for a reliable diagnosis of taxonomic status. To be biologically meaningful, classifications must involve an integration of genetic, morphological, physiological, and behavioural data. Such an integrative approach was used by Lovari (1987) for separating *R. r. rupicapra* and *R. p. pyrenaica*; a result reinforced by recent data on mitochondrial-DNA differentiation (Hammer *et al.*, 1995).

Wildlife management and hunting practices

In Europe, management and hunting methods and rationales (e.g. for meat, trophies, preventing habitat damage, etc.) vary. Regional tradition is still the most important determinant, even in countries where scientific wildlife management is practised. Regarding the characterisation and manipulation of populations, the main problems can be grouped into five categories:

1) ***Estimating population size:*** Obtaining reliable estimates of population size is usually labour-intensive, requiring qualified and motivated staff with a profound knowledge of habitats. For European Caprinae, three major difficulties in determining population size are recognised:

- Population censuses are traditionally organised at a political level (e.g. province, canton, department, protected area), and political boarders often follow mountain ridges. Consequently, with most Caprinae inhabiting mountain ranges, a population's habitat is often politically subdivided. Thus, if the timing and methodologies of censuses are not standardised among administrative units, an adequate picture of the whole population is unlikely to emerge. In addition, data are only rarely exchanged between countries or even centralised within a country.
- Some taxa live in wooded or topographically complex areas, so a satisfactory determination of population size is usually not possible.
- In some countries, the responsible government authorities are not interested in estimating and recording the numbers of individuals in populations of game animals.

2) ***Poaching and overhunting:*** Severe poaching, even in protected areas, occurs in >50% of the countries (Albania, Bulgaria, Cyprus, France, Greece, Italy, Poland, Spain, and Turkey). Furthermore, a tendency towards overhunting populations outside protected areas and hunting reserves may occur (e.g. France, Italy). Regionally, the control of harvests is difficult because of hunting traditions, or difficulties enforcing bag limits. In some countries, critical socio-economic and political issues are unresolved (e.g. poverty, civil war, crimes against humanity), so wildlife conservation may not be a priority.

3) ***Habitat use and impacts on vegetation:*** With Europe's relatively high human densities, intense and multiple land use often results in concurrent damage by different land users, and in considerable negative impact on native plants and animals (Reimoser 1992). Habitat accessibility, and/or habitat size and quality are often reduced for Caprinae, consequently increasing energetic costs, while decreasing body condition, reproductive performance, and resistance to diseases and stressors (see Ingold *et al.* 1993). An additional consequence of tourism is that forest regeneration can be affected indirectly by wildlife damage (e.g. by reducing the number of undisturbed wildlife habitats so that Caprinae are forced to use less suitable habitats or vulnerable forests) (Reimoser *et al.* 1987). The negative impact of tourism is very high both in the Alps (see Baetzing 1991) and in some nature reserves (e.g. Albania, Greece, Poland).

Due to numerous disturbances of natural regulation in the cultivated landscape, damage to wildlife plants by wild animals is increasing, especially in protection forests with excessively large ungulate populations. Intense, selective browsing on preferred trees prevents regeneration in several regions, so stable mixed stands are gradually replaced by unstable pure stands. This is not only a problem in protection forests of alpine regions (Reimoser and Völk 1988, 1990a), but also in the relative small European protected areas, especially if wildlife culling has been abandoned (Reimoser 1992). In most cases, natural predators have been eliminated, and while their re-instatement may be a conservation goal, it may not be feasible in all areas. Human intervention must be considered instead, but its long-term impacts require further study before being applied wholesale.

In some countries where Caprinae are not threatened by overhunting, a reduction and/or a deterioration of suitable habitats occurs (e.g. the Alps, Tatra mountains). Recreation activities (e.g. hiking off trails, mountain biking, cross-country skiing) reduce significantly the availability of undisturbed wildlife habitats. Consequently, Caprinae (especially chamois) are found increasingly in less suitable habitats (e.g. in protection forests) and may cause considerable damage to young trees.

4) ***Wildlife diseases:*** The most frequent causes of epizootics in chamois and ibex are the pneumonia complex (dictyocauliasis, pasteurellosis), sarcoptic mange (*Sarcoptes rupicaprae*) (Spain, Italy, Austria, Germany, and Slovenia), and infectious kerato-conjunctivitis (probably *Mycoplasma conjunctivae*) (alpine countries, and also in mouflon in France). Brucellosis is also present in France and Spain

(Tolari *et al.* 1987). Transmission from domestic ruminants to Caprinae has been discussed (Gauthier *et al.* 1991), but important etiological and epidemiological questions remain. Many epizootics are species-specific and not transmitted between wild and domestic species, but attention should be given to transmission of other diseases between the two groups. Under certain circumstances, intervention may be necessary to improve the health status of a wild population (Pastoret *et al.* 1988).

5) ***Population size:*** Half the taxa (*C. p. victoriae*, *C. p. pyrenaica*, *C. a. aegagrus*, *C. a. cretica*, *R. r. cartusiana*, *R. r. tatrica*, *R. p. ornata*, *O. o. ophion*, and *O. o. gmelinii*) occur only in small and/or fragmented populations, implying an increased risk of extinction. Locally, protection of endangered endemics remains unsatisfactory. While small population size and isolation almost inevitably lead to genetic depletion, an uncoordinated transfer of animals ("activism") risks the genetic integrity of populations and of taxa. The occurrence of infectious and transmissible diseases may also have a significant impact on the survival of such small populations.

Main conservation solutions

In general, conservation and management of European Caprinae should be based on thorough situation-specific evaluations and clear definitions of relevant goals, before decisions appropriate to a taxon are developed. To be successful, decision-making must incorporate the taxon's habitat, other wildlife and, equally importantly, the interests of local people (cf. Baskin 1994, Giles 1978, Reimoser 1992, Schröder 1985). Where appropriate, land use patterns must integrate wildlife management with range and forest management (Schröder 1985). Reimoser (1992) proposed measures for forestry, hunting, tourism, agriculture, and nature conservation, that could be adapted to, and co-ordinated for, regions large enough to cover the entire range of ≥1 population of a taxon (i.e. integral area planning, see below). The following more specific conservation solutions are proposed:

1) ***Maintaining gene pool diversity and genetic integrity of populations:*** In addition to taxon-specific recommendations in the Country Reports above, standardised guidelines need to be developed for assessing the justification of a taxon in a particular area. To preserve biodiversity, restocking should occur only in areas where the taxon was naturally present in historical or postglacial times (cf. Schmid 1985). Introductions outside such areas should be avoided. Thus, the present situation for *O. o. musimon*, considered a taxon of Sardinia and Corsica (Niethammer 1963), but now broadly distributed over continental Europe, is debatable.

2) ***Wildlife management and harvesting:*** The following measures are proposed for European Caprinae (also see Giacometti 1991): **a)** define populations as reproductive communities, regardless of political borders; **b)** assess the suitability of habitats for Caprinae; **c)** co-ordinate methods and periods for estimating population size among political units (censuses should be based on the population, not on political districts); and **d)** improve and co-ordinate methods of harvesting among political units. Such measures are practised in Switzerland for Alpine ibex.

In countries like Austria, Germany and Switzerland with problems of wildlife damage to protection forests (see Völk 1994), selective hunting (based on a taxon's ecology and social structure) for regulating population structure and size, must be used. Further, it may be better to benefit from a renewable resource than to accept considerable losses due to starvation or epidemics in overpopulated stocks. Conservation measures must consider not only the target species, but also their habitats and other species in the ecological community. Planning, co-ordination, and control of wildlife management should be directed by professional wildlife managers. In some countries, a more efficient game warden service should be established (e.g. Italy, France, Spain, Turkey, Yugoslavia). Considering the interests of local people is essential if wildlife management is to succeed, especially for controlling poaching.

3) ***Integral area planning for habitat management:*** Conservation of taxa will be successful only if appropriate habitats exist (cf. Blankenhorn 1988). Protecting habitats is important in many areas, but especially in countries where tourism is rapidly increasing (e.g. the Alps, Tatra mountains). Areas with intense tourism should be interspersed with refugia that allow recovery of animals that are particularly sensitive to disturbances (Reimoser and Völk 1990b). Education of local people, hunters and tourists is an important prerequisite for such measures to be effective.

Before choosing solutions to address particular problems, the aims of all affected land users must be clearly defined and co-ordinated. Primary aims include conservation of threatened taxa, reduction of game damage to forests (see Reimoser and Völk 1988), reduction of stress on animals, and meeting local people's requirements (tourism/wildlife watching, hunting).

Concepts for an integral management of ungulates outlined by Reimoser (1989) include: a) basic planning for the whole country or state; b) detailed regional planning; c) proper internal planning; and d) international co-ordination measures. These have been realised in the Austrian federal provinces of Vorarlberg and Salzburg, resulting in new hunting laws. At an international level, co-ordinated management has been achieved between

Vorarlberg, the Principality of Liechtenstein, and Switzerland for a red deer (*Cervus elaphus*) population (Onderscheka *et al.* 1989, Reimoser 1989), and between Switzerland, the Principality of Liechtenstein and Italy for some alpine ibex populations (Ratti 1994).

4) ***Disease control:*** Eco-pathological research should be intensified to reduce disease impacts. The aetiology and epidemiology of sarcoptic mange and infectious kerato-conjunctivitis are of special urgent need because transmission of these diseases from domestic ruminants to wild Caprinae is possible. The spread of sarcoptic mange to uninfected populations (e.g. in the alpine regions west of the Brenner pass and the orografically left side of the Inn river) must be halted. An action plan should be prepared for facilitating a rapid response in the case of an outbreak.

Interspecific transmission of nematodes associated with grazing competition is a potential threat (e.g. Cyprus, Greece, Spain, and Turkey), and systematic de-worming and medical inspection of freely pasturing domestic Caprinae are strongly recommended. Also A and B diseases (e.g. foot and mouth disease, leptospirosis, Q fever, paratuberculosis, brucellosis) listed by the Office International des Epizootics' (OIE. Paris), along with contagious ecthyma, should be eradicated or at least kept under control in domestic ungulates.

Co-operative conservation solutions to major threats requiring international actions

1) ***Avoiding genetic problems:*** Avoidance or reduction of genetic problems at the population level (see above) is an area where international co-operation among wildlife agencies can be effective. Animals may be exchanged between populations to increase genetic diversity, or agreements reached to limit the export-import of non-native taxa. Increasing heterosis must, however, be balanced with the need to maintain unique gene pools adapted to local conditions. International co-operation between research scientists is probably the most efficient means of studying such phenomena.

2) ***Habitat evaluation:*** Prior to any restocking, a habitat evaluation, following international standards (e.g. Tosi *et al.* 1986) for general transfer guidelines, should be completed. A list of suitable (unpopulated) biotopes for endangered Caprinae taxa should be provided by international organisations (e.g. appropriate sections of the European Commission or IUCN). Criteria for protected areas (e.g. IUCN criteria for national parks) should be adapted to different scenarios.

3) ***Public education and information:*** In areas where culling outside protected areas and game reserves is intensive and/or uncontrolled, the public should be made aware of the importance of conservation of threatened taxa. However, the success of such measures can be expected only if the social and economic situation of local people is improved. Provision of economic and technical support may be necessary in some circumstances.

4) ***Population censuses:*** Methods of measuring population size and structure, and of determining harvest levels, should be co-ordinated among political units practising controlled culling. Where recreation activities indirectly affect regeneration of protection forests, tourism should be restricted to, or centralised in, appropriate areas. For example, prohibiting hiking off footpaths, especially in important Caprinae refugia and pastures in the alpine zone, would be valuable in some areas (e.g. Alps, Tatra mountains). Culling rates of Caprinae, especially in forests protecting rail and road transportation corridors (e.g. the Alberg, Brenner, Gotthard, and Simplon) and human settlements from avalanches, must be locally increased to reduce browse damage. Hunting strategies should consider the maintenance of a stable population structure (sex and age classes), without overharvesting older males. Where hunting is very difficult, re-establishment or expansion of lynx populations may prevent concentrations of Caprinae in protection forests (see Haller 1992).

Acknowledgements: This work was supported by the Fund for Research on Infectious Kerato-conjunctivitis (Chur, Switzerland) to M. Giacometti, and by the Fonds zur Förderung der wissenschaftlichen Forschung (FWF, project P09660-BIO) to G. B. Hartl.

Chapter 7

China, the Commonwealth of Independent States, and Mongolia

7.1 China

Compiled from reports by:
Wang Sung, Gu Jinhe, Hu Defu and Ning Luo; Zhang Yongzu, Wang Zongyi and Yang Rongsheng; Cai Guiquan

Introduction

The People's Republic of China has the largest human population of any country in the world and its 9,564,500km^2 make it the largest country in Asia. It shares a border with 11 countries. China's 29 administrative units fall under direct control of the central government, and are comprised of 21 provinces, five autonomous regions and three municipalities. Topographically, it reaches from the world's highest mountain, Qomolangma (Chu-mu-lang-ma Feng, 8,848m), to one of the lowest places, Lake Ai-ting (154m bsl), in the Turfan depression (Turpan Pendi). Generally speaking, altitudes are highest in the west and lowest in the east, and about 33% of the country is mountainous.

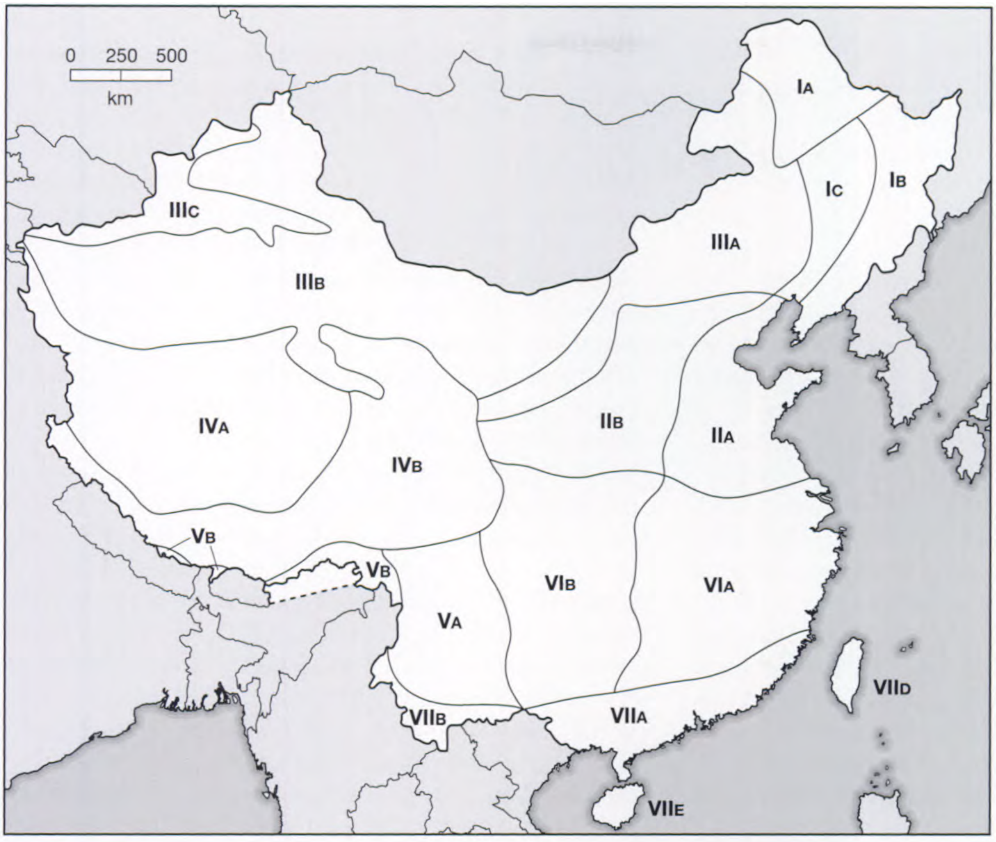
The highest region is the Tibetan plateau which extends over both Tibet (Xizang) and Qinghai, with an average altitude well over 4,000m asl. This is the highest region in the world and is well named as the "roof of the world", although its western section, the Changtang (Qiang Tang), is even higher. The most notable mountain ranges in this region are the great Himalayan chain extending along its southern border with India, Nepal and Bhutan, and the Kunlun and Altun mountains along the Plateau's northern edge. On the north side of the Kunlun Shan (mountains) lie the extensive Takla Makan desert and Tarim basin, which in turn are bordered to the west and north by the Tien Shan. To the north of these mountains lies the Dzhungarian basin, and beyond, the Altai mountains along the border with Mongolia. East of these regions are more mountains extending from the edge of the Gobi, south through the Qilian Shan in Gansu Province, through the eastern ranges of Qinghai to the Qionglai mountains of Sichuan and the Qinling Shan of Shaanxi, and finally the Wulang mountains in the southern province of Yunann bordering Myanmar (Burma), Laos and Vietnam. In the north-central and northeastern regions, lies the edge of the Mongolian plateau in Inner Mongolia, and to the southeast of this runs the Greater Khingan range. The south-central and western half of the country, from the eastern edge of the Yunnan-Kweichow highland region as far as the Yellow, East China and South China seas, consists of hills and plains below 450m asl.

With such a range of topography and geographic complexity, China's climate is highly diverse, ranging from extreme cold, dry deserts in the northwest to tropical monsoon in the southeast. The main part of the country is located in the temperate and subtropical zones. Owing to the influence of the Pacific Ocean monsoon, the climate of the eastern part is comparatively humid, while that of the western part is extremely arid because of its remoteness from the nearest oceans. The Tibetan plateau and some other uplands, are cold due to their high altitude.

China has one of the greatest ranges of ecological diversity of any country and contains almost all Holarctic types except for arctic tundra vegetation. The country extends from the tropic zone to the cold temperate zone, providing great diversification in terms of habitats and wildlife species. Two major zoogeographical divisions are recognised in China, the Northern (Palaearctic) and the Southern (Oriental) Realms that account for approximately

Table 7.1.1. Zoogeographical regions of China (see also Map 7.1.1).

Region	Subregion
Palearctic Realm	
I Northeast China	IA Da Hinggan mountains
	IB Changbai mountains
	IC Northeast China plain
II North China	IIA North China plain
	IIB Loess plateau
III Inner Mongolia–Xinjiang	IIIA Eastern steppe
	IIIB Western desert
	IIIC Tien Shan mountains
IV Qinghai-Xizang plateau	IVA Qinghai-Xizang plateau
	IVB Southern Qinghai-Xizang plateau
Oriental Realm	
V Southwest China	VA Southwest mountains
	VB Himalaya
VI Central China	VIA Eastern hills and plains
	VIB Western mountains and plateaux
VII South China	VIIA Southern coasts
	VIIB Southern Yunnan
	VIIC Haianan Island
	VIID Taiwan Island
	VIIE South China Sea islands



Map 7.1.1. Zoogeographic regions of China (after Zhang 1991) (see Table 7.1.1).

60% and 40% of the country respectively. Within these two realms, seven faunal regions are recognised (Map 7.1.1, Table 7.1.1) based on the various animal groups found within them, and corresponding to the dominant physical geographical features.

Current status of Caprinae

China is one of the most important countries for Caprinae in the world in terms of diversity at both the species and subspecific levels. Nine species are currently considered to occur there and these have been divided into as many as 32 subspecies by some authorities. Problems of Caprinae taxonomy world-wide, mean that the exact number and identity of many subspecies is either unclear or in dispute. Up to 70% of the Caprinae of China occur in the Southwest China Region, with the largest number of species distributed along the southeastern margin of Tibetan plateau, from the southern flank of Himalaya in the south, to the Heng Dun mountains in the north.

Serow (*Capricornis sumatraensis*) is widely distributed in eastern China, from the southeastern coast to the Himalayas (22° to 34°N, 87° to 121°E). Chinese biologists recognise five subspecies: Southwest China serow (*C. s. milneedwardsii*), found mainly in the Southwest China Region; Yunnan serow (*C. s. montinus*), restricted to a local area of northern Yunnan; South China serow (*C. s. argyrochaetes*) of the Central China Region; Himalayan or Nepalese serow (*C. s. thar*) in the western Himalaya (Tibet); and Medog or Bengal serow (*C. s. jamrachi* [= *C. s. thar*]) in the eastern Himalaya (Tibet). The first three subspecies were first described based on geographical variation of body colour and small skull differences (between *milneedwardsii* and *montinus*). Later, two more subspecies (*C. s. jamrachi* and *C. s. thar*) were described from southern Tibet (Feng *et al.* 1986). The local form of the *C. s. montinus* requires further comparison with the possible sympatric *C. s. milneedwardsii*. However, detailed taxonomic studies of Chinese serow have not been made since Allen's (1945) work. All five subspecies are listed as Class II under the Wildlife Protection Law of China, and most are believed by local experts, and confirmed by local commercial records, to have become severely threatened in recent years because of hunting and poaching. The species is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and is in Appendix I of CITES. For the Formosan serow (*C.* [*crispus*] *swinhoei*) see Chapter 9.10.

The taxonomy of goral (*Naemorhedus*) in China is also extremely confusing. Taxonomists in China have tended to follow Ellerman and Morrison-Scott (1951), so generally three species are recognised (see Nowak 1992:1474). Subspecies are also problematic, especially in transitional areas. Long-tailed goral (*N. caudatus*) is widespread, occurring in eastern and southern China, north to the

Small Xia'anling mountains, and west to the great bend of the Yarlung Zangbo river in Tibet. Originally, three subspecies of long-tailed goral were recorded in China under *N. goral* (*arnouxianus, caudatus, griseus*) (Shou *et al.* 1962), and later a fourth, *N. g. hodgsoni* (= *N. g. goral*), was recognised (Fen *et al.* 1986). A second species in China is the Tibetan red goral *N. baileyi baileyi,* which some authors treat as a subspecies of *N. goral* based on cranial and other morphological characteristics. Where it is sympatric with the third species of goral in China, *N. goral griseus*, no intermediate form has been found. Feng *et al.* (1986) however, believe that the red goral should be treated as a full species (*N. cranbrooki*). Whether the form found in China is *N. baileyi baileyi* or *N. b. cranbrooki* is uncertain. Goral are listed as Class II in the Wildlife Protection Law of China, in Appendix I of CITES, and as "Endangered" in the U.S. Endangered Species Act of 1973 (Federal Register of June 23, 1992). The taxonomies of both goral and serow are in urgent need of revision.

Based on careful comparisons of Himalayan tahr (*Hemitragus jemlahicus*) collected from Sikkim, and Nepal with specimens from Zhangmo (the middle Himalaya, Xizang), those from Tibet appear to belong to a form intermediate between those from the two other areas. This suggests that there is no distinct subspeciation of Himalayan tahr in China (Feng *et al.* 1986; Wang *et al.* 1984). The Chinese distribution of Himalayan tahr covers only a small remote part of the Qomolangma region.

Asiatic or Siberian ibex (*Capra* [*ibex*] *sibirica*) is either treated as a species separate from the European form (*C. ibex*; e.g. Sokolov 1959), or classed as subspecies of it (e.g. Ellerman and Morrison-Scott 1950; Corbet 1978). It is widespread, occurring in the arid mountains of northwest China, west of longitude 110°E. Among the five subspecies described by Sokolov (1959), four (*sibirica*; *hagenbeckii*; *alaiana*; *dementievi*) are considered by some to occur in China. All are listed as Class I in the Wildlife Protection Law of China (see below) because though widespread, populations are often small, fragmented and have low densities.

The genus *Pseudois* is endemic to the Tibetan plateau and originally was treated as monotypic (Allen 1940; Ellerman and Morrison-Scott 1950). Not all authors agree, and two subspecies have been recognised in China: Tibetan blue sheep (*P. n. nayaur*), and Sichuan blue sheep (*P. n. szechuanensis*). However, no comparison of geographical variation in the species has been made, and its distribution is continuous, with the geographic limits of each subspecies being uncertain. The species is found throughout Xizang, and the southern mountains of Xinjiang as far east as the northern tip of Yunnan, while the Sichuan form inhabits mountain areas in Gansu, Ningxia, Qinghai, Inner Mongolia, and Sichuan. The blue sheep in the Yangtze (Changjiang) gorge, near Batang (Sichuan), is much smaller than usual and is characterised by various features of its horns, skulls, hair and colour pattern, etc. Although it falls within the general distribution of other blue sheep, it occurs at lower elevations and occupies a different habitat. Based on these factors, and because no intermediate forms have so far been found, the dwarf blue sheep (*P. schaeferi*) is considered to be a distinct species by some authors (Feng *et al.* 1986; Groves 1978; Wu *et al.* 1990; see also Wang and Hoffmann 1987). A small population in Ningxia is believed to be a third subspecies of *P. nayaur*, and its status is currently being examined (Cai Guiquan, unpubl.). The taxonomic status of the genus requires further study because the conventional criteria that have been used to distinguish taxa, may have limited value (Geist 1991).

Of the 15 subspecies of argali sheep (*Ovis ammon*) recognised by some authors throughout the world, 10 (*adametzi*, *ammon*, *dalai-lamae*, *darwini*, *hodgsonii*, *jubata*, *littledalei*, *karelini*, *polii*, *sairensis*) are reported to occur in China. Marco Polo sheep (*O. a. polii*) has the most restricted distribution, and in the Taxkorgan Nature Reserve in the western Kunlun Shan on the border with Pakistan, it receives no official management and is even reported to be shot by border guards (Wegge 1988). Overhunting by both local people and immigrants with modern guns is reducing *O. a. hodgsonii* populations drastically on the whole of the Tibetan plateau. Most subspecies of argali are threatened in China, and the species is listed in Appendix II of CITES, with Tibetan argali placed in Appendix I. The European Union bans all imports of argali. Currently, however, the subspecies are only listed as Class II Protected Animals in China.

Takin (*Budorcas taxicolor*) is a near-endemic species of the Southwest China Region, and is distributed along the southern slopes of the southeastern Himalaya and the eastern part of Hungduan and Qinling Shan. World-wide, four subspecies have been recognised (Ellerman and Morrison-Scott 1951); Mishmi takin (*B. t. taxicolor*), Bhutan takin (*B. t. whitei*), Sichuan takin (*B. t. tibetana*), and Golden takin (*B. t. bedfordi*), and each occurs in China. Specimens of these subspecies have been examined, and their morphological characteristics show a gradual and slight geographical change in hair colour, nasal bones and horn shape, etc., thus supporting Ellerman's and Morrison-Scott's (1951) classification (Wu 1986). All subspecies of takin in China are listed as Class I in the List of Protected Animals, and in Appendix II of CITES. However, despite this protection, numbers of both Golden and Sichuan takin are decreasing, though a few golden takin are permitted to be hunted by foreigners.

Caprinae in China as a whole, are generally considered threatened at some level. For most, the situation does not appear to be improving even though since the late 1980s, all Caprinae have been included officially in the "List of Key Species of Wildlife Protected under the State Wildlife Protection Law" as either Categories I or II species (see

General conservation measures taken below). Of all the threatened Caprinae in China, the most endangered is probably the dwarf blue sheep (if it is a distinct taxon), with various subspecies of takin and argali close seconds. Unless drastic conservation measures are taken soon, many of these Caprinae will be lost, and for dwarf blue sheep, this would mean extinction of the taxon.

Serious difficulties have been experienced in the control of hunting and poaching because Caprinae are traditional game animals in China. Problems also occur because at times there have been striking contradictions between conservation as practised, and a rational and sustainable utilisation of natural resources. Caprinae are generally threatened, even in protected areas, by many factors including hunting and poaching, occupation of range by domestic animals causing degradation and loss of habitat, protection measures not being effectively implemented, lack of a wildlife-protection consciousness in many local people, protected areas lacking funds, and severe disturbance caused by other human economic activities such as mining, logging, road building, etc. The underlying reason for these threats is the large and still expanding human population, with the resulting intensification of human activities and resource demands in most areas.

Historically, economic development in western China has occurred much later than that in the eastern regions, especially on the Tibetan plateau. For this reason, Caprinae habitats are in relatively better condition in the western mountainous area than in the eastern part. However, today, even in the western regions, both development and human populations are increasing. The eastern regions are highly developed and have received tremendous pressures from human over-population for thousands of years. This has led to wildlife, including Caprinae species, being able to survive only in comparatively small populations and in small, isolated pockets of habitat.

General conservation measures taken

Establishment of protected areas and announcements of regulations for wildlife protection began in 1956 after the Third Session of the First National People's Congress. Then, starting in the mid-1960s, conservation programs were disrupted for various reasons including the Cultural Revolution. Probably in response to some of these problems, two reports ("On the Protection and Rational Utilisation of Wild Animals", and "Suggestion on the control of Exporting Rare and Precious Wild Animal with a Tentative List of 48 Species of Protected Mammals (Categories I and II)") were produced in 1962 and 1964 respectively, both of which included all species of Caprinae in China. With the economic reforms which began in 1976, conservation in China was re-initiated and has since been developing rapidly. The first 15 national nature reserves with management systems were formally established in 1976, followed by the issuing of laws and regulations by the government, adoption of the Environmental Protection Law of China in 1979, and adoption of the new Constitution in 1982 which included three articles (Articles 9, 10, and 26) concerning nature conservation. China joined IUCN and set up a WWF committee in 1980, became a contracting party of CITES the following year, and ratified the World Heritage Convention in 1985. The first Wildlife Protection Law was adopted by the National People's Congress in 1988, to which the "List of Key Species of Wildlife Protected under the State Wildlife Protection Law" is attached. Three categories of species are recognised under this law. There is a strict ban on the hunting of Class I species, except under special permit from the National Wildlife Management Authority. Hunting Class II species is limited or strictly controlled, if permitted by local provincial wildlife management authorities.

Adoption of the Environment Protection Law has provided a legitimate procedure for the establishment of protected areas. The Ministry of Forestry together with other governmental agencies, such as Agriculture, Fisheries, and the Environmental Protection Agency itself, have already set up over 600 reserves that occupy more than 2% of China's total area. In general, three types of nature reserves or protected areas were established depending on their main purpose: preservation of natural ecosystems, protection of one or more rare or endangered species, and protection of forests and individual natural features. A fourth type is the landscape area, which is mainly for tourism and for recreational purpose, is also regulated for hunting and taking of wildlife, subject to prohibition. Within all these types of protected areas, there may be further divisions according to the administration and management at either the state or local levels (Wang *et al.* 1989).

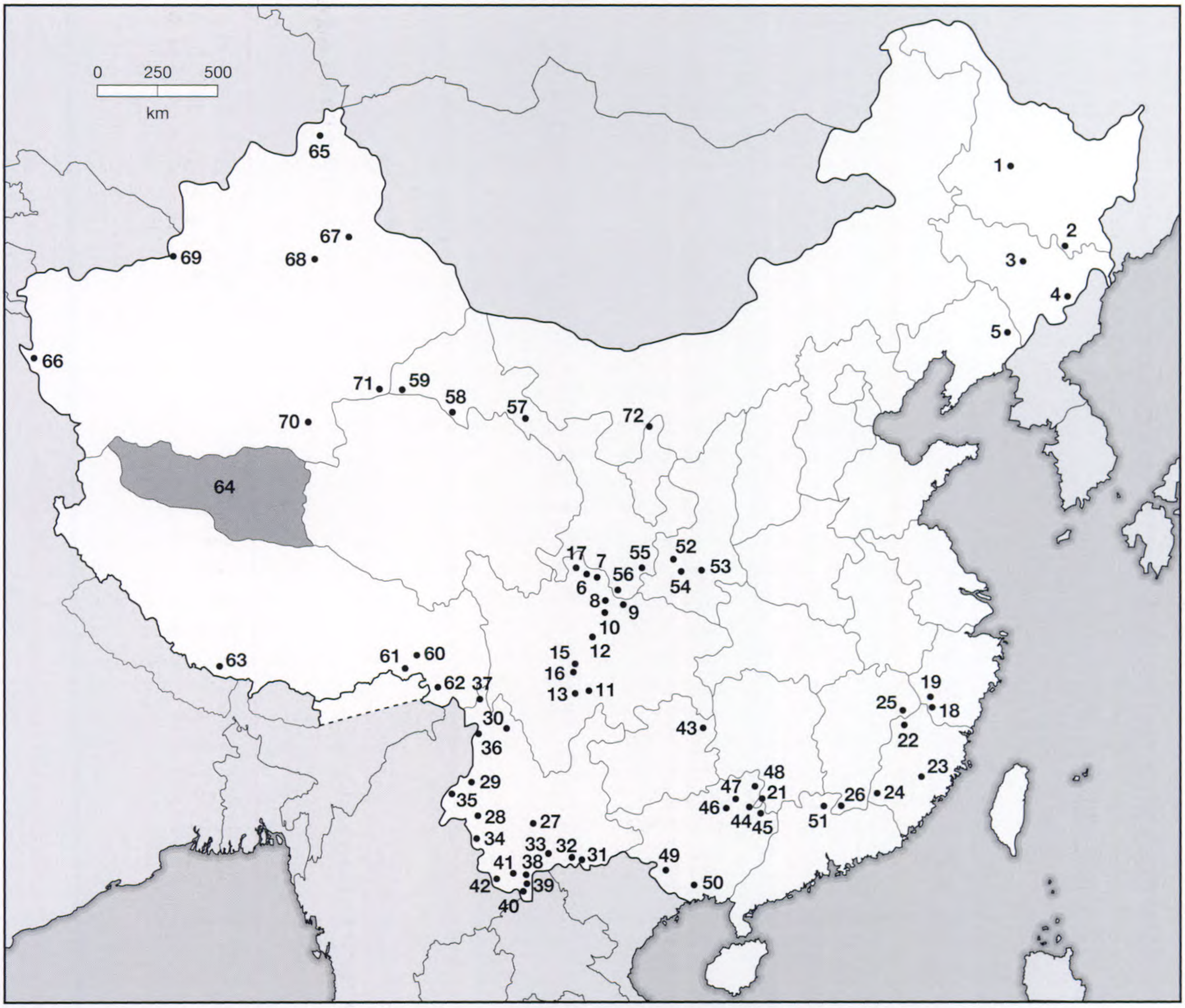
Of the 600 reserves which were to be established, >480 had been formally adopted by the government according to the National Environmental Protection Agency (Yu Xing Ping 1989). Of these, >60 are inhabited by Caprinae species, 25 of which are probably of major importance for their conservation (Table 7.1.2). Although only a small number of these reserves are primarily for the protection of Caprinae, their actual conservation value for Caprinae varies by site and by species. For instance, Taxkorgan Reserve, covering ca. 1,400,000ha of southwestern Xinjiang, is the only refuge of Marco Polo sheep in China. Here a small herd (<200 animals) exists along with around 1,000 Siberian ibex and 2,000 blue sheep. However, the activities of about 7,750 human inhabitants and their 70,000 domestic animals have caused a dramatic decrease in the value of the reserve for Caprinae conservation (Schaller *et al.* 1987; see also Wegge, 1988). A second example is the Arjin Mountain Reserve, the second largest protected area in China. This protects mainly Tibetan

Table 7.1.2. Protected areas important for Caprinae in the People's Republic of China listed by province. (ID numbers refer to Map 7.1.2)

Protected Area	Type[1]	Level[2]	Date est.	Size (ha)	Species[3]
Heilongjiang Province					
1) Taoshan	RM	L	1980	21,000	g
2) Jinpuohu	NP	L	1980	120,000	g
Jiling Province					
3) Zuojia	M	L	1982	6,625	g
4) Changbaishan	SR[b]	N	1960	190,000	g
Liaonin Province					
5) Suzihe	M	L	1987	360,000	g
Sichuan Province					
6) Jiuzhaiguo	NP	L	1978	60,000	s,g,t
7) Baihe	M	L	1963	20,000	s,g,t
8) Wanglang	M	L	1963	27,000	s,g,t
9) Tangjiahe	M	N	1986	40,000	s,g,t
10) Xiaozhaiziguo	M	L	1979	6,700	s,g,t
11) Mabian Dafengdin	M	L	1978	30,000	s,g
12) Wolong	SR[b]	N	1975	200,000	s,g,t
13) Meigu Dafengdin	M	L	1978	1,600	s,t
14) Huanglongshi	M	L	1963	40,000	g
15) Fengtongzai	M	L	1957	40,000	s,g,t
16) Labahe	M	L	1963	12,000	s,g,t
17) Tiebu	M	L	1965	23,000	s,g,t
Zhejiang Province					
18) Fenyanshan	NR	L	1975	4,667	s,g
19) Juilongshan	NR	L	1983	2,000	s,g
Hubei Province					
20) Shennongjia	RM	N	1978	77,333	s,g
Hunan Province					
21) Gaozheyuan	RM	L	1982	8,000	s,g
Fujian Province					
22) Wuyishan	SR	N	1979	56,666	s,g
23) Daiyunshan	RM	L	1985	9,731	s,g
24) Meihuashan	RM	L	1985	17,461	g
Jiangxi Province					
25) Wuyishan	RM	L	1981	5,333	s,g
26) Jiulianshan	RM	L	1981	4,067	s,g
Yunnan Province					
27) Ailaoshan	RM	L	1981	55,000	g
28) Daxueshan	RM	L	1981	15,000	g
29) Gaoligongshan	RM	L	1981	124,000	s,g,t
30) Yulonghabaxueshan	RM	L	1981	52,000	s,g,b,d?
31) Daweishan	RM	L	1981	14,000	s,g
32) Fenshuilin	RM	L	1981	13,000	s,g
33) Huangjianshan	RM	L	1981	14,000	s,g
34) Nangunhe	RM	N	1981	6,700	g
35) Tongbiguan	RM	N	1981	54,000	s,g
Yunnan Province ... continued					
36) Nujiang	RM	L	1981	22,000	t,b
37) Baimaxueshan	RM	L	1981	80,000	g,b
38) Menchan	NP	N	1981	10,807	s,g
39) Menla	SR	N	1981	73,100	s,g
40) Shangyong	RM	N	1981	20,000	s,g
41) Menyang	RM	N	1981	10,352	s,g
42) Mangoa	RM	N	1981	8,325	s,g
Guizhou Province					
43) Fenginshan	SR[b]	N	1985	38,748	s,g
Guangxi Zhuang Autonomous Region					
44) Yindinshan	RM	L	1982	21,000	s,g
45) Xilingshan	RM	L	1982	14,600	s,g
46) Shouchen	RM	L	1981	65,000	s,g
47) Huaping	SR	N	1961	21,000	s,g
48) Qianjiadong	RM	L	1982	11,000	s,g
49) Congzuo	M	L	1979	30,000	s
50) Shiwandashan	RM	L	1982	49,800	s
Guangdong Province					
51) Chebaling	RM	L	1981	5,867	s
Shaanxi Province					
52) Taibaishan	SR	N	1965	54,159	g,b,t
53) Takin Reserve	M	L	1978	16,000	s,g,t
54) Fuping	M	N	1985	35,000	s,g,t
Gansu Province					
55) Tou'ersantan	M	L	1982	31,947	s,g
56) Baishuijiang	M	N	1987	95,292	s,b,t
57) Dongdashan	RM	L	1982	4,921	a
58) Yanchiwan	RM	L	1982	42,480	b,a
59) Annanba	RM	L	1983	39,600	b,a
Xizang (Tibet) Autonomous Region					
60) Gangxiang	RM	L	1980	4,600	rg
61) Muotua	RM	L	1980	9,000	s,g,t
62) Xiaca	RM	L	1980	1,000	s
63) Qomolangma	NP	N	1989	3,448,000	s,g,ht,b,a
64) Chang Tang		N	1993	≈28,400,000	b,a
Xinjiang Autonomous Region					
65) Kanasi	RM	L	1980	250,000	i
66) Taxkorgan	RM	L	1984	1,500,000	i,b,a
67) Kalamaili	RM	L	1980	1,700,000	a
68) Tianchi	NP[b]	L	1980	38,000	i
69) Tuomu'er Top	RM	L	1980	100,000	i,a
70) Arjin Mt.	RM	N	1983	4,500,000	b,a
71) Wild Camel Reserve	RM	L	1986	1,512,500	b,a
Ninxia Huizu Autonomous Region					
72) Helan Mountains	RM	L	1982	60,970	b,a

[1] Type of protected area: M = management; NP = national park; RM = resource management; SR = scientific research; [b] Biosphere Reserve.
[2] Level: L = local; N = national.
[3] Species present: s = serow; g = goral; rg = red goral; ht = Himalayan thar; i = Asiatic ibex; b = blue sheep; d = dwarf blue sheep; a = argali; t = takin; ? = taxon suspected present.

plateau ungulates, covers a total area of ca. 4,500,000ha, and has a relatively large number of blue sheep. Despite the Reserve's size, survival of its ungulates has been threatened by the activities of people and their domestic animals (Gu 1990). Conditions have steadily worsened recently, with extensive poaching by officials and locals, as well as by the influx of thousands of goldminers. Around 10 reserves contain the majority of the world's Golden and Sichuan takin, and thus are key to these subspecies' conservation. Many other reserves are small, often only a few square kilometres, yet they contain Caprinae such as goral and serow, and therefore play a limited conservation role for these species that are widely distributed but living at very low densities.



Map 7.1.2. Locations of major protected areas with Caprinae in China (see Table 7.1.2 for further details).

***Heilongjiang Province*: 1)** Taoshan RM, **2)** Jinpuohu NP. ***Jiling Province*: 3)** Zuojia M, **4)** Changbaishan SR. ***Liaonin Province*: 5)** Suzihe M. ***Sichuan Province*: 6)** Jiuzhaiguo NP, **7)** Baihe M, **8)** Wanglang M, **9)** Tangjiahe M, **10)** Xiaozhaiziguo M, **11)** Mabian Dafengdin M, **12)** Wolong SR, **13)** Meigu Dafengdin M, **14)** Huanglongshi M, **15)** Fengtongzai M, **16)** Labahe M, **17)** Tiebu M. ***Zhejiang Province*: 18)** Fengyanshan NR, **19)** Jiulongshan NR. ***Hubei Province*: 20)** Shennongjia RM. ***Hunan Province*: 21)** Gaozheyuan RM. ***Fujian Province*: 22)** Wuyishan SR, **23)** Daiyunshan RM, **24)** Meihuashan RM. ***Jiangxi Province*: 25)** Wuyishan RM, **26)** Jiulianshan RM. ***Yunnan Province*: 27)** Ailaoshan RM, **28)** Daxueshan RM, **29)** Gaoligongshan RM, **30)** Yulonghabaxueshan RM, **31)** Daweishan RM, **32)** Fenshuilin RM, **33)** Huangjianshan RM, **34)** Nangunhe RM, **35)** Tongbiguan RM, **36)** Nujiang RM, **37)** Baimaxueshan RM, **38)** Menchan NP, **39)** Menla SR, **40)** Shangyong RM, **41)** Menyang RM, **42)** Mangoa RM. ***Guizhou Province*: 43)** Fenginshan SR. ***Guangxi Zhuang Autonomous Region*: 44)** Yindinshan RM, **45)** Xilingshan RM, **46)** Shouchen RM, **47)** Huaping SR, **48)** Qianjiadong RM, **49)** Congzuo M, **50)** Shiwandashan RM. ***Guangdong Province*: 51)** Chebaling RM. ***Shaanxi Province*: 52)** Taibaishan SR, **53)** Takin Reserve M, **54)** Fuping M. ***Gansu Province*: 55)** Tou'ersantan M, **56)** Baishuijiang M, **57)** Dongdashan RM, **58)** Yanchiwan RM, **59)** Annanba RM. ***Xizang (Tibet) Autonomous Region*: 60)** Gangxiang RM, **61)** Muotua RM, **62)** Xiaca RM, **63)** Qomolangma NP, **64)** Chang Tang. ***Xinjiang Autonomous Region*: 65)** Kanasi RM, **66)** Taxkorgan RM, **67)** Kalamaili RM, **68)** Tianchi NP, **69)** Tuomu'er Top RM, **70)** Arjin Mt. RM, **71)** Wild Camel Reserve RM. ***Ninxia Huizu Autonomous Region*: 72)** Helan Mountains RM. M = management area; NP = national park; RM = resource management area; SR = scientific research area.

The main non-government organisations concerned with Caprinae conservation include the Zoological Society of China, the Mammalogical Society of China, the Ecological Society of China, and the Wildlife Conservation Association, most of which have provincial branches. In addition, a Chinese Caprinae Specialist Group was founded in 1991. No specific programs for public awareness and education about Caprinae conservation exist, except for the issuing of a set of wild sheep and goat stamps in 1991 in conjunction with the "Year of the Sheep" in the Chinese calendar. Television has attracted people to wildlife through a special program called "Animal World". General wildlife and conservation education programs are also conducted by zoos and museums.

General conservation measures proposed

There is a constant need for biodiversity conservation and environmental management because the ever increasing human population inhabits the comparatively limited area of arable land in China. The traditional income from "Minor-harvest in the mountains" has been one of the main causes for the over-exploitation of bioresources. This has been intensified by the surplus of agricultural labourers, and has actually been encouraged by the incentives created by both legal and illegal markets.

Effective conservation of Caprinae in China must involve several different but co-ordinated conservation approaches. These would include protection of taxa and their habitats, sustainable utilisation of taxa, and public education programs. This latter need is of major importance if the other approaches are to be successful.

Protected areas are lacking for taxa such as red goral, dwarf blue sheep, and for various subspecies of argali and Siberian ibex. Clearly therefore, the protected areas so far established, do not meet the protection needs of all China's Caprinae taxa. Establishment of additional reserves for Caprinae, along with their habitats, is recommended as one of the more urgent measures in terms of their *in situ* conservation.

National and local governments should guarantee to supply the funds necessary for protected areas to function effectively, to enforce the present laws and regulations, and to generally educate the public about the need for wildlife conservation. In some areas, and for some taxa, funds may be generated for conservation, while local authorities and local people can obtain economic benefits, through carefully planned and managed sport-hunting programs, especially those directed towards foreign trophy hunters (see Stiver 1989). Such programs have already been found to be successful in some areas (e.g. selected areas in Gansu, Xinjiang, Qinghai). However, sound population data (e.g. numbers, age-sex class composition, productivity, etc.) are essential if acceptable sustainable-harvest management plans are to be developed (see **Appendix 1**). For endangered taxa, immediate steps must be taken to strengthen management of both the animals and their habitats, along with measures to strictly ban hunting, to reduce the conflicts caused by domestic animals, to enhance population monitoring, and to promote population biology studies that will provide the scientific basis for effective conservation. The role of the China Caprinae Specialists Group is to work with the IUCN Caprinae Specialist Group to implement conservation proposals and projects, to obtain international aid for important issues, and to set up any special programs that are required.

In some areas, international wildlife reserves for Caprinae and other species should be established along borders (see **7.4 Summary** following). For most Caprinae, two types of research programs are required. One would focus on obtaining census, population demography and habitat data, from which conservation management plans can be developed. The second, would review the taxonomic status of most Caprinae using the latest methods and new data, including observations of free-ranging animals in the field (see also **Chapter 12**). Additional conservation strategies for Caprinae can be suggested for each main zoogeographical region (Map 7.1.1, Table 7.1.1), based upon regional diversity in the levels of socio-economic development and biophysical characters:

I. ***Northeast China Region.*** This area has relatively more remaining forest than do other regions, but population surveys for goral are needed to develop suitable conservation plans. Because goral is a Class II species in the national wildlife protection list, it is usually treated with less attention than it deserves.

II. ***North China Region.*** Goral habitats have been largely lost since historical times. The surviving populations are small, and restricted to very fragmented refuges of unused or low-use mountain lands. Such remaining refuges require immediate identification and protection, and the protection laws must be enforced. Specific proposals for recovering populations in certain reserves must be considered, such as in Wulinshan Nature Reserve (Hebei).

III. ***Inner Mongolia-Xinjiang Region.*** The scarcity of human population in these mountain areas in or around the vast arid basin or plateau, provide relatively favourable habitats for Siberian ibex, argali, blue sheep and goral (the latter occurs only in the eastern part of this region). However, it consists of island-like environments whose vulnerable ecosystems must be protected carefully. The sometimes readily visible herds of Caprinae could lead to a misconception of abundance by administrators who lack a basic scientifically-based biological knowledge. Where populations are large and sufficiently productive, hunting seasons could be established and enforced. However, a total hunting ban for endangered taxa will be required in some areas to allow numbers to recover.

IV. ***Qinghai-Xizang Region.*** This used to be a wildlife paradise because large areas were uninhabited. However, market incentives created by the economic reforms have recently resulted in rapidly decreasing populations of argali and blue sheep, together with other wildlife. Massive expansions of livestock grazing in the formerly uninhabited hinterland, together with its inherently low carrying capacity grasslands, not only cause competition and habitat degradation, but are also accompanied by poaching. Western scholars working in this region have suggested that several nature reserves be established in Changtang, the hinterland of Xizang. In 1993, the Chang Tang Nature Reserve was designated by China. Covering ca. 28,400,000ha, it is the second largest protected area in the world (Schaller and Gu 1994).

V. ***Southwest China Region.*** Most Caprinae species occurring in China, inhabit the rather rugged mountains in this region. Although the transportation-highway system is relatively poor, Caprinae still suffer poaching and rapid habitat loss as a result of deforestation. Special efforts are necessary to enforce the protection laws in the rather inaccessible mountain environments that are settled mainly by minority groups.

VI and VII. ***Central China and South China Regions.*** The area covered by these two regions includes the greatest intensity of human activities, including agriculture and local industries. These activities place severe restrictions on land use, and so the sizes of nature reserves are usually small. Currently, the already small populations of Caprinae in these Regions are suffering because of further simplifications of their natural environment through the planting of fruit or other economic trees in mountain areas, by habitat loss, and poaching encouraged by the black market. To counter the problems in these two Regions, a total ban of hunting of goral and serow should be implemented and enforced, together with studies of population demography and distributions. After these have been accomplished, appropriate conservation management plans can be developed.

A taxonomic study to determine the status of Asiatic ibex, blue sheep and argali is warranted for conservation purposes.


J. Dolan

A captive Southwest China serow (*Capricornis sumatraensis milneedwardsii*) showing the striking long-haired neck mane of an adult male.

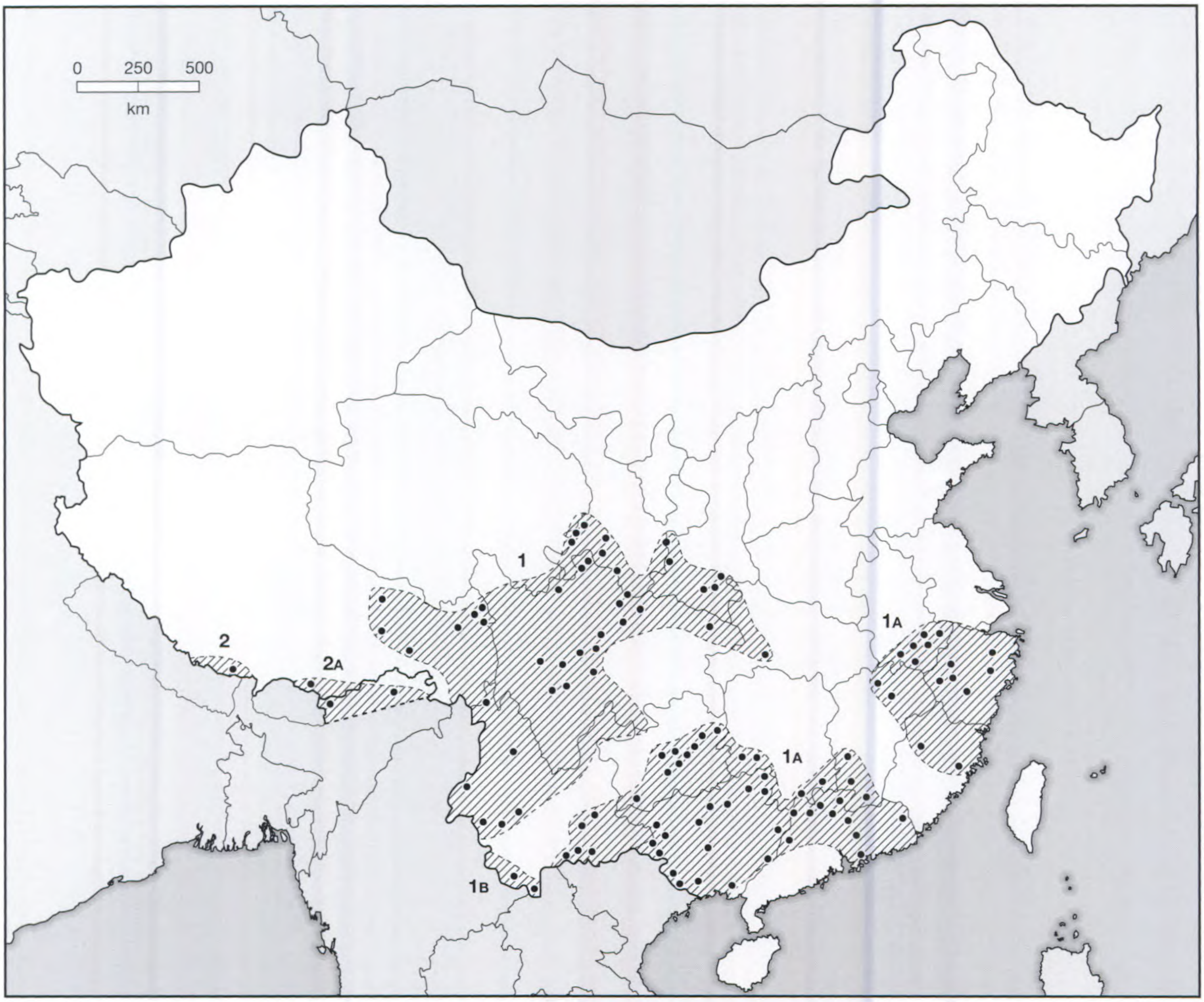
Species accounts

Over the last few decades, some information, mostly in Chinese and some in English, has been published on the ecology and population biology of Caprinae in China (e.g. Cai *et al.* 1990; Deng 1984; Feng *et al.* 1986; Gu and Gao 1991; Lin 1985; Luo and Gu 1991; Mead 1989; Neas and Hoffmann 1987; Ren and Yu 1990; Schaller 1977; Schaller *et al.* 1986; Wang 1987; Wang *et al.* 1962; Wu 1986; Wu and Niu 1981; Wu J. *et al.* 1966, 1986; Wu S. *et al.* 1990; Wu Y. *et al.* 1990; Yao 1990; Zhang C. 1987, 1988; Zhang Y. 1991; Zhen *et al.* 1989).

Specific location data (dots) shown on distribution maps presented in this report are from "The Atlas of Mammalian Distributions in China" (Zhang 1991).

Southwest China serow (*Capricornis sumatraensis milneedwardsii*)

Distribution: This serow is widely distributed through much of southern China (Map 7.1.3). The general distribution range may be taken to include all the area of the Southwest China Region from southern Gansu (= Kansu) southward through Sichuan and most of Yunnan, and beyond into Myanmar. There, it inhabits steep areas and winters in the forest belt, ascending into alpine cliffs in summer (Yao 1990). Records show a more or less continuous distribution along the ranges of the Hungduan mountain system. East of this region, the populations occurring in adjacent mountain areas of Qinling (Southern Slope), Shaanxi and Guizhou are referred to this subspecies (Zhen 1982). Probably, a few populations which exist in the northwestern Hengduan mountains of Yushu and Nangqen (Qinghai) (Li *et al.* 1989) could also be this subspecies. Serow attributed to *C. s. argyrochaetes* has a comparatively widespread distribution through western and southern Zhejiang, northern Fujian, most of Jiangxi (Shen *et al.* 1982), eastern Guizhuo (Luo *et al.* 1985), northern Guangdong, eastern and southwestern Guangxi, eastern Yunnan, where it inhabits low mountains and foothills. Populations referred to *C. s. montinus* have a comparatively narrow distribution in China, occurring mainly in the tropical rain forests of southern Yunnan. The taxon was first described in 1919 by Andrews (Allen 1945) from specimens collected around the Snow Peak of Yulong mountain, Lijiang County



Map 7.1.3. General distribution of serow (*Capricornis sumatraensis*) in China. 1) Southwest China serow (*C. s. milneedwardsii*); 1A) *argyrochaetes* [= *C. s. milneedwardsii*]; 1B) *montinus* [= *C. s. milneedwardsii*]; 2) Himalayan serow (*C. s. thar*); 2A) *jamrachi* [= *C. s. thar*]. Names in square brackets are names used in the Species accounts.

(Yunnan). It may also occur in southwestern Sichuan, as indicated by specimens from the adjacent mountains of Jijiang (Hu 1984).

Population: No total estimates of numbers have been made. Populations in the area of *argyrochaetes* are small and isolated, and its general distribution range falls within regions with relatively dense human populations which are well-exploited economic areas. Although no population estimates have been made in this area, numbers are believed to be decreasing (Dong 1988) and its distribution range is gradually being reduced.

Threats: The meat, fur and various parts of this serow are highly prized by local people for food and medicinal purposes, so it is heavily hunted. For example, each year 300 pelts are taken from Shaanxi Province alone (Zhen and Yao 1984). If hunting does not stop, the subspecies will become endangered throughout its range. In addition, it is threatened because its habitat is rapidly being lost to deforestation and land clearing. In 1962, a die-off caused by an unknown epizootic was reported in the Tangjiahe area (Qing Chuan county, Sichuan) (Hu 1984).

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and in Class II in China's list of protected species. This serow exists in many protected areas (Table 7.1.2, Map 7.1.2) including: ***Sichuan*** – Baihe, Fentongzhai, Jiuzhaiguo, Labahe, Mabian Dafengdin, Meigu Dafengdin, Tangjiahe, Tiebu, Wanglag, Wolong and Xiaozhaiziguo; ***Shaanxi*** – Tabaishan, Fuping (Wu *et al.* 1986) and Takin Reserve; ***Gansu*** – Baishuijiang and Tou'ersantan; ***Yunnan*** – Fenshuilin, Gaoligongshan, Tongbiguan, Xishuanbangnan and Yulonghabaxueshan (Lijiang and Zhongdian); ***Fujian*** – Daiyunshan and Wuyishan; ***Zhejiang*** – Fengyangshan and Jiulongshan; ***Jiangxi*** – Jiulianshan and Wuyishan; ***Guangxi*** – Congzuo Xiling, Huaping, Qianjiadong, Shouchen and Yindinshan; ***Guizhou*** – Fenginshan; ***Guangdong*** – Chebaling.

Status within country: Indeterminate.

Overall its status is Indeterminate, although populations referred to *argyrochaetes* are considered Endangered.

Conservation measures proposed: 1) Reclassify serow as Class I in the national wildlife protection list. **2)** Ban hunting and **3)** the State Commercial System should be prohibited from purchasing products of this animal. **4)** Conduct basic population surveys to determine distributions and numbers for development of conservation actions. **5)** Undertake studies of ecology, population and management problems of this serow as part of the conservation management program for the giant panda.

Himalayan or Nepalese serow (*Capricornis sumatraensis thar*)

Distribution: Occurs in the forest belt between 2,000 and 3,000m asl only in the narrow area on south slope of Qomolangma on the border with Nepal (Map 7.1.3). Identification of this subspecies in China is based on an imperfect specimen collected at Zhangmo, the border area of Xizang, about 60km to the northeast of Kathmandu, Nepal. Observations of serow running across highways are not infrequent (Feng *et al.* 1986). The population found in the narrow area east of the "Big Turning Point of Yarlung Zangbo river", where it inhabits sub-alpine forests (Feng *et al.* 1986), is referred to *C. s. jamrachi*. Identification of this taxon, which is mainly distributed in Darjeeling area (Feng *et al.* 1986), is based on a specimen obtained from Pugiongshan in Medog county in Xizang.

Population: No estimates of population size or trends have been made, but the *jamrachi* population is believed to be small (Feng *et al.* 1986).

Threats: The main threat is probably hunting.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and in Class II in China's listed of protected species. Two reserves have been established in Xiaca and Muotuo, and it should occur in the international protected area, the Qomolangma Nature Reserve, on the Sino-Nepal border (Table 7.1.2, Map 7.1.2).

Status within country: Indeterminate.

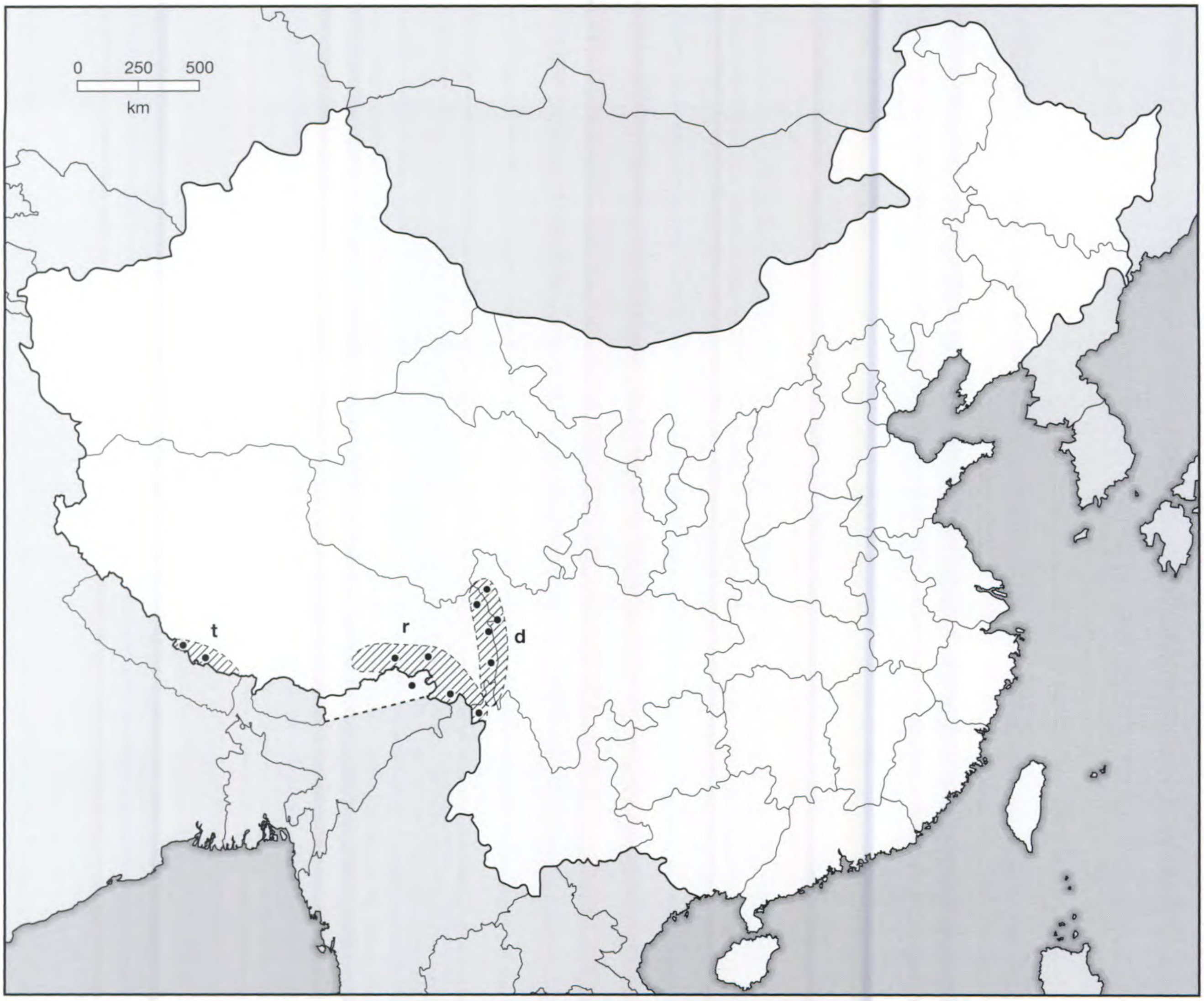
Conservation measures proposed: 1) Undertake censuses to determine population status and distribution, including surveys in the Chun-pi valley. **2)** Examine the taxonomic status of *C. s. jamrachi* in relation to *C. s. thar*.

Red goral (*Naemorhedus baileyi baileyi*)

Distribution: This species, sometimes referred to as *N. cranbrooki* in China, has a narrow distribution, and inhabits the largest remaining native coniferous forests up to 4,000m asl in the eastern Himalaya of southeastern Tibet (Xizang). According to summer surveys carried out in this region from 1987 to 1988 (Zhang 1987, 1991), the distribution area is between about 27° to 29°30'N and 96° to 98°E, in four prefectures (Boni, Nying, Mainling and Medog) (Zhang 1987) (Map 7.1.4). This current range in

Red goral (*Naemorhedus baileyi baileyi*) is found only in a restricted area of Tibet (China), northern Mynamar, and Assam (India). Shanghai Zoo, China.

R. Wirth



Map 7.1.4. General distribution of r) red goral (*Naemorhedus baileyi baileyi*), t) Himalayan tahr (*Hemitragus jemlahicus*), and d) dwarf blue sheep (*Pseudois schaeferi*), in China.

southeastern Tibet is believed to be reduced considerably and is now confined to an area of <8,000km² in Tongmai (Bomi), Dongjiu, Pelung, and Bayu (Linzhi) and Medog, around the junction of the Pelung Zangbo and Yarlung Zangbo rivers (Feng *et al.* 1986; Zhang 1987, 1991). This goral is also known to occur in Gongshan county, southeastern Yunnan (Lu 1987).

Population: Random sampling during summer field studies from 1987 to 1988 provided some information on the red goral population in Xizang (Zhang 1991). Total numbers were estimated to be 810 to 1,370 individuals, distributed as follows: 120 to 180 for Linzhi, 60 to 220 for Bomi, 320 to 380 for Zayu, 220 to 450 Medog, and 90 to 140 for Mainling (Zhang 1991).

Threats: Hunting and habitat loss caused by rapid forestry expansion, are the major threats. Since the opening up of and the economic reforms in Tibet, hunting has had a major negative impact on the population of red goral. This is due primarily to the increasing number of immigrants and modern hunting weapons. It was said that in the three provinces of Pelung, Dingjiu and Bayu in the Linzhi county, only about 150 individuals of this species had been hunted annually before the early 1980s. Although a hunting ban was in effect over the last five years, poaching is still common and takes place most often when animals move down to their winter ranges (Zhang 1991).

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and as a Class I Protected Species in China. Legally it received total protection in 1987 (Zhang 1991). It is known in at least four protected areas, all in Tibet: Gangxiang, Muotuo, Xiaca (Table

7.1.2, Map 7.1.2) and Medoq. A small herd has been breeding successfully in Shang Hai Zoo.

Status within country: Endangered.

Conservation measures proposed: 1) Enforce the existing protection laws for this species. **2)** Establish the proposed protected areas for this species that have not yet been acted on by the government of Tibet Autonomous Region (TAR). These are: **a)** an area of 200km diameter, with its centre at "big turning point of Yarlung Zangbo Jiang" (Zhang 1987); and **b)** an "International Mountain Research Centre" in Yegon county with eight nature reserves in the area surrounding Nanjabarva Peak (Mountaineering and Scientific Expedition, Chinese Academy of Sciences 1985). These reserves would include parts of the four counties mentioned above, and contain the core range of red goral, an area that is relatively pristine and has a widespread, complex mountain ecosystem plus a diverse fauna and flora. Obviously efforts should be made to encourage the Government of TAR to make a decision and then to organise the necessary surveys for these proposal's.

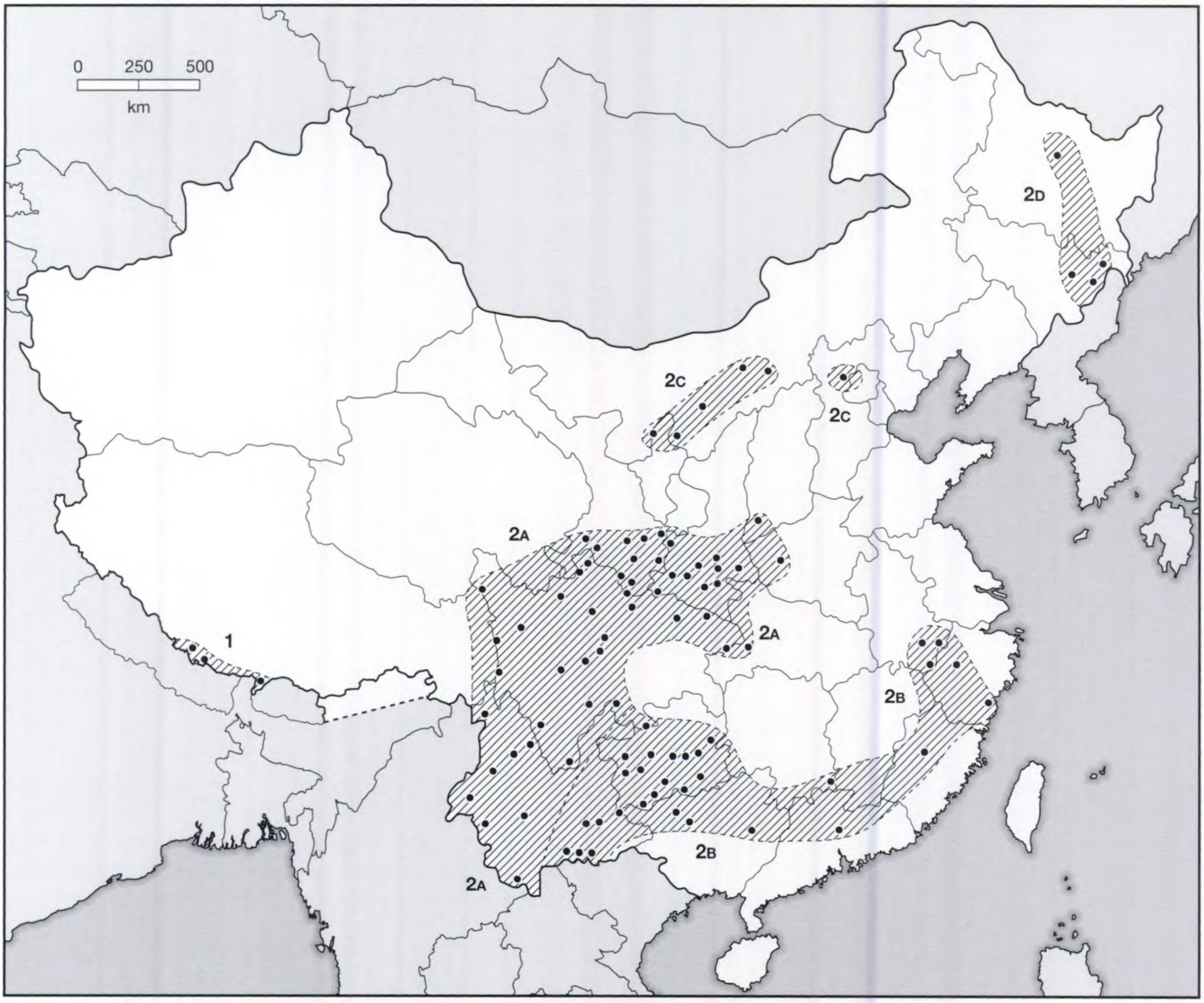
Long-tailed goral (*Naemorhedus caudatus*)

Distribution: Grey long-tailed goral (*Naemorhedus caudatus griseus*) is a widespread species found throughout southern, southeastern and parts of northeastern China (Map 7.1.5). The distribution area begins in the highlands on the eastern margin of the Tibet plateau, corresponding to the Southwest China Region. There, it inhabits steep areas and plateaux. Its habitats include subtropical mixed forests, evergreen-deciduous forests (Feng *et al.* 1986) in southeastern Tibet, southeastern Qinghai, southern Gansu and Shaanxi, western Sichuan, western Hubei, and western Yunnan. It also occurs in the adjacent mountain ranges of Defan and Weining in northwestern Guizhou (Luo *et al.* 1985), and in Guinan in eastern Qinghai (Li *et al.* 1989). Populations in this part of the distribution area are referred to *N. goral griseus* in China. Goral in the next part of the distribution area, in the Central China Region, are referred in China to *N. goral arnouxianus*. Here, isolated populations are scattered through the subtropical deciduous forests of the low mountains and hills of southern Shaanxi (Shenxi), southern Anhui, south of Zhejiang and north of Fujian, in eastern Jiangxi, Hubei, Hunan to the northern part of Guangdon and most parts of Guizhou and eastern Guangxi (Luo *et al.* 1985). In these areas the human population is relatively dense. In recent years, goral has neither been found nor hunted in Zhejiang and Anhui, and is probably severely threatened (Dong 1988; Wang 1990). Populations in a second distribution area belong to *N. c. caudatus*, sometimes referred to *N. g. caudatus* in China. This area extends from the Helan mountains (Ningxia) to include the Luliang and Heng mountain ranges of northern Shanxi, and the Daqinshan north of Hohhot (Inner Mongolia), and east as far as the mountain regions of north Hebei (north and west of Beijing) and the Taiyue mountains south of Yuci (Shanxi). The last area of goral distribution in China is in the northeast, and stretches along the Xiao Hinggan Ling mountains (Lesser Khingan range), along the lower reaches of Sungari and Amur rivers in eastern Jilin and Heilong Jiang, and eastern Liaonin, and includes the Changbaishan range (Jilin) on the border with North Korea (Map 7.1.5). The goral in this area is referred by some authorities to the Amur or Korean goral (*N. caudatus raddeanus*), although most Chinese authors consider it to be *N. g. caudatus*.

Population: No estimate of total population size has been made, but in the western part of its distribution numbers are believed to be declining.

Threats: The decline in numbers is believed to be due to overhunting, and goral are frequently hunted or snared by the local people for meat, fur and medicines. Between 1,200 to 1,300 pelts are harvested each year in Shaanxi Province alone (Zhen 1984). Besides hunting, deforestation for logging and cultivation is the other main threat. Not only does this reduce habitats but it also causes fragmentation of goral habitat. This is especially true in the region surrounding the great lake basins along the Changjiang river. The populations in Shanxi, Hebei and Inner Mongolia are probably Endangered, and goral are rarely seen in most of the mountains in the North China Region.

Conservation measures taken: Long-tailed goral is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and as a Class II protected species in China. Protection is not very effective because local people are mostly ignorant of the egislation. It is believed to occur in many protected areas (Table 7.1.2, Map 7.1.2) including: ***Fujian*** – Daiyunshan and Meihuashan; ***Gansu*** – Baishuijiang and Tuo'ersantan; ***Guangxi*** – Huaping, Qianjiadong, Shouchen, Xilingshan and Yindinshan; ***Guizhou*** – Fenginshan; ***Hubei*** – Shennongjia; ***Hunan*** – Gaozheyuan; ***Jiangxi*** – Jiulianshan and Wuyishan; ***Shaanxi*** – Fuping (Wu *et al.* 1986), and Taibaishan; ***Sichuan*** – Baihe, Fentongzhai, Huanglongshi, Jiuzhaiguo, Labahe, Mabian Dafengdin, Tangjiahe, Teibu, Wanglong, Wolong, and Xiaozhaiguo; ***Xizang*** – Muotuo and Xiaca; ***Yunnan*** – Ailaoshan, Baimaxueshan, Daweishan, Daxueshan, Fenshuilin, Gaoligongshan, Huangjianshan, Mangoa, Menchan, Menla, Menyang, Nangunhe, Shangyong, Tongbiguan, and Yulonghabaxueshan; ***Zheijiang*** – Fengyangshan and Jiulongshan. The Wulingshan Nature Reserve, established in 1983 by Hebei Provincial



Map 7.1.5. General distributions of Himalayan (*Naemorhedus goral goral*) and long-tailed (*N. caudatus*) gorals in China. **1)** *N. g. goral* (sometimes referred to *N. g. hodgsoni* in China); **2)** *N. caudatus*; **2A)** *N. goral griseus* [= *N. c. griseus*); **2B)** *N. goral arnouxianus* [= *N. c. griseus*]; **2c)** *N. goral caudatus* [= *N. c. caudatus*]; and **2D)** *N. goral caudatus* [= *N. c. raddeanus*]. Names in square brackets are names used in the **Species accounts.**

Government and located to the west of Beijing, is for the full protection of several wildlife species, including goral. It may also occur in most of the nature reserves located within its range in the North China and the Northeast China Regions. These include Taoshan and Jinpuohu (Heilongjiang); Chanbaishan and Zuojia (Jilin); and Suzihe (Liaonin).

Status within country: Indeterminate.

Conservation measures proposed: 1) Adopt a strict ban on hunting. **2)** Carry out surveys to determine population status. **3)** At the same time as the surveys, ascertain if the species does survive in the nature reserves listed, and in the surrounding areas. **4)** Following these steps, further conservation actions can be proposed.

Eastern Himalayan goral (*Naemorhedus goral goral*)

Distribution: This subspecies, also referred to *N. goral hodgsoni* in China, has a narrow distribution zone that is located in the border area of Tibet (Map 7.1.5). Specimens have been collected from Cuona, Gyirong (Zongga) and Zhangmo.

Population: No estimate of population size available, but numbers are thought to be small (Fen *et al.* 1986).

Threats: Hunting is probably the main threat to its survival, however, the extent is unknown. It may be limited due to the predominant religious beliefs, which are against hunting wildlife, belonging to the local Tibetan people who live in a rather inaccessible mountain society.

Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Listed as a Class II protected species in China and in Appendix I of CITES. It receives protection in the Qomolangma Nature Reserve on the border with Nepal (Table 7.1.2, Map 7.1.2).

Status within country: Indeterminate.

Conservation measures proposed: 1) Determine status and distribution before **2)** developing a detailed conservation strategy.

Tibetan blue sheep (*Pseudois nayaur nayaur*)

Distribution: Formerly abundant (Schaller *et al.* 1987, 1988a), but now much restricted throughout most of its range (Feng *et al.* 1986). Distribution runs from western Tibet, where there are small populations in the mountains bordering the western edge of Aru Co, extending eastwards with scarce, scattered populations north of Siling Co in north-central Tibet (Schaller 1988), to its most easterly record to date occurring around Jiangda, west of Jinsha river. The animals occurring to the north of Xizang in Kunlun-Altun and Pamir could be treated as this subspecies until further work is undertaken (Map 7.1.6). The eastern limit of this subspecies distribution has not been determined (see also *P. n. szechuanensis* below).

Population: Thought to be widespread and relatively plentiful in northern Tibet and the uninhabited areas inland of the Kunlun mountains. Also considered relatively abundant in the Taxkorgan Reserve (Xinjiang) at the junction of the western Kunlun Shan, the Karakoram and the Pamir (Qian *et al.* 1965; Schaller *et al.* 1988b), and in three mountain regions surveyed in Qinghai Province (Schaller *et al.* 1988a). However, no confirmed estimates of population size are available. The following estimates of population density and total numbers have been reported: Altun Nature Reserve (Xinjiang) – 4.5 animals/km^2 (Gu 1990); Mariang, Taxkorgan Nature Reserve (Xinjiang) – 2.5/km^2, total of 260 in 120km^2 (Schaller *et al.* 1987); Raskan, Taxkorgan Nature Reserve (Xinjiang) – 0.2/km^2, total 31/150km^2 (Schaller *et al.* 1987); Jianggelesayi (Altun mountain) – 2.6/km^2, total 50/19km^2 (Luo and Gu 1991); Tatieksu (Altun mountain) – 9.4/km^2, total 307/32.2km^2 (Luo and Gu 1991). Extrapolating from local censused areas to other, larger areas of generally similar habitat, rough estimates for the following populations have been made: 3,948 in 703km^2 of the western part of Altun mountains (Luo and Gu 1991); 8,000 on the northern Tibet plateau within Xinjiang (Gu and Gao 1991); and 10,000 Altun (Arjin) Nature Reserve, Xinjiang (Gu 1990). It is hard to evaluate figures derived from such extrapolations, and in some specific areas the figures are believed to be significantly overestimated (Achuff and Petocz 1988).

Threats: The general picture of the populations of blue sheep given above probably indicates their classification as Class II species in the national protection list is correct. However, uncontrolled hunting in most areas, including some nature reserves where people live, are major threats to the species. According to purchase records of wild ungulate pelts from the areas on northern flank of the Kunlun Shan in Hotan region (Xinjiang), between 1958 to 1982 the total number of ungulates killed was 44,700. More than the half of them were blue sheep, the remainder included *Capra sibirica*, *Gazella subgutturosa*, *Procapra picticaudata*, *Panthalops hodgsoni* and *Ovis ammon* (Luo and Gu 1991).

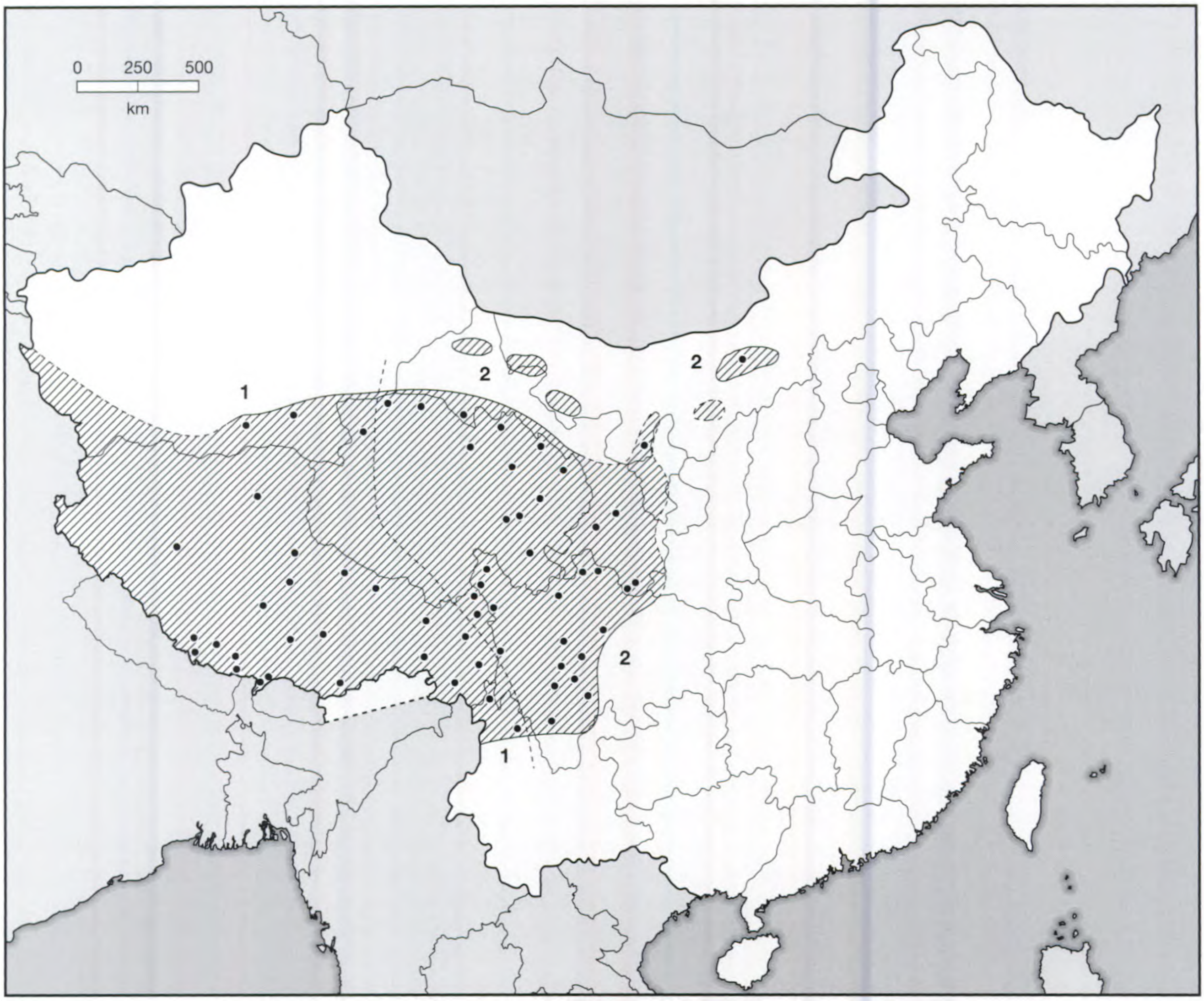
Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Listed as a Class II species means that hunting is allowed only under permit from the Bureau of Forestry Department. These animals are found in several protected areas (Table 7.1.2, Map 7.1.2) including the Chang Tang Nature Reserve (Schaller and Gu 1994), Medoq, Qomolangma and Zayu Reserves (Tibet); the Arjin Mountain Reserve (Achuff and Petocz, 1988; Butler *et al.* 1986; Gu 1990) and Taxkorgan Reserve (Schaller 1977) (Xinjiang); and the Yanchiwan Nature Reserve (western Gansu). The Dulon International Hunting Area was established in 1986, and involves local people as guides, cooks, guards etc., with the result that illegal hunting has been reduced in the area (Zheng 1991).

Status within country: Not threatened.

Conservation measures proposed: 1) Make systematic surveys and censuses along with studies of population dynamics, especially if hunting programs are to be considered. **2)** Control domestic animal numbers within protected areas, and **3)** promote the function of reserves. **4)** Outside such areas, consider protection through sustainable use such that local people gain measurable benefits. At present, trophy hunting for this subspecies has been designated for north slope of Arjin mountain outside the reserve (Luo and Gu 1991).

Sichuan blue sheep (*Pseudois nayaur szechuanensis*)

Distribution: The western limits of this subspecies have not been satisfactorily determined. Possibly it begins on the eastern side of the Tibetan plateau, and runs east to include most of Qinghai, the Hungduan mountains of western Sichuan (Shi and Zhao 1989), south as far as



Map 7.1.6. General distribution of blue sheep (*Pseudois nayaur*) in China. **1)** *P. n. nayaur*; **2)** *P. n. szechuanensis*.

Yunlong in northern Yunnan (Liu *et al.* 1984;), Gansu's Qilian mountains (Zhang and Wang 1964; Zhen *et al.* 1989), north-eastward along the loess plateau and mountain ranges (Zhen *et al.* 1989), northwestern Ningxia, southern Inner Mongolia (Li *et al.* 1989; Hu *et al.* 1984), and some isolated areas in the Daqinshan (Shuo 1962) (Map 7.1.6).

Population: No estimates of total population size are available. The density in part of Yanchiwan Nature Reserve (Gansu) was estimated at 3.3/km^2 (Zhen *et al.* 1989). A study carried out in Yushu and Golog counted 2,594 individuals in a sampling area of 760km^2 (overall density of 3.4/km^2). A total of 144 groups comprised of 4,470 individuals were observed in the whole region studied in 1986 and 1988 in Yushu and Golog, southeastern Qinghai (Ren and Yu 1990). Around 1,210,000 individuals were estimated by extrapolation in Qinghai in 1962, of which, 267,000 were in the eastern part. In 1972, 92,000 individuals were surveyed in the western part. Populations are often fragmented and scattered.

Threats: Between 1958 and 1989, 100,000 to 200,000kg of blue sheep meat were exported each year from Qinghai, mostly to West Germany. This represented approximately 5,000 to 10,000 blue sheep shot annually for export. These were in addition to those taken by local hunters. Not surprisingly this level of harvesting has eliminated the subspecies from various ranges, and together with uncontrolled hunting, has greatly reduced populations (Schaller 1988; Schaller *et al.* 1988a). Market hunting was banned in 1989.

Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Placed in Class II in the national protection list, and occurs in several nature reserves including: Baishujiang

(Gansu); Menda (Qinghai); Fengtongzai, Huanglongshi, Labahe, Mabian Dafengding and Tiebu (Sichuan); Baimaxueshan and Nujiang (Yunnan); and Helan mountains (Ningxia) (Table 7.1.2, Map 7.1.2).

Status within country: Insufficiently Known.

Conservation measures proposed: 1) Determine the status, distribution and population productivity to aid development of conservation plans, and certainly before any further hunting is allowed. **2)** Ban hunting until these data are obtained.

Dwarf blue sheep (*Pseudois [nayaur] schaeferi*)

Distribution: Its range is restricted to a narrow area along the Jingshajiang (Golden Sand river) Valley, which forms part of the upper reaches of the Changjiang (Yangtse) river (Map 7.1.4). Specimens have been collected from Batang (Sichuan), and confirmed in Baiyu, to the north of Batang (Cai *et al.* 1990). Local hunters claim it is found in Derong (south-western Sichuan), in Deqen (north-western Yunnan), and in Markam (eastern Xizang); areas that are all to the west and south of Batang (Wu *et al.* 1990).

Population: No population estimate, but local hunters report numbers have declined drastically in recent years, with previously observed group size ranges of 10 to 36 having dropped to three to eight animals recently. Density estimates also suggest low numbers with only 0.5 to 1.0 sheep/km^2 (Wu *et al.* 1990).

Threats: Hunting is a major threat to these animals, and if effective protection measures are not adopted quickly, the taxon will disappear in the near future.

Conservation measures taken: Listed as Endangered (A2d,B1+2e) in the 1996 IUCN Red List of Threatened Animals (Groombridge 1993). There is no formal legislation for its protection in China because when the national protection list was established, this species was considered to be *P. nayaur* and placed in Class II. Since dwarf blue sheep was recognised as a separate species, a concerted effort has been made by scientists temporarily working in the area to educate local hunters. The species does receive protection from local people in Baiyu (Sichuan) because of their religious beliefs (Cai *et al.* 1990).

Status within country: Endangered.

Conservation measures proposed: 1) Re-assess its taxonomic status. **2)** If it proves to be a separate species, dwarf blue sheep should be raised to a Class I species in the national protection list. **3)** Protected areas need to be established. Reserves at Batang, or in adjacent areas where the population is still relatively abundant, have been suggested (Wu *et al.* 1990). **4)** At the same time, surveys are essential to determine status and total distribution throughout its suspected range.

Himalayan tahr (*Hemitragus jemlahicus*)

Distribution: Tahr appears to be restricted to a relatively small area (Map 7.1.4) near the Qubuo (Boqu) river Valley in Quxiang area, (Qomolangma region) Zhangmo, Tibet (Xizang), on the southern slope of the Himalaya (Beijing Natural History Museum 1977).

Population: There are no estimates of numbers, but the population is thought to be small, and only a few have been observed in the field (Feng *et al.* 1986).

Threats: Uncontrolled hunting and deforestation.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and as a Category I species in China. It occurs in Qomolangma Nature Reserve on the Sino-Nepal border.

Status within country: Endangered.

Conservation measures proposed: 1) Undertake a survey and census to determine the species' distribution and status. **2)** Strictly forbid hunting immediately.

Asiatic ibex (*Capra [ibex] sibirica*)

Distribution: Siberian ibex is found primarily in the mountains surrounding Xinjiang, but also in those of northern Gansu, Inner Mongolia, and extreme northwestern Tibet (Map 7.1.7). Populations referred to *C. s. alaiana* are relatively widespread in western Xinjiang in the mountains around the Dzhungarian basin including the mountains along the border with Kazakhstan from south of the Ertix river, through the Kok Shaal Tau mountains along the border with Kirgizstan and into the Pamir along the border with Tadjikistan, Afghanistan and Pakistan, and also throughout the Tien Shan ranges on the southern edge of the basin. Ibex attributed to *C. s. dementievi* are limited to the Kunlun mountains east of the Yarkant river (76°E). Populations considered to be *C. s. hagenbeckii* occur along the Sino-Mongolia border in the Baytik mountains (Xinjiang), in the Bei mountains (Gansu), and as far east as the Daqinshan of central Inner Mongolia (Xin and Yang 1982). Those referred to *C. s. sibirica* are restricted to the Altai mountains in northern Xinjiang, along China's borders with Mongolia, Kazakhstan and Russia.

Map 7.1.7. General distribution of Asiatic ibex (*Capra [ibex] sibirica*) in China. 1) *sibirica*; 2) *hagenbeckii*; 3) *alaiana*; 4) *dementievi.*

Population: No overall population estimate. In recent years, the population referred to *alaiana* in the Tien Shan was roughly estimated to be between 40,000 and 50,000 individuals. Densities in other areas are relatively low. Rough estimates of ibex numbers in the Bei mountains are between 3,000 and 4,000 individuals. The species has almost disappeared in the Daqin mountains range. According to a survey by Wang (1983), the density in the low mountain belt of the Altai is around 0.13 ibex/km^2 and the population size is small.

Threats: Previously in Kunlun mountains and in Gansu, it was well protected by the restricted border zone, but in the 1980s, the habitat became the winter grazing pastures of domestic livestock, and this, together with poaching and habitat degradation, have become serious threats to the ibex. Populations in the Qiling mountains in northern Qinghai, disappeared before the 1960s, due primarily to overhunting (Zhang and Wang 1964). Throughout its range, ibex is threatened by poaching, mainly because like other mountain ungulates, it has traditionally been an important supplementary food for local people. Poaching also occurs in some areas by military personnel, road maintenance workers, and others, especially in areas accessible by vehicle (Schaller *et al.* 1987). Additional threats to ibex include competition with livestock for food and habitat, and in some areas by predators. As a result of these threats, many populations have declined significantly, especially in regions with dense human populations.

Conservation measures taken: Listed as Class I in the Wildlife Protection Law of China. Asiatic ibex occurs in at least five protected areas (Table 7.1.2, Map 7.1.2) including:

Xinjiang – Altun (Arjin), Kanasi (Altai mountains), Tuomur Feng and Bogeda Feng (Tien Shan); ***Xizang*** – Taxkorgan and possibly in northwest Chang Tang Nature. It is supposed to occur in Arjin Mountains Nature Reserve (Xinjiang), but no living animals were observed in recent surveys (Achuff and Petocz 1988; Butler *et al.* 1986; Gu 1990).

Status within country: Indeterminate.

Threatened in most areas except perhaps in the Tien Shan. In the rest of the Xinjiang ibex population can be considered Indeterminate, and Endangered in the Altai mountains where poaching is the main threat. Its status is probably Vulnerable in Kunlun mountains, and in Gansu. Populations in the northwest and south to the Pamir, as well as in the Kunlun mountains are considered Vulnerable.

Conservation measures proposed: 1) Determine the status of populations throughout their distribution in China. **2)** Provide total protection in some areas (e.g. in the Altai). **3)** Consider others for development of managed, sustainable trophy hunting programs. These latter programs may be useful where ibex numbers are sufficiently abundant, and where removal or reduction of livestock are advised, local people should be provided with compensation. **4)** In Gansu, move livestock away from the border, **5)** create a reserve to join up with the Great Gobi Reserve in Mongolia, not only to protect ibex but also kiang, argali, gazelle, saiga and snow leopard, amongst other species.

Adult male Siberian ibex (*Capra* [*ibex*] *sibirica*) in Halle Zoological Garden, Germany.

L. Baumgarten (WWF)

Altai argali (*Ovis ammon ammon*)

Distribution: The Altai argali is restricted to the low mountains and foothills of the Altai mountains around Qinghe in northern Xinjiang along the border with Mongolia (Map 7.1.8).

Population: Densities have been estimated to be very low within only 0.06 argali/km^2 (Wang 1983), and the total population extrapolated from this density is only several hundred.

Threats: The subspecies has a very restricted distribution in China but its range is an extension of the populations in Mongolia (see **7.3 Mongolia**). Poaching is its main threat in China.

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, as a Class II species in China, as "Endangered" in the U.S. Endangered Species Act of 1973, and included in import restrictions of the European Union. Found in no protected area, but does receive some protection because it occurs in the restricted area along the border with Mongolia.

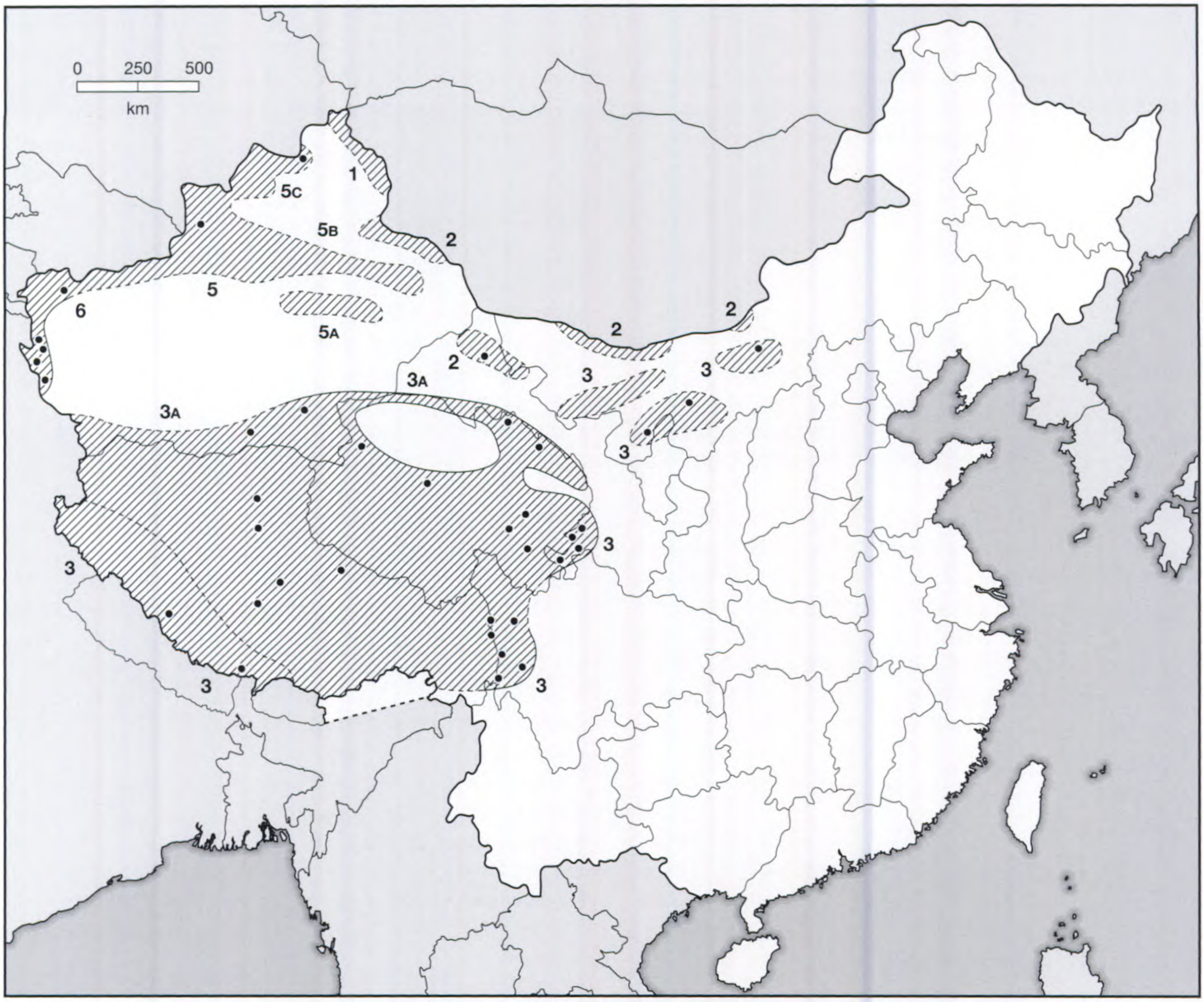
Status within country: Endangered

Conservation measures proposed: 1) Determine its status and distribution more clearly, and then **2)** establish a joint Sino-Mongolian protected area.

Gobi argali (*Ovis ammon darwini*)

Distribution: This subspecies has a discontinuous distribution in the mountain regions of northern Xinjiang, northwestern Gansu, and Inner Mongolia (Map 7.1.8). Its range begins east of the Dzhungarian basin (Xinjiang), northeast of Jiangjunmiao, and runs through the Haputikeshan and Suhaitushan of the Baytik mountains along the border with Mongolia. It extends into the Mazongshan in the Bei mountains (Gansu), and into Inner Mongolia in the Yinshan as far as the Daqinshan range.

Population: The total population is estimated between 2,100 and 2,800 animals. Of these, 1,500 to 2,000 occur in



Map 7.1.8. General distribution of argali (*Ovis ammon*) in China. **1)** *O. a. ammon*; **2)** *O. a. darwini*; **3)** *O. a. hodgsonii*; **3A)** *dalai-lamae* [= *O. a. hodgsonii*]; **4)** *O. a. jubata*; **5)** *O. a. karelini*; **5A)** *adametzi* [= *O. a. karelini*]; **5B)** *littledalei* [= *O. a. karelini*]; **5C)** *sairensis* [= *O. a. karelini*]; **6)** *O. a. polii.* Names in square brackets are names used in the **Species accounts.**

Xinjiang, 200 to 300 in the Bei mountains (Gansu), 300 to 400 in Equnaqi (Inner Mongolia), and only 24 in the Daqin mountains (Inner Mongolia).

Threats: In areas away from border regions, habitat disturbance, poaching and competition with domestic livestock, especially for water, are the main threats. This is true especially around the Kalamaili mountains (Xinjiang) and Daqinshan (Inner Mongolia), with the result that numbers have been severely reduced.

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, as a Class II species in China, as "Endangered" in the U.S. Endangered Species Act of 1973, and banned from import by the European Union. Limited protection provided in Kalamaili Reserve (Table 7.1.2, Map 7.1.2).

Status within country: Endangered.

Conservation measures proposed: 1) Remove domestic livestock from the border zone to reduce competition. **2)** Establish a reserve in China corresponding to the Great Gobi Reserve of Mongolia (see also measures proposed for *Capra sibirica* above).

Tibetan argali (*Ovis ammon hodgsonii*)

Distribution: Probably the most widespread argali in China, it occurs across most of the Tibetan plateau (Map 7.1.8).

However, large areas south of the Yarlung Zangpo river (Tibet), in the Gangdise Shan to the Aling-Nganglong Kangri mountains in southwestern Tibet have either extremely low densities or no animals at all. It is also scattered through the Kunlun Shan and Arjin mountains (southern Xinjiang), in most of Qinghai except the Qaidam (Chaidamu) basin, and in the Qilianshan (south-central Gansu) as far east as the Shalulishan range of western Sichuan. The argali found along the northern edge of the Arjin Shan range is sometimes referred to *O. a. dalaie-lamae*.

Population: The total population has been roughly estimated at between 29,000 and 36,000 individuals based on extrapolation from the following limited, and often very low, density estimates. The density on Kunlun mountain, Arjin mountain and Aljin Reserve was estimated to be 0.014 animals/km^2 (Ren *et al.* 1987) and based on this, the population in Xinjiang was projected to be 6,000 to 8,000 animals. However, a 1992 survey in the Aljin mountains estimated 16,000 to 23,000 for an area of 30,000km^2 (Gu and Luo-Nin, in press). From Ali Kekexili districts to Shuanghu in western Tibet, densities are even lower and the population believed to number 6,000 to 7,000 animals. This probably represents 75% of the whole Tibetan population. For Gansu, where this argali is concentrated on the western part of the Qilianshan, the density is estimated at 0.5 argali/km^2 and the total population at around 3,000 individuals. In Qinghai, it is found mainly in the northwest and southwest, and on Bulieganbudai mountain to the south, and is estimated to total around 2,000 sheep. Finally, in western Sichuan, a rough estimate is around 1,000 individuals, and no more than 1,000 are believed to remain south of the Yarlung Zangpo river (Tibet) (Gu *et al.* 1991). [Ed. note – Due to the difficulties of field surveys, the relatively small number of density estimates with high variance (see Zheng and Zhu 1990), and the vast areas over which they are extrapolated, the preceding numbers are probably significant over-estimates.]

Threats: Although total numbers appear high, densities are extremely low and populations are scattered throughout the distribution area. Consequently, local populations can be easily decimated by factors such as poaching, habitat loss, and competition with livestock. In fact, unless this argali is protected soon, it will probably disappear from most steppe regions in Qinghai (Schaller 1988) and other areas.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, as a Class II species in China, and as "Endangered" in the U.S. Endangered Species Act of 1973. Imports are banned by the European Union.

Known in the following protected areas: Arjin Mountain Reserve (Xinjiang); Qomolangma Reserve and the Chang Tang Nature Reserve (Tibet) (Schaller and Gu 1994); and Annanba, Dongdashan, Xiaosuganhu and Yanchiwan Reserves (Gansu) (Table 7.1.2, Map 7.1.2). In the 1980s, a trophy hunting program for foreign hunters was established in Gansu. Around 10 animals are harvested each year. Censuses suggest that as a result of increased management and protection associated with this program, argali numbers in the area increased. A trophy hunting program for foreign hunters has been developed for the Aljin mountains (Gu and Luo-Nin, in press), but has not yet been implemented.

Status within country: Indeterminate.

Conservation measures proposed: **1)** Undertake, immediately, more surveys and censuses throughout the range to more accurately determine its status. **2)** Develop more effective control of poaching. **3)** If suitable populations are identified in surveys, sustainable management plans could be developed for hunting areas. **4)** Determine the taxonomic status of *O. a. dalaie-lamae*.

Shansi or Northern Chinese argali (*Ovis ammon jubata*)

Distribution: Found from the Yabraishan, Langshan and Daqin Shan ranges of Inner Mongolia, and in the Helan Shan on the border of Inner Mongolia and Ninxia (Map 7.1.8). It no longer exists in the Hen Shan of Shaanxi.

Population: A total of 600 to 700 animals was estimated to remain in Inner Mongolia in the 1980s.

Threats: Poaching.

Conservation measures taken: Listed as Endangered (C1+2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, as a Class II species in China, as "Endangered" in the U.S. Endangered Species Act of 1973, and cannot be imported into the European Union. Known in only one protected area, the Helan Mountain Nature Reserve (Table 7.1.2, Map 7.1.2), but may also occur in Liupanshan Nature Reserve.

Status within country: Endangered.

Conservation measures proposed: **1)** Raise protected status to Class I and **2)** enforce a total ban on hunting. **3)** Undertake a census and distribution survey to aid conservation plans.

Tien Shan argali (*Ovis ammon karelini*)

Distribution: This argali is found throughout the mountain ranges in northern and north central Xinjiang (Map 7.1.8), and is considered by some to be comprised of four subspecies. *O. a. karelini* is recognised in the Tien Shan range between elevations of 2,000 and 4,000m asl, with the western limit of its distribution lying north of Kashi (Kashgar). From here it extends east to the vicinity of Bosten Hu (Bagrax lake), including the mountains surrounding Yuli and Urdusi basins. Its northern limit is Tekes He and it extends into the Narat Shan and Eren Habirga Shan. It reaches the south slopes of the Tien Shan in the Dabanchen area, south of Urumqi. Argali referred to *O. a. adametzi* inhabit elevations between 1,500m and 3,000m asl on the Kuruktag range, north of the Konqi river, from southeast of Korla to northeast of Lopnor. *O. a. littledalei* is considered to occur in the area from the Alatau mountains, northwest of Yining on China's border with Kazakhstan, along the north slopes of the Borohoro Shan and Eren Habirga Shan in the Tien Shan range, in the Bogda Shan east of Urumqi, and beyond to the Karlik Shan south of Barkol Hu and into the North mountains (Karlik Shan?), a small insular range of the Tien Shan east of Bogda Shan near Barkol county (Map 7.1.8). The Dzhungarian Gate (Alataw Shankou), northwest of Ebinur Hu, is the northern limit of this subspecies. *O. a. sairensis* occupies the low mountains and hill regions near Jeminay south of the Ertix (Kara Irtysh) river, south through the Ba'erluke mountains, the Ta'erbahatai mountains and into the Sau'er (Sair) mountain region west of the Dzhungarian basin. Its southern limit is the Dzhungarian Gate, northwest of Ebinur Hu.

Population: Densities of this argali appear low throughout its distribution. Average densities of between 0.2 to 0.4 animals/km^2 were estimated during censuses made of *O. a. karelini* in areas around Aksu, Laohuitai and Hejing. Density estimates on the south slopes of the Bogda Shan run from 0.08 to 0.12 individuals/km^2. In the eastern Tien Shan and the North mountains, densities have been estimated to range from 0.32 to 0.41 argali/km^2. Finally, density estimates of 0.12 animals/km^2 were obtained in a 1990 survey northwest of Ebinur Hu. Based on these densities, Gu *et al.* (1991) extrapolated estimates of 8,000 to 11,000 argali (2,000 to 3,000 *karelini;* 2,000 to 3,000 *adametzi*; 2,000 to 2,500 *littledalei*; 2,000 to 3,000 *sairensis*).

Threats: In the 1960s and 1970s, the annual illegal kill of mountain ungulates, including argali, estimated from pelts collected by the commercial department, varied from 3,000 to 30,000 animals (Gu *et al.* 1991). Since the 1970s, significant increases in human use of the low mountains of middle region of Tien Shan has led to declines in argali numbers. The major threats to this argali are poaching and livestock grazing, however, the low densities and fragmented distributions of many populations also threaten its survival.

Conservation measures taken: Listed as Vulnerable (A2cde,C1+2) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, as a Class II species in China, and as "Endangered" in the U.S. Endangered Species Act of 1973. It cannot be imported into the European Union. This argali occurs in only one protected area; Tuom'er (Tomur) Feng Reserve situated at the extreme western of the Tien Shan range, near the border with Kazakhstan and Kirgizstan.

Status within country: Endangered.

Conservation measures proposed: 1) Immediately increase its status to Class I in the national protected list, and **2)** enforce a hunting ban. Next, **3)** carry out distribution and population census surveys throughout its range. Then, if appropriate, **4)** consider the potential for controlled trophy hunting programs. **5)** Establish an adequate protected-areas system. Tuom'er Feng Reserve requires enlarging, and anti-poaching patrols are required together with limitations on livestock grazing (Schaller *et al.* 1987). It is also necessary to develop proposals to establish more nature reserves in the Tien Shan to protect argali and other wildlife that are representative of these high, arid ecosystems. A reserve should also be established in the North mountains of Baliku. In the border region, a joint Sino-Kazakhstan survey and strict control of poaching should be implemented.

Pamir or Marco Polo argali (*Ovis ammon polii*)

Distribution: Occurs on the Pamir plateau along China's western border with Tadjikistan, from just west of Koktal (Xinjiang), south and east to the border with Afghanistan, to the west end of Kunlun mountains southeast of the Khunjerab (= Hongqilapu) pass on the Sino-Pakistan border (about 36°50'N, 76°E) (Map 7.1.8). In this latter region, a small population is restricted to the western side of the Chalachigu valley in the western part of Taxkorgan Nature Reserve. Sheep migrate between Taxkorgan Nature Reserve and the adjacent Khunjerab National Park (Pakistan) (Schaller *et al.* 1987; Wegge 1988).

Population: Total population size is <2,000 to 3,000 (Gu *et al.* 1991), and perhaps as few as 1,000. In Taxkorgan Nature Reserve, numbers are uncertain because sheep migrate in December and January from Afghanistan and Pakistan to rut in China (Schaller *et al.* 1987). During a summer survey by Schaller *et al.* (1987), a total of 89 argali were observed in the area of the Mintaka pass (850km², density 0.1/km²), none were seen elsewhere, and they believed that there were <150 in Taxkorgan Nature Reserve. Wegge (1988) estimated that between 100 to 200 may winter in the Chodpur area, 2km east-southeast of Khunjerab pass.

Threats: Poaching is a serious threat to this subspecies. The Karakoram Highway has been a major factor in its decline by providing access for poachers (Schaller *et al.* 1987). Even in Taxkorgan Nature Reserve, border guards are known to shoot Marco Polo sheep (Wegge 1988), and the argali also faces serious competition from vast numbers of domestic livestock on both sides of the Sino-Pakistan border, with as many as 70,000 livestock being reported on the Chinese side (Schaller *et al.* 1987).

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, as a Class II species in China, and as "Endangered" in the U.S. Endangered Species Act of 1973. The European Union bans import of this and other argali. In China, it occurs in only one protected area: in the western part of Taxkorgan Nature Reserve in the Kunlun Shan. Here they receive little if any protection from either poaching or competition with livestock (Schaller *et al.* 1987; Wegge 1988).

Status within country: Endangered.

Conservation measures proposed: If this argali is to survive in China, the following steps must be taken immediately. **1)** Raise its protected status to Class I. **2)** Eliminate poaching. **3)** Reduce or eliminate livestock grazing on both sides of the border in the Taxkorgan-Khunjerab region. This will require the co-operation of, and concessions to, the local Kirghiz and Tadjik peoples. The problems and consequences are similar for both China and Pakistan, therefore co-operation between authorities in the two countries is essential to ensure the survival of this subspecies. **4)** Determine the feasibility of establishing an international border park(s) involving China, Pakistan, Afghanistan and Tadjikistan (a proposal for an international Pakistan-Chinese park was made in 1981, and a tentative proposal to include Taxkorgan along the border of China with Pakistan and Tadjikistan was suggested by Thorsell *et al.* 1991). **5)** Develop co-operation with authorities in Afghanistan and Tadjikistan to conserve this argali. **6)** If numbers are shown to increase, a trophy hunting program could be considered to generate benefits for argali conservation and the local communities. Such a program needs a sound sustainable-use management plan, which in turn will require surveys and quantitative estimates of population productivity.

Golden takin (*Budorcas taxicolor bedfordi*)

Distribution: This subspecies is confined to the Qinling mountains in southern Shaanxi where distribution records of its occurrence have been collected throughout mountain ranges between elevations of 1,500 to 3,600m. The area covers 17 counties of Shaanxi Province, west from Mount Ziboshan in Lioba County, as far east as Niubeiliang in Zashui County (Ge 1990; Schaller *et al.* 1986; Wu *et al.* 1991) (Map 7.1.9).

Population: The total population size is ≥1,200 individuals (Ge 1990). Three centres of relatively high population density occur in Taibai, Ningshan and Zhouzhi, where they are restricted to the upper catchments areas of several rivers (Wu *et al.* 1987). In 1974, a field survey of five areas gave the following numbers of takin: Fuping – 104; Taibai – 191; Yangxian – 225; Zhouzhi – 587; Ningshan – 135 (Total 1,242; Wu *et al.* 1987).

Threats: Habitat loss, hunting and tourism. Deforestation, highway construction, hunting and a major die-off of bamboo were the major causes of the decline of takin around Zashui. There were about 250 to 300 individuals during the 1950s, and recently, these were reduced to 72

Golden takin (*Budorcas taxicolor bedfordi*) in Shanghai Zoo, China.

R. Wirth

which remain in the Zhashui Nature Reserve (see below) (Wu *et al.* 1987).

Conservation measures taken: Listed as Endangered (A2cd,C2a,D1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, and as Class I in China. Currently, it is found in two protected areas, Fupin and Taibeishan (Zhashui Takin) Nature Reserves (Table 7.1.2, Map 7.1.2), where it has been well protected since 1978 along with the giant panda and golden monkey. According to censuses in Fuping Reserve between 1981 to 1984, there were 133 to 153 individuals belonging to five or six groups (Wu *et al.* 1986; Wu *et al.* 1991), and around 72 animals in 13 groups in were estimated in Taibeishan Nature Reserve (Wu *et al.* 1987). A small number of golden takin are permitted to be shot by foreign hunters each year.

Status within country: Endangered.

Conservation measures proposed: 1) Carry out the improvements in management of the Fuping and Taibai Nature Reserves suggested by Wu *et al.* (1987): **a)** establish mineral licks; **b)** protect its main feeding ground, especially the winter ranges and bamboo habitats; **c)** prohibit cutting bamboo for local industrial needs; and **d)** protect the habitat used during the rut which is situated in alpine and subalpine zones. **2)** Initiate the integrated study of the mountain ecosystems in the two nature reserves containing takin proposed by Wu *et al.* (1987). **3)** Establish the proposed Great White Mountain National Park to provide further protection for this subspecies. **4)** Evaluate the sustainability of the current hunting program.

Mishmi takin (*Budorcas taxicolor taxicolor*)

Distribution: Mishmi takin is found in southeastern Tibet (Xizang) and northwestern Yunnan, but its distribution in China is split into two sections by the extreme northeast tip of India and northern Myanmar (Map 7.1.9). In Tibet, the western boundary is formed by the great bend of the Yarlung Zangbo (Tsangpo) river, where it occurs south of Medog on the mountain slopes on the border with Assam (India). It enters China again southeast of here in northern Yunnan, where it inhabits the Gaoligongshan range which lies between the west side of the Salween (Nu) river and the Sino-Myanmar border. This eastern section of its distribution extends from around Gongshan in the north, south to include Fugong, Lushui, Tengchong, Baoshan and at least as far as Longling (Feng *et al.* 1986; Wu *et al.* 1987).

Population: No estimate has been made of the total population, but numbers are believed to be low, especially in the Tibet section. About 200 inhabit the Gaoligongshan Nature Reserve.

Threats: Hunting is the main threat, but also habitat destruction caused by deforestation.

Conservation measures taken: Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. In China, it is a Class I species in the national protection list, but due to the remoteness of the area, it is doubtful that the local people are aware of this legislation. Occurs in Nujiang Nature Reserve, located in the northern mountains of Yunnan, that was established in 1981 to protect this takin along with other endangered species. Herds of >100 animals have been seen in this nature reserve (Lu 1987). It also occurs in Gaoligongshan and Mabiandafendin Nature Reserves (Sichuan).

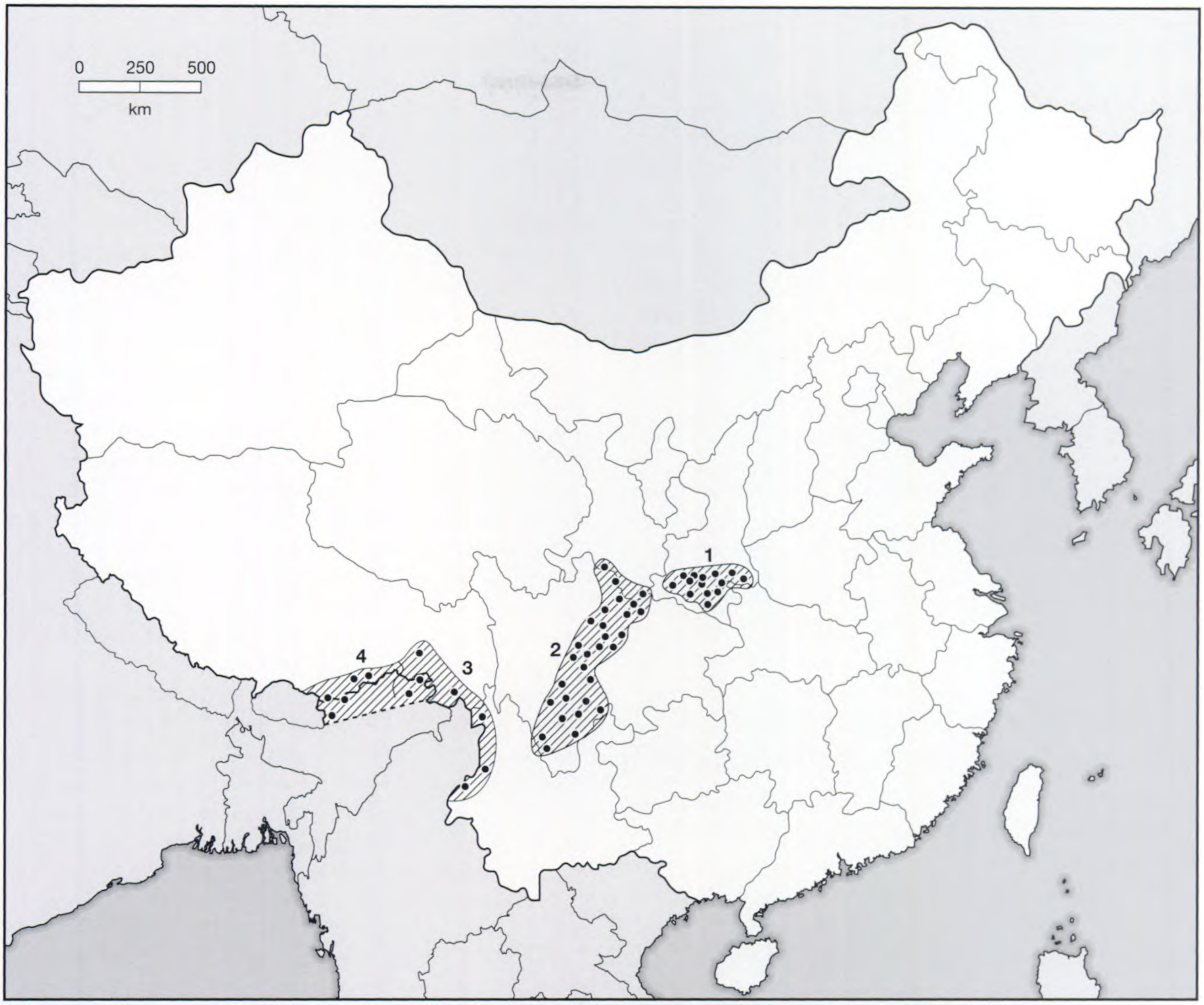
Status within country: Indeterminate.

Conservation measures proposed: 1) Complete a population census of the Mishmi takin, beginning in the Nujiang Nature Reserve, before moving to other parts of its range. **2)** Develop a co-operative program between Chinese and Myanmar authorities to strictly forbid hunting of this animal.

Sichuan takin (*Budorcas taxicolor tibetana*)

Distribution: Sichuan takin is found along the eastern margin of the Tibet plateau. Here, its distribution runs from the Min mountains along the Sichuan-Gansu provincial border, south through the Qionglai mountains west of Chengdu to the border with Yunnan Province (Map 7.1.9). Records of this takin have been found from more than 50 counties in Minshan in the north, Xianling in the west, as well as in the Qionglai Shan in the centre, and the Liang Shan in the south.

Population: No total population estimate has been made, but several thousand animals are believed to inhabit the Qionglai and Min mountains. A survey of Sichuan takin populations carried out in 1975 in the Wolong and Tangjiahe Nature Reserves (Qingchuan county), estimated 191 (Wu *et al.* 1987) and 370 to 410 (Ge *et al.* 1989) animals respectively. Large herds numbering as many as 45 to 100 individuals have been seen occasionally in Tianguan, Baoxing, Pingwu and Qingchuan. Other population observations estimate the young to account for 17.8%, the subadults for 13.3% and the adults 68.9%, while the adult male: female sex ratio is 2:1 (Wu *et al.* 1990; see also Schaller *et al.* 1986).



Map 7.1.9. General distribution of takin *Budorcas taxicolor* in China. **1)** *B. t. bedfordi*; **2)** *B. t. tibetana*; **3)** *B. t. taxicolor*; **4)** *B. t. whitei*.

Threats: Overhunting has resulted in local extirpation of this takin in some areas of its range, and recovery has been slow despite legal protection measures (see below). Habitat loss and disturbance from tourism are also significant threats.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, and a Class I species of the national protection list of China. Between 1963 to 1978, a total of 10 nature reserves were established in Sichuan to protect endangered animals such as the giant panda and golden monkey, but most also provided protection for Sichuan takin. Protected areas with this subspecies include: Baishuijiang (Gansu); Baihe, Fengtongzhai, Jiuzhaigou, Labahe, Mabian Dafending, Tangjiahe, Wanglong, Wolong and Xiaozaiziguo (Sichuan) (Table 7.1.2, Map 7.1.2). Captive breeding has been successful in Chengdu Zoo since 1978 (Hu *et al.* 1984).

Status within country: Rare.

Conservation measures proposed: Further scientific study on the ecology and management of this subspecies is necessary for its long term conservation.

Bhutan takin (*Budorcas taxicolor* ***whitei***)

Distribution: This subspecies is known to occur south of the Yarlung Zangbo river, from Gyaca, Nangxian, Mainling, Myingchi, Cona and Lhunze, on the southern flank of the eastern Himalaya, to the west side of the big bend of the Yarlung Zangbo river (Map 7.1.9).

Population: Nothing is known concerning its population size or trend.

Threats: With almost no management or protection in the remote border areas, overhunting by local people is hard to control, and hunting of large herds in winter is reported to be a serious problem (Feng *et al.* 1986).

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, and in Class I of China. It is found in Nujiang (Yunnan) and Muotua (Feng *et al.* 1986) Nature Reserves (Table 7.1.2, Map 7.1.2).

Status within country: Indeterminate.

Conservation measures proposed: 1) Educate local people to make them aware of conservation legislation. **2)** Develop co-operative conservation measures with Bhutan. **3)** Undertake a survey to census numbers and delineate distributions.

7.2 The Commonwealth of Independent States (former USSR)

P.I. Weinberg, A.K. Fedosenko, A.B. Arabuli, A. Myslenkov, A.V. Romashin, I. Voloshina and N. Zheleznov

Introduction

Until recently, the largest country in the world (22,400,00km^2) was known as the Union of Soviet Socialist Republics. Currently most of the 17 union republics, 20 autonomous republics (8 autonomous regions, 10 autonomous national districts, six territories and 123 regions) of the former USSR, belong to the Commonwealth of Independent States (CIS)

A broad picture of the CIS's topography is one of plateaux and mountain ranges in the east, broad plains and depressions to the west, and an almost continuous belt of mountains (Caucasus, Kopet Dagh, Pamir, Altai, Tien Shan, Altai and Sayans) along its entire southern border from west to east. The highest ranges among these, the Pamir and Tien Shan, lie in Tadjikistan, Kirgizstan and south-eastern Kazakhstan. More mountain ranges occur east of Lake Baikal and the Lena river, occupying the Far East and East Siberia as far as the Bering sea. The most notable of these are the Stanovoi, Verkhoyansk and Chersky ranges, and the Aldan and Kolyma Uplands. Several lesser ranges (Sikhote-Alin and Dzhugdzur) stretch along the coast of the Japan and Okhotsk seas. Together, these latter ranges form a vast mountainous country in the basins of the Lena, Yana, Kolyma and Anadyr rivers. Even Kamchatka peninsula is almost entirely dominated by a volcanic mountain chain – the Srediniiy range. The only mountains in the western part of the CIS are the Carpathians which cut across the south-west corner of the Ukraine, and the Urals that run north-south to separate Europe and Asia. The Russian or East European plain lies between the Carpathians and Urals, averaging 170m in elevation with heights up to 360m asl, and containing a mix of river valleys, lakes, and swamps. The northern part of the plain was previously glaciated, while in the south are huge loess deposits in the Ukraine and the Don river basin. The West Siberian plain, an area of low relief, and one of the largest lowlands in the world, lies to the east of the Urals. Here, elevations rise no higher than 200m asl, and its southern edge is bordered by the Turgai lowlands that are characterised by extensive low plateaux and areas below sea level. The third major plateau, the Central Siberian plateau, falls between the Yenisey and Lena rivers. It lies mainly between 450 to 900m asl, and is bounded to the north by the Khatanga or North Siberian Lowland and the Taimyr peninsula, and to the east, by the Central Yakut plain.

The climate is predominantly continental, and varies from frigid Arctic conditions in the north, through the temperate climate of the majority of the country, to arid subtropical conditions in central Asia and parts of Transcaucasia. Vegetation zones naturally reflect this diversity and include tundra, vast taiga forests, rolling steppe grasslands, cold and hot deserts, temperate and subtropical forests, and typical Mediterranean vegetation (mostly in the Caucasus).

Current status of Caprinae

The CIS has one of the most diverse Caprinae faunas in the world with 11 autochthonous species and as many as 23 subspecies. These animals are found mainly in the south where most mountain ranges occur, from the Caucasus between the Black and Caspian seas, east through the high mountain ranges of central Asia. However, they also inhabit mountain regions in northern and northwestern Siberia, including the Kamchatka Peninsula. The Greater Caucasus, especially its western and central parts, receives high levels of precipitation, similar to the European Alps. By contrast, the Ustyurt plateau and Kopet Dagh are desert or semi-desert mountains, while the Sayans are covered by taiga and montane steppe. Thus Caprinae occur in almost all mountain vegetation zones.

Amur, also referred to as Korean or Manchurian, long-tailed goral (*Naemorhedus caudatus raddeanus*), is restricted to a few small scattered areas in western Russia, where it inhabits montane forests along the border with China and along the coastal cliffs overlooking the Sea of

Japan. The second extant rupicaprid, the Caucasian chamois (*Rupicapra rupicapra caucasica*), also restricted in distribution, is found in two separate areas; through the Greater Caucasus, and in the Caucasus Minor between the Black and Caspian seas. Tatra chamois (*R. r. tatrica*) was once found in the Carpathians, but is now extinct (see **Conservation measures proposed** for chamois below).

There are at least five members of the genus *Capra*. Wild goat (*Capra aegagrus*) occurs in the southwestern mountains from Georgia (Persian wild goat or bezoar (*C. a. aegagrus*)) to Turkmenistan (Sind wild goat (*C. a. blythi*), also referred to as Turkmen wild goat (*C. a. turcmenica*)), with Asiatic or Siberian ibex (*C.* [*ibex*] *sibirica*) occupying the high mountains of central Asia. The Tadjik markhor (*C. falconeri heptneri*), also called the "screw-horned" goat in Russian, is restricted to a few small populations in the mountains north of the Amu Darya (Oxus) river. It is the most threatened member of this genus in the CIS. Two interesting species of wild goat are unique to the Greater Caucasus mountains of Georgia and Russia. These are the East Caucasian or Daghestan tur (*C. cylindricornis*), and the Kuban or West Caucasian tur (*C* [*ibex*] *caucasica*). These species inhabit mainly alpine and subalpine habitats, but also use forested areas in steep terrain. Their taxonomic status and their relationship to other Caprinae is unclear (although West Caucasian tur has obvious phenotypic affinities with Alpine ibex), and some Russian biologists recognise a third species – *C. servetzovi*.

Sheep are also particularly well represented in the Republics and Autonomous States. They are home to five subspecies of mouflon-urial (*Ovis orientalis*), five argali (*Ovis ammon*), and four snow sheep (*Ovis nivicola*). Transcaucasus or Armenian mouflon (*O. o. gmelinii*) is severely reduced in numbers and is restricted to a very small area in the mountains between Nakhitchevan and Armenia, and in an even smaller area in Azerbaijan. Transcaspian urial (*O. o. arkal*), also called Arkal or Ustyurt sheep, inhabits the dry mountains and steep river canyons west of the Caspian sea, in southwestern Kazakhstan, northern Turkmenistan and northwestern Uzbekistan. Its numbers had declined significantly, but recently, numbers appeared to respond positively to protection measures. However, there is no evidence that this positive response has continued. South of the Arkal's range, in the mountains along Turkmenistan's borders with Iran and Afghanistan, lives the Afghan or Turkmen urial (*O. o. cycloceros*). Although the most numerous of the urial in the CIS, it is considered Vulnerable. The Kizil-Kum or Severtzov's urial (*O. o. severtzovi*) is an endangered subspecies of sheep now restricted to two small areas west and south of Aydarkul Lake (Uzbekistan). South of here occurs another endangered urial, Bukhara urial (*O. o. bocharensis*), located in four isolated areas in the mountains just north of the Amu Darya. The taxonomic status of at least one population of this subspecies is uncertain; it may belong to Ladakh urial (*O. o. vignei*).

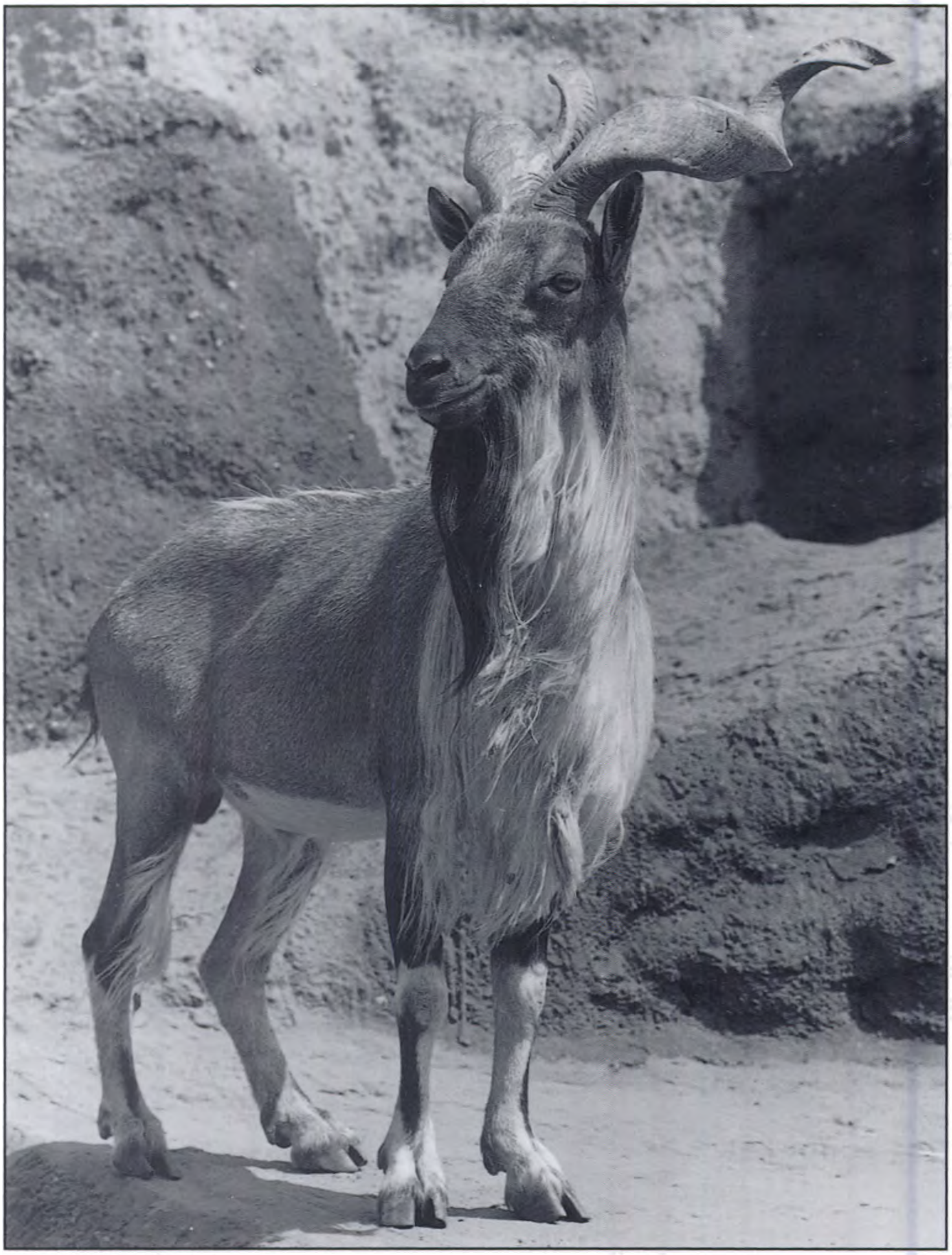
Altai argali (*Ovis ammon ammon*) is found in a few extremely small, scattered populations along the Russian border with the Mongolian Peoples' Republic, and is considered Endangered. It is the only subspecies called "argali" in Russian, all the remaining subspecies are referred to as "arkhar". The Kara Tau argali (*O. a. nigrimontana*) is also Endangered and is restricted in distribution to a single area in the western Kara Tau mountains of southern Kazakhstan; possibly ≤250 individuals survive. The Kazakhstan argali (*O. a. collium*) is reported to be relatively numerous and to occupy a huge area of low mountains north of Lake Balkash (Kazakhstan), and dwell east as far as the Chinese border. South of Lake Balkash, through the mountains of Kirgizstan east to the Chinese border, is the Tien Shan argali (*O. a. karelini*), whose numbers despite a relatively wide distribution, are few and declining. These latter two subspecies were considered a single subspecies, *O. a. karelini*, by Geist (1991), but not by Russian biologists. Most recently, Geist (pers. comm. 1994) has revised his opinion based on new evidence, and now recognises them as separate subspecies. The fourth subspecies of argali in the CIS is the Marco Polo sheep or Pamir arkhar (*O. a. polii*). Its distribution extends from the Pamir mountains of southeastern Tadjikistan, north through the mountains into Kirgizstan along the border with China, to just east of Lake Issyk-Kul.

Snow sheep (*Ovis nivicola*) is a Pachycerine sheep unique to the mountain ranges of eastern Siberia. The number of subspecies recognised varies from two to at least six (Baskin 1985; Heptner *et al.* 1961; Revin *et al.* 1988; Valdez 1982; Zheleznov 1975), and both taxonomic differences and distribution ranges are not clear. Sheep just east of the Lena river are referred to Yakutian sheep (*O. n. lydekkeri*), those on the Stanovoi and Kolymsk ranges as Okhotsk sheep (*O. n. alleni*), while those further east are either included in the latter or divided into one or two subspecies (Chukotsk sheep (*O. n. tschukstchorum*) and/or Koryak sheep (*O. n. koriakorum*)) (see Baskin 1985; Zheleznov 1975). Finally, most authors recognise two other subspecies, the isolated Putoran or Norilsk sheep (*O. n. borealis*) just east of the Yenisey river, and the Kamchatka snow sheep (*O. n. nivicola*) found in the mountains along most of the Kamchatka peninsula.

While the degree of threat varies, most Caprinae taxa in the CIS are threatened, with poaching and domestic livestock posing the major threats. Almost every taxon has declined since the end of World War II, some almost to the point of extinction. While a few have shown short periods of increase, the current situations in many autonomous states and republics leaves open the question of what will happen to conservation legislation. Additional factors (e.g. armed conflicts, promotion of hunting of threatened taxa, etc.) threaten Caprinae, and there are strong indications that many have declined significantly in the last two years. Hence the immediate future for Caprinae (and most other wildlife) is precarious. Until political conditions stabilise and until reliable censuses are made, most population estimates and categories of threat for Caprinae in the CIS must be treated conservatively and to some degree, pessimistically. Currently, almost all Caprinae, no matter how vulnerable or threatened (including Tadjik markhor and Bukhara urial), are subjected to trophy hunting for hard currency.

Of particular interest to CIS is the taxonomy of wild sheep. For example, some authors refer all urial, mouflon and argali sheep to *O. ammon*; ***O. o. bocharensis*** **has been considered as Ladakh urial (*O. v. vignei*); *O. o. cycloceros* has been grouped with** *O. o. arkal*; ***O. a. nigrimontana***, *collium* and *polii* have been considered as a single subspecies; Severtzov's urial (***O. o. severtzovi***), has been considered a subspecies of argali (***O. ammon***); and finally, the number and criteria for separating subspecies of *O. nivicola* require attention.

The only evidence of bharal or blue sheep (*Pseudois nayaur*) in Tadjikistan was published by Sapozhnikov (1983). Remains of an adult male were found by a geologist on Sarykol range (south-western Pamir). Sapozhnikov (1983) also mentions some unknown ungulates repeatedly



M. Lyster (WWF)

Adult male Tadjik markhor (*Capra falconeri heptneri*). London Zoo.

seen during aerial counts (from helicopter) in the Pamir; most probably these were bharal. These data were neither confirmed later nor denied.

The most recent evidence of autochthonous populations of muskoxen (*Ovibos moschatus*) in Russia are remains dated at ca. 2,800 years BP, but all current populations of the species result from re-introductions. Thirty animals (10 from Banks Island, NWT, Canada, and 20 from Nunivak Island, Alaska, USA [N.B. animals from Alaska originally from Greenland]) were held in a small enclosure and then released in the Taymyr region, between 1980 and 1982. Numbers had increased to about 230 by 1987. Muskoxen also have been reintroduced to Vrangel (Wrangel) Island (Map 7.2.1, Table 7.2.1), where there were up to 100 animals in 1990.

General conservation measures taken

Conservation began in 1909 and led to the first Soviet state nature reserve being established in 1919, and the first protected areas legislation in 1921. A series of conservation acts followed in 1957, with further legislation in 1968 and 1972. Current legislation is based on "The Law of Wildlife Protection and Use and the Law of Air Protection", which came into force in 1981, and which included measures and regulations for protected areas and wildlife protection. This law is probably the most important legislation dealing with wildlife conservation in the country. The decree of the USSR Supreme Soviet dealt with nature conservation and use of natural resources. Environmental protection was receiving increasing importance, as shown by the 1977 Constitution of the USSR in which under Article 18, it was the state's primary duty to protect and make scientific use of natural resources including environmental quality, while Article 67 obliged all Soviet citizens to protect nature. These were supplemented by the 1985 decree on the enforcement of nature conservation laws and rational use of natural resources (IUCN 1989b, 1992a). The current status of conservation and conservation legislation is unknown and the future is very uncertain.

The USSR Red Data Book (Borodin 1984) recognised five categories of threat: I – species threatened with extinction unless specific measures taken; II – species whose population is still large but that are suffering catastrophic reductions which in the near future will place them under the threat of extinction; III – rare species, not yet threatened with extinction; IV – species whose biology is little known, hence unable to categorise; V – restored species. Many republics also have their own Red Data Books. The Soviet Union held meetings every five years on ungulates and other rare mammal species in the USSR. Discussions of general wildlife conservation in the former USSR can be found in Pryde (1986, 1987).

Article 21 (Section 6 – "creating reserves and sanctuaries") and Article 25 ("protection of animals in preserves, reserves and other protected areas") of the 1980 Law on Wildlife Protection and Use, form the legislative basis for state protected areas (IUCN 1989b, 1992a). At least 10 different categories of protected areas existed in the USSR, varying in the extent of protection provided and covering more than five million km^2 or around 20% of the land surface of the country. However, there are six main categories relating to natural areas, the most important of which is the state nature reserve [zapovednik] of which there are 150 covering 17.5 million ha (less than 1%) in the 15 Soviet republics. The total number of protected areas is currently unknown. Zapovedniki are established primarily to preserve the natural fauna and flora, and even whole ecosystems, and permit minimal human activities within them. A network of preserves has been adequately developed only over the last 10 years. Being owners of their land, the reserves do not admit unauthorised visitors, and any other land-use is generally forbidden.

All other categories of protected areas are situated on lands belonging to other organisations, such as kolkhozs, state forests, etc. For this reason, they cannot provide, even formally, the necessary degree of protection and must allow various land-use practices within them. Usually only hunting is prohibited. These categories include: National Parks [natsional'nyi park] of which there are a total of 21; Nature Sanctuaries or Partial Reserves [zakaznik]; National Hunting Reserves [zapovedno-okhotnich'ye khozyavtso]; and Nature or National Monuments [prirodny, pamyatnik]. There are also State Forests and Forest Reserves, but these are managed primarily for human activities (IUCN 1989b, 1992a). Though the number of protected areas is considerable, the actual protection they provide is much less than might be expected. The actual area and borders of almost every reserve differ greatly from those planned, and are usually smaller. Often wild species are excluded from the best pastures and sometimes from watering places, and many if not most reserves give only seasonal shelter to, or protect only part of, the local wildlife populations.

Beginning in 1988, the majority of the natural reserves were under the jurisdiction of the USSR State Committee for Nature Conservation (Goskompriroda) and its subdivisions and departments in different republics. In 1991, this committee was re-organised into the Russian Ministry of Ecology and Natural Resources, and now almost all the reserves in Russia belong to this ministry. The situation in other states of CIS may be different. Fish and Game Departments that control hunting and fishing in Russia, are also under the jurisdiction of the Ministry of Ecology. Thus the main functions of this ministry are: management of nature protection actions and nature reserves, monitoring hunting activities, use and

Table 7.2.1. List of important protected areas with Caprinae in the Commonwealth of Independent States (ID numbers refer to Map 7.2.1).

Protected Area[1]	Type[2]	Size (ha)	Date est.	Species[3]
1) Caucasus (R)	R[b]	263,300	1924	c,wt
2) Ritsa (G)	R	16,289	1930	c,wt
3) Pskhu-Gumista (G)	R	40,818	1946	c,wt
4) Teberda (R)	R	85,840	1935	c,wt
5) Kabardin-Balkarian (R)	R	74,100	1976	et
6) North Ossetian (R)	R	29,900	1967	c,et
7) Kazbegi (G)	R	8,707	1976	c,et
8) Tushetian (G)	R	12,484	1980	c,w,et
9) Lagodekhi (G)	R	17,718	1912	c,et
10) Zakataly (Az)	R	23,844	1928	c,et
11) Ilisu (Az)	R	9,345	1987	c,et
12) Ismailly (Az)	R	5,778	1981	c,et
13) Kintrishi (G)	R	13,893	1959	c
14) Borzhomi	R	17,348	1885	c
15) Geighel (Az)	R	6,739	1926	w
16) Khosrov (Ar)	R	29,196	1958	w,am
17) Shikakhokh (Ar)	R	10,000	1953	w
18) Ordubad(Az)	S	40,00	1973	w,am
19) Ustyurt (Kz)	R	223,300	1984	tu
20) Kaplankyr (Tk)	R	570,000	1979	tu
21) Siunt-Khasardagh (Tk)	R	29,700	1979	au
22) Kopet Dagh (Tk)	R	49,793	1976	w,au
23) Badkhyz (Tk)	R	87,640	1941	au
24) Nuratau (Uz)	R	22,130	1975	su
25) Zaamin (Uz)	R	15,600	1959	i
26) Gissar (Uz)	R	76.889	1985	i
27) Surkhan (Uz)	R	?	?	m,bu
28) Kugitang (Tk)	R	?	?	m,bu
29) Dashti-Jum (Td)	R	19,700	1983	m,bu
30) Aksu-Dzhabagly (Kz)	R	74,400	1920	i,ta
31) Besh-Aral (Kr)	R	18,200	1979	i,ta
32) Chatkal (Uz)	R[b]	35,809	1947	i
33) Sary-Chelek (Kr)	R	23,900	1959	i,ta
34) Naryn (Kr)	R	24,200	1983	i,ta
35) Alma-Ata (Kz)	R	73,325	1931	i
36) Karkaraly (Kz)	NP	80,000	1971	ka
37) Bayan-Aul (Kz)	NP	45,000	1977	ka
38) Altai (R)	R	86,361	1932	i,aa
39) Kosh-Agach (R)	S	241,100	1966	aa
40) Sayano-Shushensky (R)	R[b]	389,570	1974	i
41) Kedrovaya Pad (R)	R	17,897	1916	?
42) Ussuri (R)	R	40,432	1932	n
43) Lazo (R)	R	116,500	1935	n
44) Sikhote-Alin (R)	R[b]	34,705	1935	n
45) Dzhugdzhur	R	?	?	os
46) Magadan (R)	R	869,200	1982	os
47) Kronotsky (Kronoki) (R)	R	1099,000	1934	ks
48) Vrangel Island	R	76,780	1976	o
49) Putoran (R)	R	1000,000	1988	ps
50) Ramit (Td)	P	16,168	1959	i

[1] Republics: Az = Azerbaijan; Ar = Armenia; G = Georgia; Kz = Kazakhstan; Kr = Kirgizstan; Td = Tadjikistan; Tk = Turkmensitan; Uz = Uzbekistan; R = Russia

[2] Type of protected area: NP = national park; R = nature reserve; S = sanctuary; [b] Biospshere Reserve

[3] Species: n = Amur long-tailed goral; c = Caucasian chamois; w = Wild goat; i = Asiatic ibex; m = Tadjik markhor; et = East Caucasian tur; wt = West Caucasian tur; am = Armenian mouflon; tu = Transcaspian urial; bu = Bukhara urial; au = Afghan urial; su = Severtzov's urial; aa = Altai argali; ka = Kazakhstan argali; ta = Tien Shan argali; ks = Kamchatka sheep; os = Okhotsk sheep; ps = Putoran snow sheep; o = muskox (introduced)

conservation of lands, registration of threatened fauna and production of the USSR Red Data Book, and promotion of nature education. In the Central Asian republics, about 100,000km^2 still remain in the zapovedniki, zakazniki, and national parks, but the total amount of preserved land has been decreasing by roughly 10% each year for the past several years (Anon. 1995a).

There are many protected areas with Caprinae in the CIS (Map 7.2.1, Table 7.2.1), although the exact number, especially outside Russia, is difficult to ascertain, especially under the present conditions. Captive breeding programs existed for some species such as Armenian mouflon, Tadjik markhor, Bukhara urial and Altai argali (see **Species accounts**).

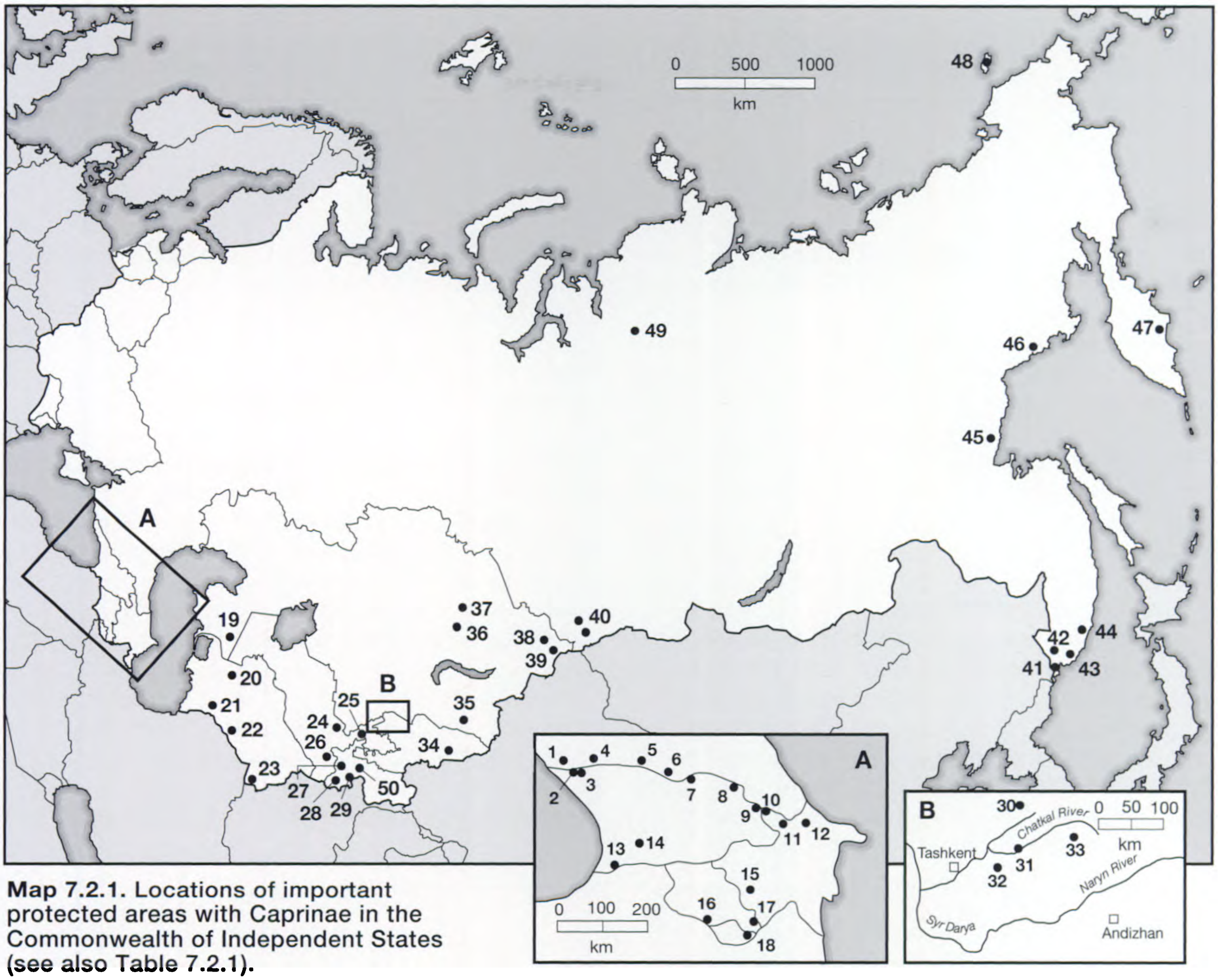
The All Russian Society for Nature Conservation, founded in 1924, is both the oldest and the largest nature conservation organisation in the country. There were/are also other national nature conservation organisations in all the republics, including the USSR Geographical Society, the USSR Theriological Society, and the USSR Ornithological Societies (IUCN 1989b, 1992a). Most recently, the Ecological Union and the Green Party have become established.

General conservation measures proposed

There are several major problems for the conservation of Caprinae (and all other ungulates) in the CIS, three of which must be emphasised. The first issue is the state of unrest in most regions inhabited by Caprinae, especially in the Caucasus and central Asia. This problem has two consequences: a) a lack of control even by the appropriate ministry officials, and b) a large number of powerful firearms (mostly illegal) that are at people's disposal. The second problem is the emergence of large and mostly foreign markets for trophies (horns, mounted heads, etc.). The value that some western hunters place on trophy Caprinae and the medicinal value to far eastern buyers, are well known, so most local people are eager to become involved in both markets. The third major problem results from the rather grim economic situations in CIS that result from a lack of funding even for existing organisations, and from a lack of real interest on the part of people who are not favourably disposed towards nature conservation.

The network of protected areas within the USSR was being constantly expanding, particularly in the 1970s and 1980s, and there were many proposals concerning new reserves and the reorganisation (usually enlarging) of existing ones (see Sokolov and Syroyechovsky 1985, 1990a, b). For the Caucasus region these include:

1) Reorganisation of the existing Chechen-Ingush Sanctuary into a nature reserve to conserve Daghestan tur, chamois, and a small population of wild goat, that may still remain there.



Map 7.2.1. Locations of important protected areas with Caprinae in the Commonwealth of Independent States (see also Table 7.2.1).

1) Caucasus NR, **2)** Ritsa NR, **3)** Pskhu-Gumista NR, **4)** Teberda NR, **5)** Kabardin-Balkarian NR, **6)** North Ossetian NR, **7)** Kazbegi NR, **8)** Tushetian NR, **9)** Lagodekhi NR, **10)** Zakataly NR, **11)** Ilisu NR, **12)** Ismailly NR, **13)** Kintrishi NR, **14)** Borzhomi NR, **15)** Geighel NR, **16)** Khosrov NR, **17)** Shikakhokh NR, **18)** Ordubad S, **19)** Ustyurt NR, **20)** Kaplankyr NR, **21)** Siunt-Khasardagh NR, **22)** Kopet Dagh NR, **23)** Badkhyz NR, **24)** Nuratau NR, **25)** Zaamin NR, **26)** Gissar NR, **27)** Surkhan NR, **28)** Kugitang NR, **29)** Dashti-Jum NR, **30)** Aksu-Dzhabagly NR, **31)** Besh-Aral NR, **32)** Chatkal NR, **33)** Sary-Chelek NR, **34)** Naryn NR, **35)** Alma-Ata NR, **36)** Karkaraly NP, **37)** Bayan-Aul NP, **38)** Altai NR, **39)** Kosh-Agach S, **40)** Sayano-Shushensky NR, **41)** Kedrovaya Pad NR, **42)** Ussuri NR, **43)** Lazo NR, **44)** Sikhote-Alin NR, **45)** Dzhugdzhur NR, **46)** Magadan NR, **47)** Kronotsky (Kronoki) NR, **48)** Vrangel Island NR, **49)** Putoran NR, **50)** Ramit R. NR = Nature Reserve; NP = National Park; S = Sanctuary.

2) Reorganisation of Ordubad Sanctuary into a nature reserve covering 16,400ha in Nakhichevan containing about 300 wild goat and 200 Armenian mouflon.
3) Tutgun Nature Reserve in the Delidagh massif in Armenia, covering 22,000ha and harbouring up to 200 wild goats.
4) Upper Svanetian (Zemosvaneti) Reserve on the southern slope of the Greater Caucasus in Georgia with Daghestan tur and chamois.

In Georgia, there are plans to increase the Tushetian section of Akhmeta Reserve to include wild goat habitat, and the Lagodekhi Reserve is to be increased for East Caucasian tur and Caucasian chamois. A proposal has been made to reintroduce Tatra chamois from Slovakia into the Carpathian Reserve.

In the Central Asia region, the following nature reserves have been proposed:

1) Karatau Reserve (Kazakhstan) for Karatau argali.
2) Ermentau Reserve (Kazakhstan) for Kazakhstan argali.
3) Dzhungarian (Kazakhstan) for Asiatic ibex.
4) Pyanj Karatau (Tadjikistan) for Bukhara urial.
5) Balkhan Reserve (Turkmenistan) for Turkmen urial and wild goat.
6) Zorkul Reserve (Tadjikistan) for Pamir argali.
7) South Ustyurt Reserve (Uzbekistan) for Ustyurt urial.
8) Most reserves of the Middle Asia and Kazakhstan need to be increased in size for them to be effective.

Many more proposals could be included here, but there are reasonable doubts as to whether they would ever be implemented under the current economic conditions in the countries concerned. The general opinion among many zoologists is that the most urgent need is not to produce new protected areas, but to maintain the existing ones effectively. It should be noted that several existing reserves, as well as some proposed ones, are situated in military activity zones; for example, along the Armenian-Azerbaijan border and around Karabakh. This is of particular concern for Armenian mouflon and wild goat.

Most species of Caprinae in the CIS have the potential for sustainable trophy hunting programs in which foreign hunters are brought in, and resulting moneys and benefits are directed to both local people (wildlife guards, hunting guides, etc.) and to wildlife conservation. However, before these can be safely developed, thorough and extensive wildlife surveys are required, not only to locate the most suitable areas or populations, but simply to provide the data for developing basic wildlife management and conservation strategies if they are to be sustainable.

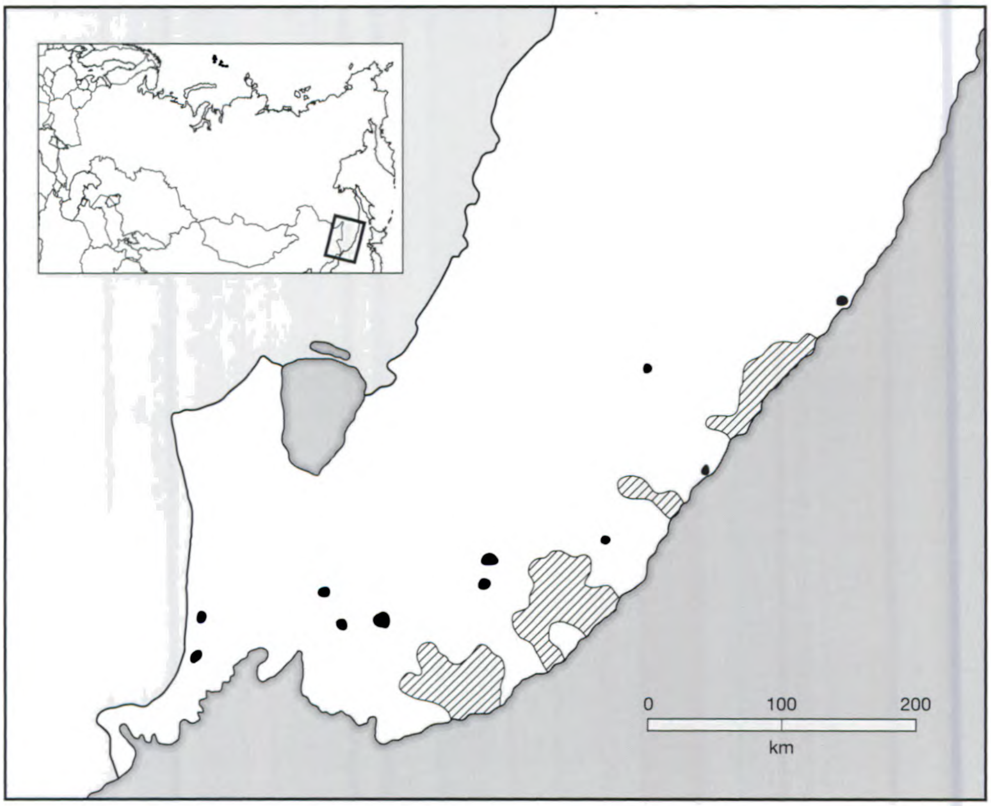
Conditions are changing rapidly in the former soviet republics and the impacts on wildlife, including Caprinae, are invariably negative. It is imperative that the necessary population data are collected immediately and effective conservation strategies developed. At the same time, all republics should be encouraged to join and abide by CITES regulations with respect to threatened species. This is particularly important for Caprinae in these countries because most are highly prized and valuable trophy species.

Species accounts

General biological information on most species can be found in many publications; e.g. Baskin (1985), Heptner *et al.* (1961), Kotov (1968), Myslenkov and Voloshina (1989), Popkova (1967, Revin *et al.* (1988), Sapozhnikov (1976) Sludskiy *et al.* (1983), Weinberg (1984).

Amur long-tailed goral (*Naemorhedus caudatus raddeanus*)

Distribution: Previously goral was distributed along almost all of the southern half of Sikhote-Alin range, (i.e. the entire Primorsky Territory and southern part of Khabarovsk Territory) and on the southern end of the Bureya range. Its occurrence in this last area is under question. In the 1960s and 1970s, goral were repeatedly observed along the left tributaries of the Khor river, along the Kafen, Chuken and Sukpay rivers, on the western slopes of Central Sikhote-Alin (approximately 47°N, 137°E) (Dunishenko 1983). The third part of this species range occupies mostly the eastern slope of Sikhote-Alin along the coast of the Sea of Japanese, between 43°40'N and 45°N, and also all the southern end of Sikhote-Alin range (Myslenkov and



Map 7.2.2. General distribution of Amur or Manchurian long-tailed goral (*Naemorhedus caudatus raddeanus*) in Russia.

Voloshina 1989). The fourth part, occurs along the Chinese-Russian border in the Khasan region. A fifth area reportedly exists along the same border south of Khanka lake. Its distribution within these parts is patchy because goral is confined to specific habitat – steep rocky slopes covered with sparse, montane broad-leaved forest, from sea level to about 1,000m asl (Heptner *et al.* 1961) (Map 7.2.2).

Population: In 1977, the total number was estimated at 600 to 750 animals (Bromley, 1977). Recent analysis (Myslenkov and Voloshina 1989) indicates no decline in numbers or disappearance of any known local population, and the numbers along the Sea of Japan may be slowly increasing. Lazo District has about 300 animals, Terneisky District around 250, Olginsky District 80, and Dalnegorsky District 15 to 20 goral. Population density in several places, for example in Sikhote-Alin Reserve, reaches 35 animals/km^2.

Threats: Poaching, which may be increasing since the demise of the USSR, and natural mortality, which can be high in years with heavy snowfall.

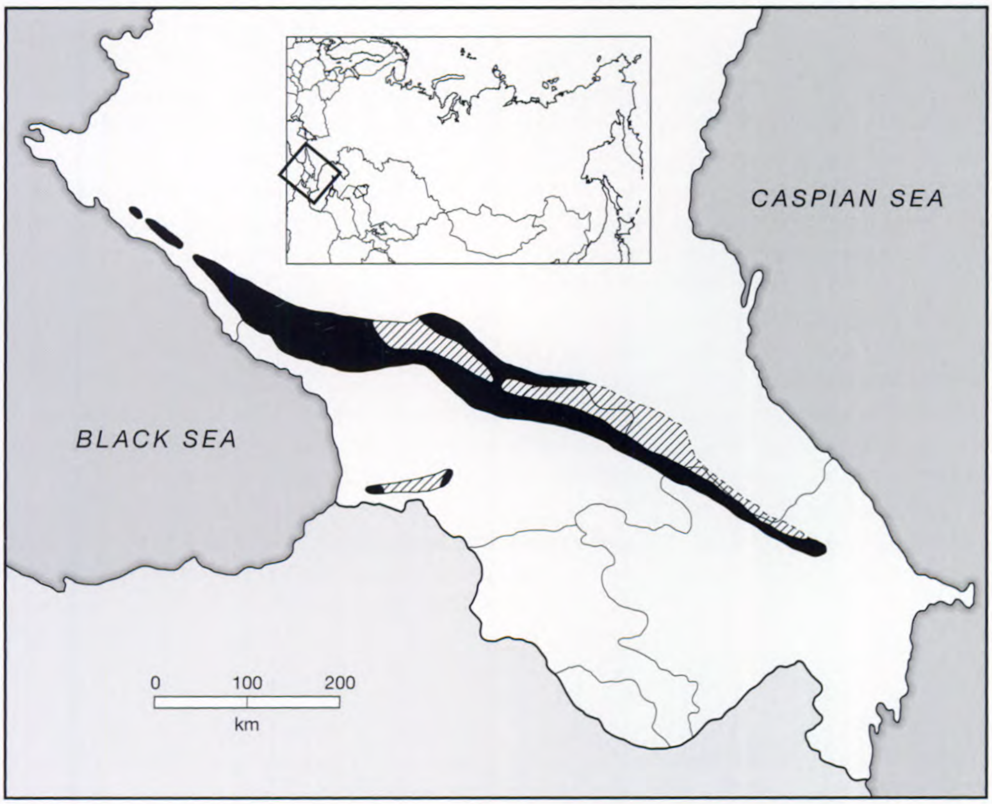
Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES along with all goral, and in Category I of the Russian Red Data Book (Borodin 1984). Protected in five Nature Reserves: Lazo Reserve harbours some, Sikhote-Alin Reserve has about 200, Zheleznyakovsky Sanctuary about 50, Vasilkovsky Sanctuary about 50, and an unknown but small number in Ussur Reserve (Myslenkov and Voloshina 1989) (Map 7.2.1, Table 7.2.1). Captive breeding programs are being carried out in Lazo and Sikhote-Alin Reserves.

Status within country: Indeterminate.

Conservation measures proposed: **1)** Reintroduce goral in appropriate areas formerly inhabited by the species to help restore its range. **2)** Enlarge the size of the Sikhote-Alin Reserve to include the area south along the coastline. **3)** Prohibit boats from approaching protected shores, keeping a distance of at least 0.5km.

Caucasian chamois (*Rupicapra rupicapra caucasica*)

Distribution: Its distribution consists of two separate parts, the Greater Caucasus and the Caucasus Minor (Map 7.2.3). The chamois tends to be a forest dweller and generally occurs on both sides of the Greater Caucasus from just east of Pshada river near Gelendjik (45°N, 38°E), southeast for about 900km to Mount Babadag (41°N, 48°15'E) in Azerbaijan (Alekperov *et al.* 1976; Durov 1977). Although still relatively continuously distributed, it becomes increasingly less numerous east of North Ossetia,



Map 7.2.3. Distribution of Caucasian chamois (*Rupicapra rupicapra caucasica*) in the CIS.

particularly in Daghestan, and more occur on the southern slopes in Azerbaijan than on northern ones. However, its range in the Greater Caucasus is beginning to fragment all over. In the Caucasus Minor, populations are scattered and isolated. Here the chamois is confined mainly to the Meskhet and Trialeti ridges (Georgia) between 41°30'N, 42°E and 41°30'N, 44°E, which are the wetter areas of the Caucasus Minor.

Population: The total population was estimated in the early 1990s to be ca. 15,000 chamois, with about half in the western half of the Greater Caucasus and only ca. 500 in the Caucasus Minor. Of total chamois, an estimated 5,000 occur in Georgia. Numbers of this chamois have decreased drastically over the last 20 years throughout their range, and are still declining. Over the last two to three years, the decline has accelerated and numbers are believed to have been reduced by as much as 50% (P. Weinberg, unpubl. data).

Threats: Until recently, this chamois was common in the western half of the Greater Caucasus, and very rare in Daghestan where they are often displaced by wild goat (*Capra aegagrus aegagrus*). The reason for the decline in numbers in some populations, even in protected areas, is unknown, although outside of these areas, poaching related to political unrest is a major threat. In some areas, competition with domestic livestock is a problem, and competition with tur, red deer (*Cervus elaphus*), and roe deer (*Capreolus capreolus*) is also possible.

Conservation measures taken: Listed as Vulnerable (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), it was previously in Category III of the Georgian Red Data Book (1982), but is now placed in Category IV in the new edition (in press). Hunting chamois is strictly prohibited throughout the Caucasus. According to Sokolov and Syroyechkovksy (1990a) it occurs in the following Nature Reserves: ***Azerbaijan***: Ilisu, Ismailly and Zakataly; ***Georgia***: Lagodekhi, Kazbegi, Kintrishi, Pshu-Gumista, Ritsa and Tushetian; ***Russia***: Caucasus, North Ossetian (North Ossetia) and Teberda (Karachai-Circassia) (Map 7.2.1, Table 7.2.1). Of all these protected areas, only the Big Caucasus Reserve and to a lesser degree Teberda, Lagodekhi and Zakataly Reserves, play an effective role in the protection of this subspecies. Protection is provided by rangers of the Hunters' and Fishermen's Society, by Hunting Inspection officials, and by forest guards.

Status within country: Vulnerable.

Conservation measures proposed: No conservation measures have been proposed in addition to those already taken.

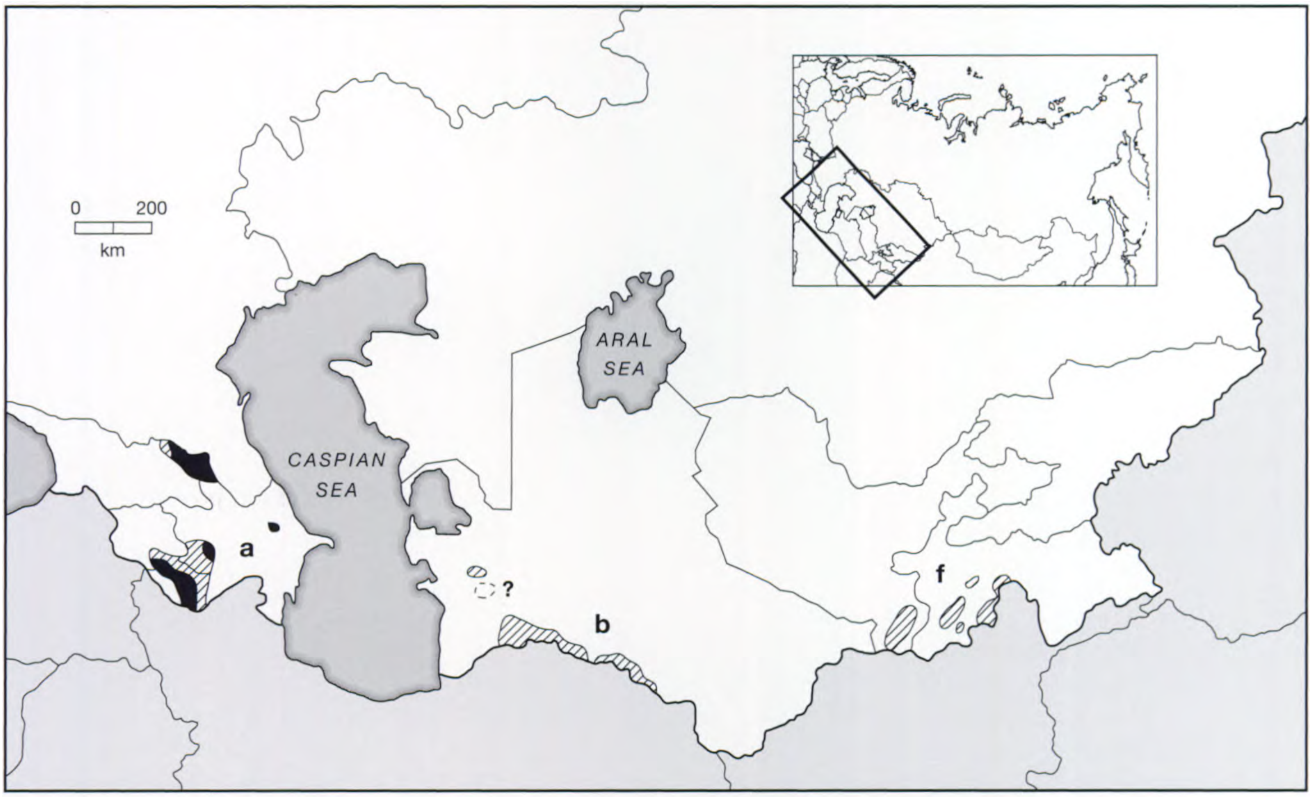
Wild goat (*Capra aegagrus*)

Distribution: Two subspecies of wild goat are recognised. The distribution of *C. a. aegagrus* is in two separate parts. It occurs often in forested areas along northern slopes of the Greater Caucasus mountains from the Upper Argun river, in Chechen-Ingushetia and in Georgia, up to the headwaters of the Jurmut river (around 42°30'N, 46°E) in Daghestan, with an isolated population on the south slopes of Mount Babadagh, Azerbaijan. It also occurs in the more drier, open habitats in the Caucasus Minor mountains in both Azerbaijan and Armenia, south and east of Sevang lake, namely the Shakhdagh, Mrovdagh, Karabakh, Gegam Vardenis and Zangezur ranges, and on the Delidagh massif between 39° to 40°30'N and 45° to 46°39'E (Map 7.2.4). The second subspecies, the Turkmen wild goat (*C. a. blythi* [= *turcmenica*]), occurs in scattered populations in the central Kopet Dagh along the border between Turkmenistan and Iran between about 37°20'N, 55°20'E and 38°N, 57°20'E, and in the Large Balkhan (Bolshye) north of Nebit Dagh about 39°30'N, 50°30'E (Map 7.2.4). It is not known whether this subspecies still inhabits the Small Balkhan (Malye).

Population: It inhabits mainly forested habitat, so accurate censuses are difficult to make. The total population estimate for wild goat was between 10,500 and 11,000 individuals in the late 1980s. Of this total, *C. a. aegagrus* numbered between 3,500 and 4,000, with 1,500 in the Greater Caucasus (Arabuli 1989; Bathiyev 1989; Prilutskaya and Pishvanov 1989) and the rest in the Caucasus Minor, where more than half (1,000 to 1,250) lived in the southern half of the Zangezur range (Kuliyev 1981). The overall population trend for this subspecies is negative, and for the last two to three years the rate of decline has increased. For *C. a. blythi* [= *turcmenica*], Korshunov (1986), whose data are most reliable, estimated that the total population was ≤7,000 animals. Most of these were in central Kopet Dagh, with >3,000 inhabiting the Kopet Dagh Reserve. However, numbers have recently declined as much as 50% in some areas of the Kopet Dagh (V. Lukarevsky, *in litt.* 1994)

Threats: Poaching, competition for food with domestic livestock, and disturbance and habitat loss from logging and land clearing, are major threats.

Conservation measures taken: *C. a. aegagrus* is protected by law, and is included in Category II in the Red Data Book of the USSR (Borodin 1984), Georgia (1982) and Russia (1983). No more than 200 occur in at least three protected areas (Map 7.2.1, Table 7.2.1). Wild goat is found in Tushetian Reserve in the Greater Caucasus, and in the Caucasus Minor, in the Geigel (Azerbaijan) and the Khosrov (Armenia) Nature Reserves (Sokolov and Syroyechkovsky 1990a). It also occurs in Ordubad



Map 7.2.4. General distribution of wild goat (*Capra aegagrus*) a) *C. a. aegagrus* and b) *C. a. blythi* [*turcmenica*], and f) Tadjik markhor (*Capra falconeri heptneri*) in the CIS.

Sanctuary (Nakhichevan), and periodically in Shikakhokh Nature Reserve (Armenia).

Turkmen wild goat (*C. a. blythi* [= *turcmenica*]) is also protected. It is listed as Vulerable (A2cde) in the IUCN Red List of Threatened Animals (IUCN 1996) and is included in Class II in the USSR Red Data Book (Borodin 1984). Kopet Dagh Nature Reserve is the only protected area with this subspecies. The Turkmenistan Government planned to allow hunts for 20 goats in 1993–94; the current licensed hunting situation is unknown.

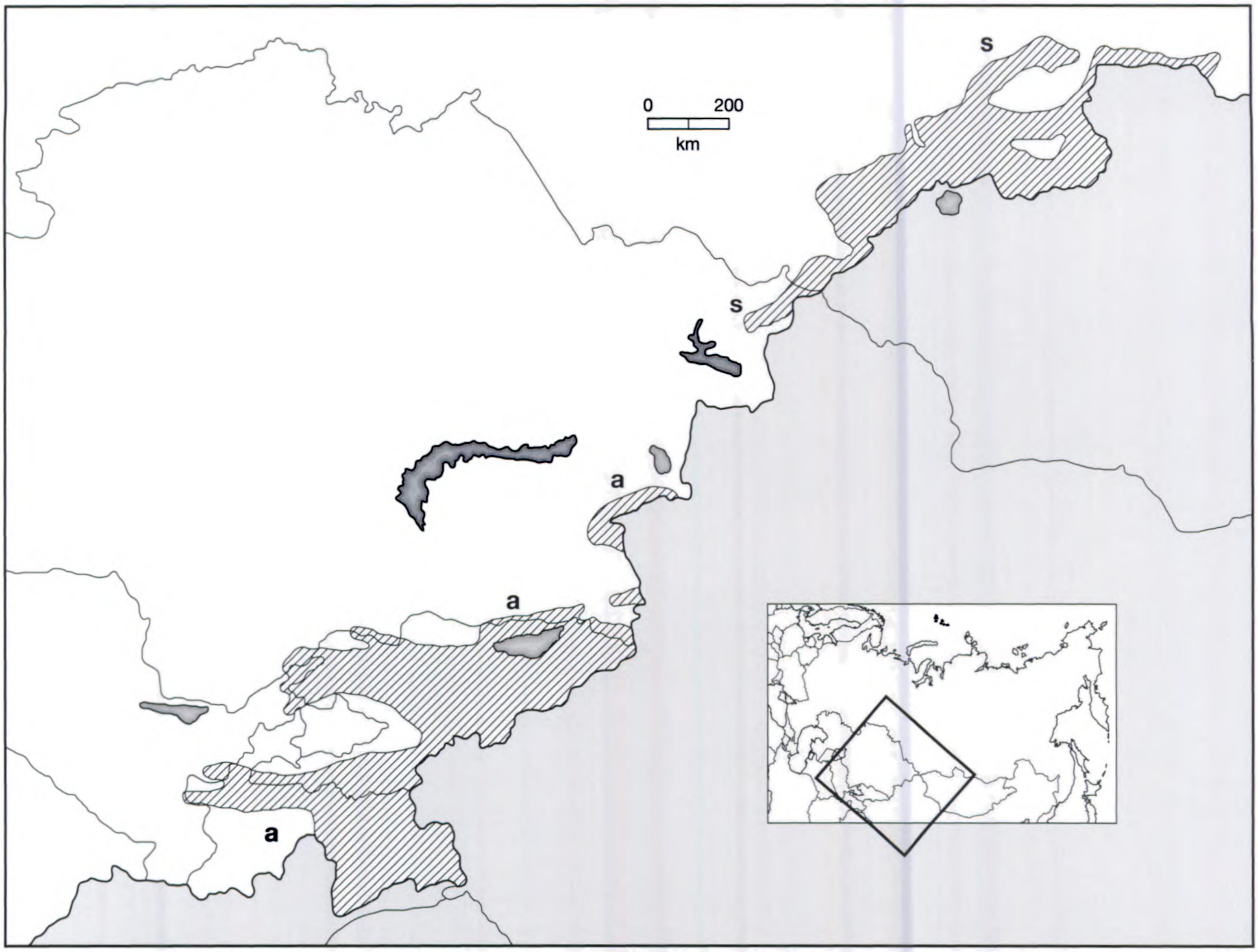
Status within country: Vulnerable – *C. a. aegagrus*; Vulnerable – *C. a. blythi* [= *turcmenica*].

Conservation measures proposed: 1) Apply more strict and effective control of poaching. However, most local people in the Caucasus consider wild goats and other species as a source of meat, hides and horns, so stricter prohibition measures alone would not be adequate. It is also essential to **2)** protect the subspecies' forest habitat in Daghestan. Both these objectives could be best accomplished in reserves. **3)** Establish at least three new protected areas, one on the southern flank of Zangezur Ridge in Nakhichevan (Caucasus Minor), the second in western Daghestan, the third in the Large Balkhan. **4)** Re-introduce wild goat into the Siunt-Khasardag Nature Reserve in the western Kopet Dagh, and into the Badkhyz Nature Reserve in the Gyaz-Gedyk range.

Asiatic ibex (*Capra [ibex] sibirica*)

Distribution: Asiatic ibex has a widespread distribution in Kazakhstan, Kirgizstan, and southern Siberia, where it occupies precipitous habitats in a range of environments from hot deserts, low mountains and foothills, to high mountain ridges. It is found throughout the Pamir, Tien Shan, Dzhungarian Alatau, Altai, Tuva mountains, and western and eastern Sayan (Map 7.2.5). Heptner *et al.* (1961) distinguished two subspecies, *C. s. alaiana* in the mountains of middle Asia and Kazakhstan, and *C. s. sibirica* in the Altai and Sayan.

Population: The total estimate is between 100,000 to 110,000 animals. Most of these occur in Kirgizstan and Tadjikistan (ca. 70,000) and Kazakhstan (ca. 17,000), with far fewer (8,000 to 9,000) in southern Siberia (3,000 to 3,500 in the Altai, 2,500 in Tannu Ola mountains of Tuva, 1,500 in Western Sayan and 2,000 to 2,500 in Eastern Sayan) and Uzbekistan (2,400; B. Dyakin, *in litt.* 1993). Numbers for the Pamir are unknown, but the species was considered to be common, especially in the western part. A recent survey



Map 7.2.5. General distribution of Asiatic ibex (*Capra* [*ibex*] *sibirica*) **in the CIS. s)** *sibirica*; **a)** ***alaiana.***

in the Tien Shan of Kazakhstan, indicates that ibex numbers have also declined in some areas (Green and Mahon 1995).

Threats: Although hunted legally under licence, most are shot illegally and in large numbers. Siberian winters are often characterised by deep snow and hard frosts which have negative impacts on ibex numbers. In Middle Asia and Kazakhstan, herds have been decimated by infestations of mange (*Acarus siro*), and in Chatkal Nature Reserve numbers have fluctuated as much as 30% due to outbreaks of sarctopic mange (Chernagaev *et al.* 1995).

Conservation measures taken: Apart from protected areas Asiatic ibex receives no other formal protection. It is known in the following Nature Reserves: ***Kazakhstan***: Aksu-Dzhabagly, Alma-Ata and Markakol; ***Kirgizstan***: Besh-Aral, Issyk-Kul', Naryn and Sary-Chelek; ***Russia***: Sayano-Shushensky and Altai; ***Tadjikistan***: Ramit; ***Uzbekistan***: Chatkal, Gissar and Zaamin (Map 7.2.1, Table 7.2.1). Chatkal Nature Reserve is joined as a "cluster reserve" with Sary-Chelek Nature Reserve located 50km southeast of Tashkent, and occupies the southwest end of Chatkal range in the western Tien Shan (41°N, 69°59'E). Most of these protected areas harbour small populations of between 200 and 400 ibex, although Sayano-Shushensky Reserve has about 1,000, and Alma-Ata has up to 700 animals. The average number of ibex estimated in Chatkal NR between 1984 and 1993 was around 500 animals/year, although numbers fluctuated as much as 30%. A similar number of ibex was estimated for Gissar NR between 1983 and 1990 (Chernagaev *et al.* 1995).

Status within country: Not threatened. Although not threatened in total, many individual populations are in danger of being greatly reduced or even extirpated, in many parts of its range.

Conservation measures proposed: 1) Create an adequate protected areas system for ibex in central and eastern regions of Eastern Sayan. **2)** Stop poaching, with special effort made in areas with currently heavy exploitation.

Tadjik markhor (*Capra falconeri heptneri*)

Distribution: Previously, markhor occupied most of the mountains lying along the north banks of the Upper Amu Darya and the Pyanj rivers from Turkmenistan to Tadjikistan. Today it is found in only about two to three scattered populations in a greatly reduced distribution. It is limited to the region between lower Pyanj and the Vakhsh rivers near Kulyab in Tadjikistan (about 70°E and 37°40' to 38°N), and some may still exist in the Kugitangtau range in Uzbekistan and Turkmenistan (around 66°40'E and 37°30'N) (Map 7.2.4).

Population: The total population is estimated to be about 700 animals, and numbers are generally decreasing. In the Khozratisho range and in Kushvoristone (Tadjikistan) there were around 350 markhor (Sokov 1989), but nothing is known about current population numbers in Tadjikistan. A recent survey in Kugitang revealed that its western (Turkmenistan) slopes harbour over 250 markhor (Weinberg *et al.*, in press). In the early 1980s there were 400 in the whole of Uzbekistan according to the Uzbek Red Data Book (1983), but in 1994 there were only 290 estimated in this Republic, with only 86 counted in the Surkhan Nature Reserve in May 1993 (Chernagaev *et al.* 1995).

Threats: Reportedly poached for meat and for horns which are used for medicinal purposes in the large Asian market. Also threatened by habitat loss, disturbance and forage competition from domestic livestock. Most recently, the civil war has affected the Babatagh mountains, and poaching is totally uncontrolled.

Conservation measures taken: Listed as Critical (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES along with all other markhor, in Category I of the USSR Red Data Book (Borodin 1984), and listed in the Uzbek Red Data Book (1983). It occurs in three Nature Reserves: Kugitang (Turkmensitan), Surkhan (Uzbekistan), and Dashti Jum (Tadjikistan) (Map 7.2.1, Table 7.2.1). Hunting by foreigners is currently permitted (at least two markhor/year) in Tadjikistan, with the government planning to allow more to be hunted in 1993–94, but the current status of hunting is uncertain. In Uzbekistan, two markhor were taken in 1994, and "Glavbiocontrol" of the State Committee for Nature Protection planned for two markhor licences to be issued in 1995 (Anon. 1995b).

A captive herd of markhor is reported in Dashti Jum NR, and a captive breeding program is apparently underway in Ramit Nature Reserve in the Gissar range (Tadjikistan), with about 10 animals released by 1989. However, the Islamic opposition set up its headquarters in Ramit NR during the civil war and ensuing battles did extensive damage to the ecology of the reserve. All markhor currently held in western zoos are considered to belong to this subspecies.

Status within country: Endangered.

Conservation measures proposed: 1) Stop poaching as soon as possible. 2) Halt trophy hunting until professional biologists have completed adequate population surveys and thoroughly assessed the suitability of such programs. 3) Enlarge the size of the Kugitang Nature Reserve (Turkmenistan) on the western slopes of the Kugitangtau, because it protects only the high elevation summer habitat of markhor and the currently unprotected lower winter ranges are grazed by livestock.

East Caucasian or Daghestan tur (*Capra cylindricornis*)

Distribution: This species' range begins around the headwaters of the Baksan river (about 42°N, 43°E) east of Mount Elbrus and stretches for some 600km eastwards along both slopes of the Greater Caucasus to Babadagh mountain (Kuliyev 1981; Zalkin 1955) (Map 7.2.6).

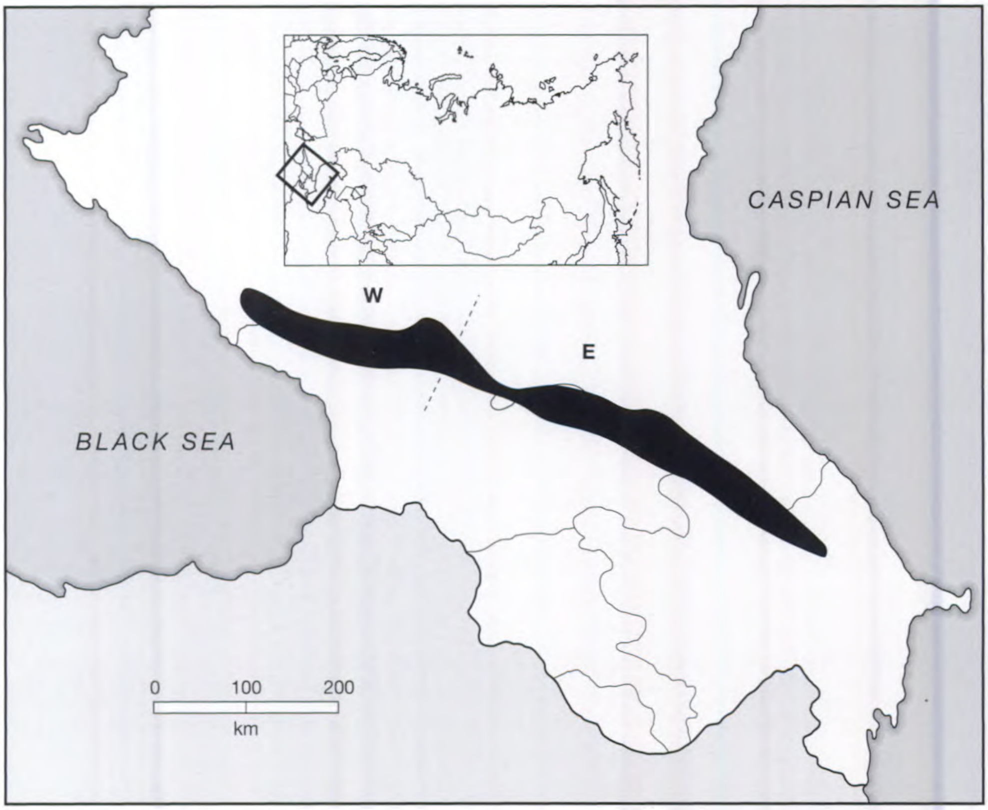
Population: Following a period of increase between the 1940s and 1960s, numbers have since declined. In the late 1960s and early 1970s, the total number was estimated to be between 25,000 to 30,000 animals (Kuliyev 1981; Ravkin 1975), but by the late 1980s had declined by >30% to between 18,000 and 20,000 head, of which ca. 2,000 occurred in Georgia. The latest data (Magomedov and Akhmedov 1994) suggest up to 20,000 tur for Daghestan alone, but this may be optimistic. Nevertheless, if this figure is accurate, the total current population exceeds 25,000 tur.

Threats: Poaching occurs, and some areas of their range are overgrazed by domestic livestock.

Conservation measures taken: Listed as Vulnerable (A1d+2de,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and placed in Category III in the Georgian Red Data Book (1982). Hunting is forbidden in Georgia, but is permitted under licence in Azerbaijan and Russia. This species of tur is found in several Nature Reserves: 5,200 in Kabardin-Balkarian (Russia), 1,000 in North-Ossetian (Russia), 700 in Lagodekhi (Georgia), and 3,000 in Zakataly (Azerbaijan) (Map 7.2.1, Table 7.2.1). Other protected areas with this species include Tushetian and Kazbegi (Georgia), and in Ilisu and Ismailly together with a sanctuary of the same name (Azerbaijan). Of these, tur receive effective protection only in Kabardin-Balkarian, North-Ossetian, Lagodekhi and Zakataly Nature Reserves.

Status within country: Vulnerable.

Adult male East Caucasian or Daghestan tur (*Capra cylindricornis*) in captivity.



Map 7.2.6. Distributions of E) East Caucasian or Daghestan tur (*Capra cylindricornis*), and of W) Kuban or West Caucasian tur (*Capra [ibex] caucasica*) in the CIS.

Conservation measures proposed: 1) Create new reserves, particularly in Chechen-Ingushio and Daghestan on the border with Georgia and Azerbaijan. **2)** Strictly enforce protection measures outside the 4-month hunting season. If controls are successful and the population responds, **3)** consider the possibility of increasing the annual hunting quota.

Kuban or West Caucasian tur (*Capra [ibex] caucasica*)

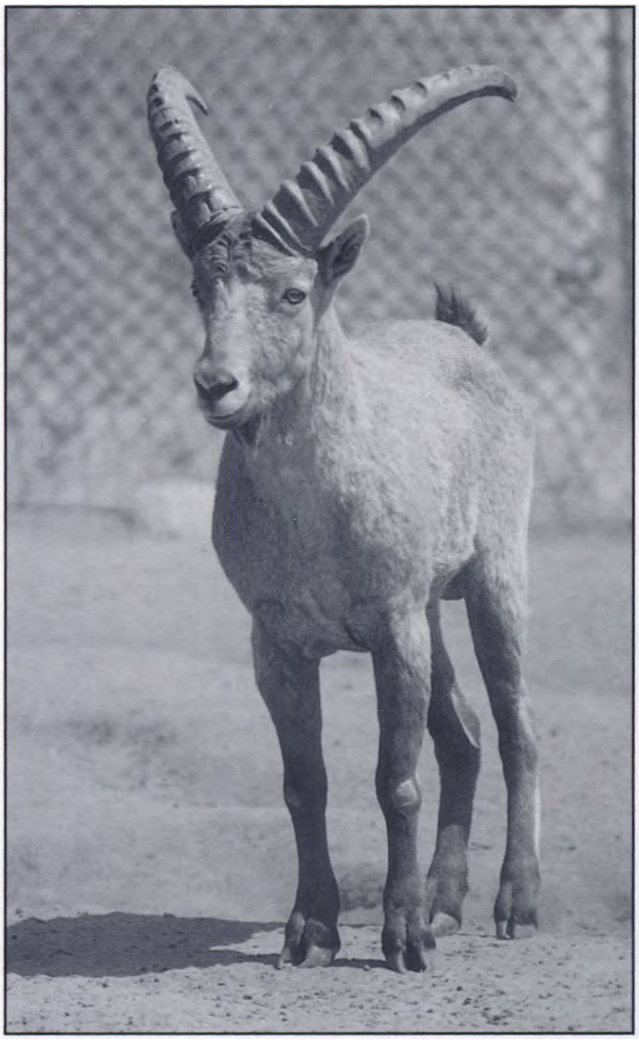
Distribution: The range of this tur in the western part of the Greater Caucasus, stretches about 300km from Chugush mountain (about 44°N, 40°E) northeast of Sochi, to the upper Baksan river (about 43°N, 43°E) in the central part of the mountain range (Kotov 1968) (Map 7.2.6).

Population: The total population estimate in the late 1980s was ca. 12,000 animals, but in the last two to three years numbers have been declining significantly (P. Weinberg, unpubl. data).

Threats: Livestock grazing and particularly poaching are the major threats, combined with the impacts of severe winters.

Conservation measures taken: Listed as Endangered (A1d+2cde) in both the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and the Karachai-Circassia Red Data Book (1988). This tur is protected in the Caucasus Nature Reserve (Russia) which has played a major part in its conservation (Bannikov 1977). It also occurs in the following Nature Reserves: Teberda (Karachai-Circassia, Russia), and Pskhu-Gumista and Ritsa (Georgia) (Map 7.2.1, Table 7.2.1). Hunting under licence is permitted in some areas.

A captive male Kuban or West Caucasian tur (*Capra [ibex] caucasica*). San Diego Wild Animal Park, California, USA.



D. Shackleton

Status within country: Vulnerable.

Conservation measures proposed: The most useful conservation measure at present would be to increase the level and effectiveness of protection in existing reserves, because organisation of new ones is unlikely.

Transcaucasus or Armenian mouflon (*Ovis orientalis gmelinii*)

Distribution: Inhabits the Transcaucasus, specifically the Zangezur (Zangezrskiy) range in Armenia and Nakhichevan, and possibly just into the extreme southwestern tip of Azerbaijan. However, most occur on the Nakhichevan side of these mountains from 40°N, 45°E to 38°30'N, 46°30'E (Map 7.2.7).

Population: Current numbers are unknown, but probably ≤1,000 individuals. It was numerous until the 1950s when herds of up to 200 could be seen. It has since declined, and by the end of the 1960s, there were ≤750 in Azerbaijan and Armenia. For a brief period, numbers did increase until the late 1970s when the population in Nakhichevan ASSR alone numbered 1,000 to 1,200 animals (Alekperov and Kuliev 1981).

Threats: In danger of extinction due to poaching, and loss of forage and water to domestic livestock grazing.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Category I of the USSR Red Data Book (Borodin 1984). In Armenia, it has been forbidden to hunt them since 1936. Armenian mouflon is found only in two protected areas, the Khosrov Nature Reserve in Armenia created for this mouflon's protection but which fails to fulfil this task because of territorial changes, and the Ordubad Sanctuary (Nakhichevan, Azerbaijan) (Map 7.2.1, Table 7.2.1). A captive breeding program has been initiated at the Zoological Institute of Armenia.

Status within country: Endangered.

Conservation measures proposed: 1) Determine current numbers, status and distribution as soon as possible. **2)** Expand Khosrov Nature Reserve to include areas which had been used previously by sheep, and **3)** reorganise the Orbubad Sanctuary into a state reserve. **4)** Control livestock and eliminate, or significantly reduce poaching.

Ustyurt sheep or Transcaspian urial (*Ovis orientalis [vignei] arkal*)

Distribution: Found in Kazakhstan, Turkmenistan and Uzbekistan where it inhabits the ravines surrounding the Ustyurt plateau and Kaplankyr, and on the Mangyshlak Peninsula where it is found in the moderately high mountains of Karatau, the precipices and ravines of Northern Aktau (all in Mangysklan and to the south to Kara-Bogaz-gol) and similar habitat in Karagie, Kaunda, Kazakhla, Kulandaga, Kazakhly-Sora and other areas (Map 7.2.7).

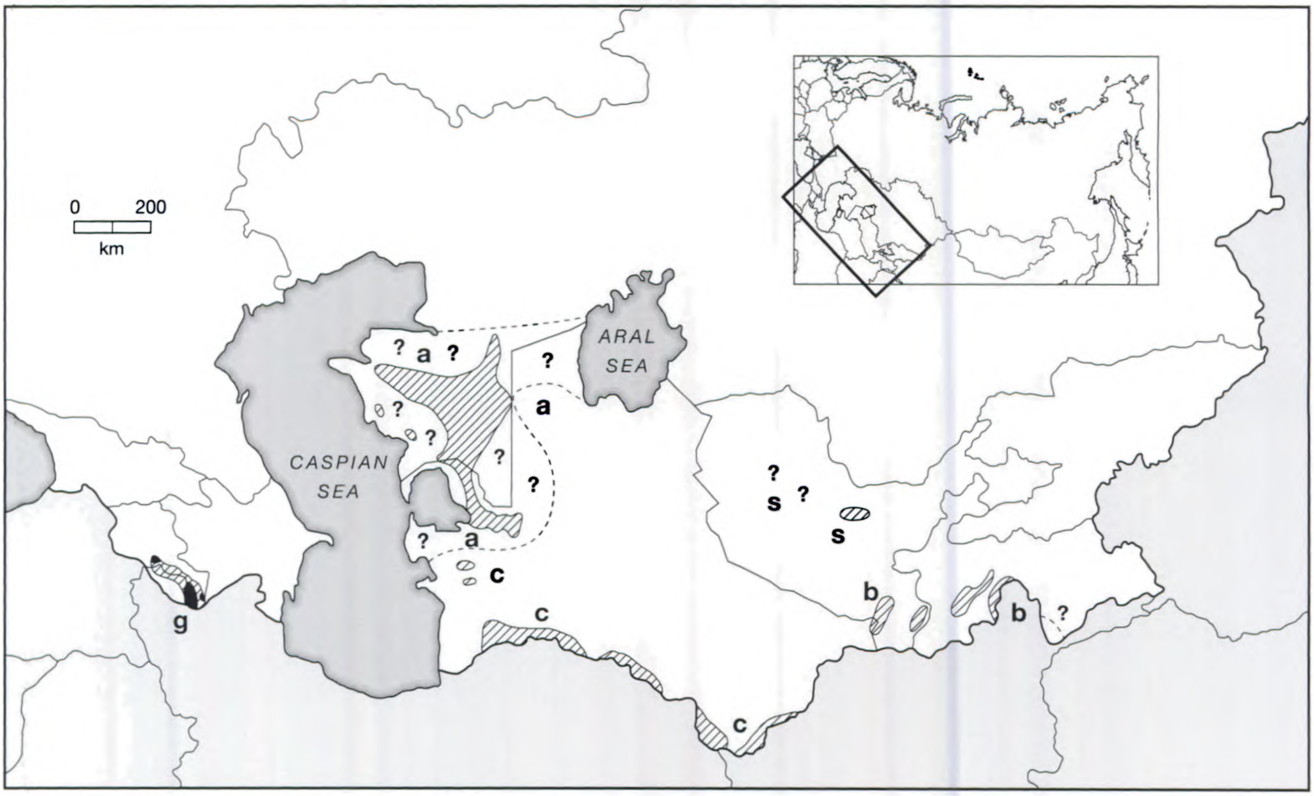
Population: The total number estimated at the beginning of the 1990s was ca. 6,000 animals. Numbers had declined sharply before the mid-1960s, when 3,000 were estimated for Kazakhstan, and continued to decline to 2,000 by the 1970s and 1,500 at the beginning of the 1980s (Lankin 1982; Savinov and Bekenov 1977). In the early 1980s, 800 were estimated in Turkmenistan, of which 500 were found along the shores of Kara-Bogaz Gol and 300 in the southern ravines (Zarkhidze and Gorbunov 1983). Following protection resulting from its listing in the USSR Red Data Book, numbers of this subspecies began to increase in the latter half of the 1980s, with some populations re-establishing themselves naturally. However, since the early 1990s the populations appear to have once more declined. About 300 were thought to inhabit Uzbekistan in 1983 but have since declined (O. Tsaruk, *in litt.* 1994) with ca. 40 near the border with Turkmenistan (B. Dyakin, pers. comm. to E. Mukhina, 1995).

Threats: Poaching remains a major threat and is the cause of the latest decline. It is carried out by locals, especially around the limited waterholes used by the urial, using both firearms and snares (Fedosenko 1986; Gorbunov 1986).

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and as Category II in the USSR Red Data Book (Borodin 1984). This urial is found in the following Nature Reserves (Sokolov and Syroechkovsky 1990b): Kaplankyr (Turkmenistan); Ustyurt (about 600 head) (Kazakhstan) (Map 7.2.1, Table 7.2.1). The Uzbekistan State Committee for Nature Protection (Republican State Board For Conservation and Utilisation of Flora, Fauna, and Protected Lands) plans to allow two of this urial to be taken by foreign hunters in 1995 (Anon. 1995b).

Status within country: Vulnerable.

Map 7.2.7. General distributions of g) Transcaucasus or Armenian mouflon (*Ovis orientalis gmelinii*), a) Transcaspian urial (*O. o. arkal*), s) Kizil-Kum or Severtzov's urial (*O. o. severtzovi*), b) Bukhara sheep (*O. o. bocharensis*), and c) Afghan urial (*O. o. cycloceros*), in the CIS.



An adult male Transcaspian urial (*Ovis orientalis [vignei] arkal*) showing its characteristic neck ruff.

Conservation measures proposed: Reduce significantly poaching. If this can be controlled, the existing measures will be sufficient as long as they are maintained.

Bukhara urial (*Ovis orientalis [vignei] bocharensis*)

Distribution: Bukhara urial occurs in Tadjikistan, Turkmenistan and Uzbekistan. It is found on the north sides of the Amu Darya and Pyanj rivers, where it inhabits the Kugitang and Baisuntau mountains, the Babatagh and Karatau ranges, the Vakhsh range on the east bank of the Vakhsh river, and the southwestern part of the Pamir (Luzhevsky 1977; Sapozhnikov 1976) (Map 7.2.7). The taxonomic status of the last population is uncertain; it may belong to Ladakh urial (*O. o. vignei*).

Population: Numbers have fluctuated slightly since the 1970s (Frolov and Golub 1983; Luzhevsky 1977), and by the late 1980s, the total number estimated was only 1,000 animals (Prisyazhniuk 1990). However, Sokov (1989) mentioned >1,000 for Tadjikistan alone, so together with Uzbekistan and Turkmenistan there might have been up to some 1,200 animals. However, numbers are believed to be decreasing now, and in some areas populations are very small. For example, in Uzbekistan on the western slopes of the Kugitangtau on the Turkmen-Uzbek border, there may be as few as 100 individuals (B. Dyakin, Dep. of Hunting Management, Uzbekistan, pers. comm. to E. Mukhina), with only five counted in May 1993 in the Surkhan Nature Reserve (Chernagaev *et al.* 1995).

Threats: The decrease in numbers is attributed to poaching and competition with domestic livestock, coupled with droughts and severe winters. The Babatagh mountains have been a centre in the civil war in Tadjikistan and poaching is totally uncontrolled. The winters of 1968–69 and 1971–72 were especially harsh in Tadjikistan, and many urial carcasses were found in spring 1969 in the Kugitangtau.

Conservation measures taken: Listed as Endangered (A2cde,C1+2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and as Category I in the USSR Red Data Book (Borodin 1984). This urial is found in the following Nature Reserves: Dashti Tum (Tadjikistan), Kugitang (Turkmenistan) and Surkhan (Uzbekistan) (Map 7.2.1, Table 7.2.1). In 1991, 14 were reported in Surkhan NR but only five in 1993 (Kh. Mengliev, pers. comm. to E. Mukhina 1995). The Uzbekistan State Committee for Nature Protection plans to allow two of this urial to be taken by foreign hunters in 1995 (Anon. 1995b), and Tadjikistan planned to allow hunts for this urial.

Status within country: Endangered.

Conservation measures proposed: 1) Halt all hunting. **2)** Carry out surveys and censuses. **3)** Reconsider the potential for hunting programs only if they are sustainable and will clearly improve conservation status of markhor. If not, maintain a hunting ban and provide further protection. **4)** Establish reserves at Babatagh (when fighting ceases) and at Baisuntau in Uzbekistan. **5)** Examine the possibility of re-establishing a population in the Tigrovaya Balka Nature Reserve. Reduce significantly **6)** poaching and **7)** competition with livestock.

Afghan or Turkmen urial (*Ovis orientalis [vignei] cycloceros*)

Distribution: Found only in Turkmenistan, where its distribution stretches south-eastwards in scattered populations from the Large (about 39°40'N and 54°30'E) and Small Balkhan mountains north of Nebit-Dagh, through the Kopet-Dagh mountains, in the mountains on the right bank of the Tejen, in an area between the Kushka and Murgab rivers, and in the ravines and rolling hills of Namansaar, Yer Oilanduz (Badkhyz) as far east as Southern Karabil (about 36°20'N and 64°30'N) (Map 7.2.7).

Population: The estimate for the total population in the late 1980s and early 1990s was between 10,500 and 11,000 urial. Numbers had increased slightly from the estimates of 7,000 to 9,000 made in the 1970s (Babaev *et al.* 1978), when there were 2,000 in the Kopet-Dagh Reserve, with about 1,500 in the Badkhyz Reserve (Gorelov 1978). Although about half the total numbers probably still occur within protected areas, outside them these urial exist mainly in relatively low densities. Recent evidence reports a significant decline in numbers in the eastern Kopet Dagh and in Badkhyz, with only 150 to 200 in Big Balkhan and 300 to 350 in the western Kopet Dagh (V. Lukarevsky, *in litt.* 1994).

Threats: Poaching is the main threat, but there is also competition from domestic livestock for forage and water.

Conservation measures taken: Listed as Vulnerable (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and placed in Category II of the USSR Red Data Book (Borodin 1984). Approximately half the total population lives in protected areas in Turkmenistan. Kopet Dagh Nature Reserve was established primarily for preservation of this subspecies, and they are also found in Siunt-Khasardag and Badkhyz Nature Reserves (Map 7.2.1, Table 7.2.1). The Turkmenistan Government planned hunts for two of this urial in 1995.

Status within country: Vulnerable.

Conservation measures proposed: 1) Increase the enforcement of existing protective measures both in and outside protected areas. **2)** Decrease poaching. **3)** Ensure any hunting programs are sustainable and based on sound biological data.

Kizil-Kum or Severtzov's urial (*Ovis orientalis [vignei] severtzovi*)

Distribution: Previously distributed over a wide area of Uzbekistan where it occupied the mountains of Beltau, Aktau, Tamdytau, and other low ranges in the high desert regions. Today, it is mostly restricted to the higher, widespread mountains of Nuratau, north of Samarkand (Uzbekistan) between about 41°N, 66°E to 40°10'N, 67°30E (Map 7.2.7).

Population: The most recent estimates, based on density estimates extrapolated from census transects made in 1994, suggests there are >2,000 urial, which compared to estimates in 1983 of 1,500 indicates a possible increase (Chernagaev *et al.* 1994; E. Chernagaev, pers. comm. to E. Mukhina 1995).

Threats: The current survival of this urial depends entirely on the Nuratau Nature Reserve. However, there is strong pressure from locals to us the area (see **Conservation measures taken** below). The previous decline in numbers was attributed to poaching, and to competition and disturbance from domestic livestock. Poaching is still a significant problem outside the Reserve, and almost all urial that leave it are shot (E. Mukhina, *in litt.* 1994).

Conservation measures taken: Listed as Endangered (A2cde,C2b) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and in Category I of the USSR Red Data Book (1984). The species occurs only in one protected area, the Nuratau Nature Reserve (Uzbekistan) (Map 7.2.1, Table 7.2.1), where approximately 700 used to exist. This Reserve, established in 1975, is vital to the subspecies' continued existence. Currently it protects ca. 98% of the total population, so it is essential to maintain the reserve's effectiveness. A few years ago, 4,386ha of the Reserve's 22,130ha were given over to forestry management (although the transaction is not yet legal), and the area is now badly degraded by livestock grazing. Most recently, local pastoralists have requested that the Reserve be turned over to them in this period of financial crisis. It must be noted that urial numbers in this reserve fluctuate seasonally. There is currently also a captive herd of about three animals (1995) in the Nuratau Nature Reserve. Since 1994, two urial each year have been allowed to be hunted the Reserve.

Status within country: Endangered.

Conservation measures proposed: 1) Ensure the maintenance of Nuratau Nature Reserve and provide its staff with support to undertake surveys and an ecological study. **2)** Increase the size of the Nuratau Reserve so that it includes all the urial's most important seasonal ranges. **3)** Determine and then eliminate the causes of poaching. **4)** Provide local people with a reasonable livelihood, because they depend at present on parts of the Reserve for grazing livestock, their main means of support. A proposal has been made and discussed with locals regarding potential economic developments (E. Mukhina, *in litt.* 1995); **5)** Conduct surveys to determine distribution and numbers in the remainder of its range.

Altai argali (*Ovis ammon ammon*)

Distribution: The Altai argali was previously found in Tuva, south Altai and southeast Zabaikal, but by the 1980s it had disappeared in the Kuray and South-Chuya ranges and from the Ukok plateau. Currently, it is found only in the remote southeast Altai mountains at the head of the Bukhtarma river above 2,400m asl, east along the Sailyugem range, in part of the Shapshal range, and into the mountains of Mongun-Taiga and the western Tannu-Ola range (Map 7.2.8). It re-occurs further east on the Sangilen plateau (Map 7.2.8).

Population: Current total population estimates range from 450 and 700 individuals. Since the mid-1980s, the 300 animals in the Altai had remained relatively stable or possibly increased slightly, while 270 were estimated to exist in Tuva (Smirnov 1990). However, today no population is reported to be larger >50 animals and many have <20 (J. Dolan, pers. comm. to D.M. Shackleton, 1993).

Threats: Both poaching and domestic livestock (competition and disturbance) are the main threats to its continued survival. Poaching appears to be a particular problem in Tuva, and winter cattle grazing in the Altai. Heavy hunting of these sheep is also reported when they cross into Mongolia (J. Dolan, pers. comm. 1993). The most recent report (1994) indicates that licences to shoot this argali are being sold at US $30,000 each.

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), as a Category I species in the USSR Red Data Book (Borodin 1984), along with all other argali it is in Appendix II of CITES, and listed as "Endangered" in the U.S. Endangered Species Act of 1973. Imports of argali have been banned by the European Union. It occurs in only two protected areas: Kosh-Agach Sanctuary and Altai Nature Reserve (Map 7.2.1, Table 7.2.1). Kosh-Agach plays an insignificant role in the subspecies' conservation; it harbours about 160, and only some 60 occur in the Altai Reserve. A small captive herd is kept at Chirga (Altai) at the laboratory of the Biological Institute and Institute of Genetics and Cytology of the Siberian branch of the Academy of Sciences.

Status within country: Endangered.

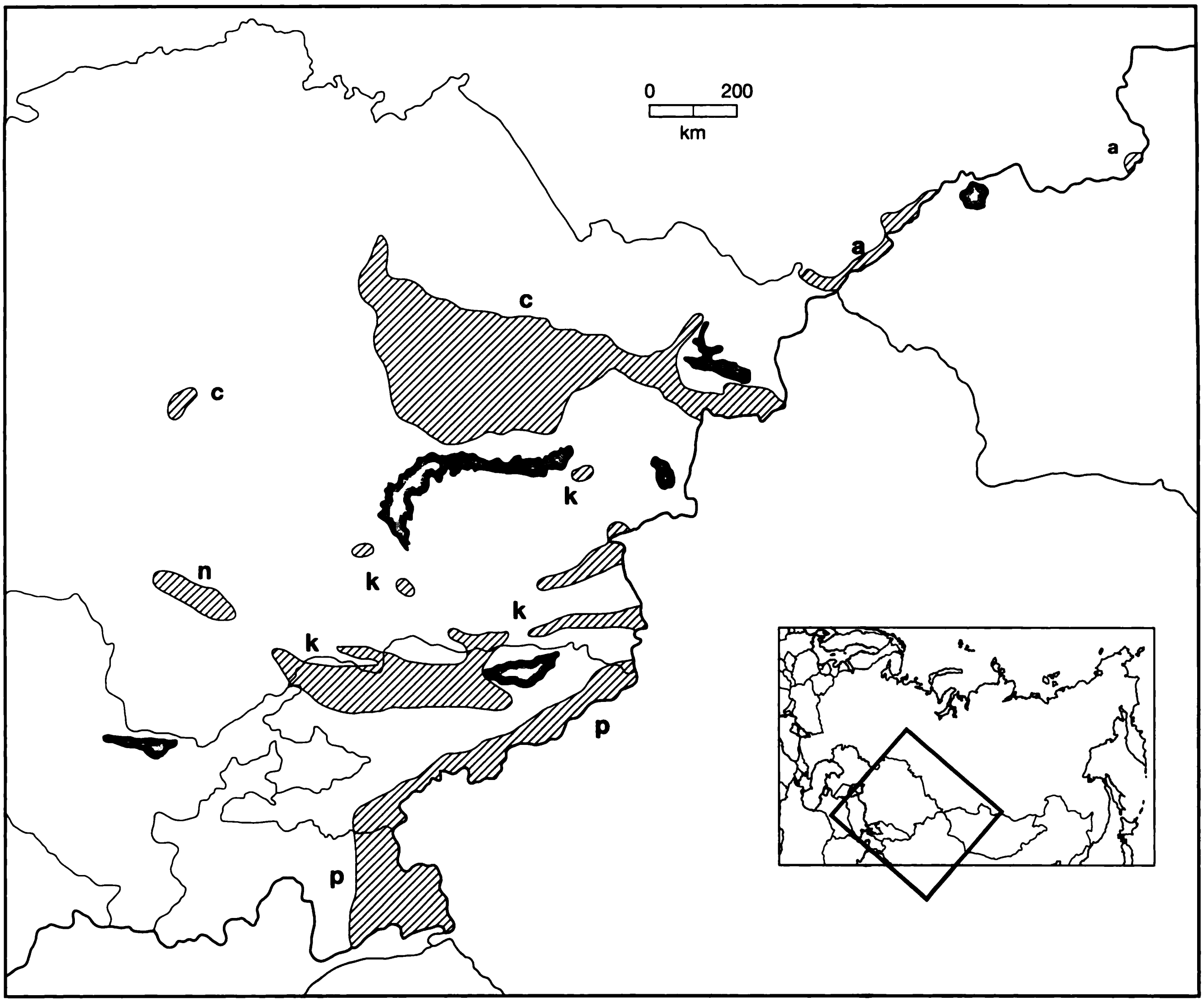
Conservation measures proposed: 1) Halt all current hunting. **2)** Establish, immediately, protected areas within the eastern boundaries of Sailyugem on the border with Mongolia, together with other reserves in Mongun-Taiga (Tuva). One such area in Altai would be in the upper reaches of the Chagan-Burgazy river, where a protected area of about 15,000 to 20,000ha should be established for 150 to 200 argali. **3)** Halt winter grazing of cattle in the southern part of the Altai Reserve, and **4)** obtain co-operation with the Mongolian Government to control the hunting of this argali when it crosses into their country.

Kazakhstan argali (*Ovis ammon collium*)

Distribution: It occurs only in Kazakhstan where this argali inhabits the Kazakhsky Melkosopochnik southeast from around Tselinograd to the Tarbagatay range on the border with China, and as far south as the mountains north of Lake Balkhash. There are two other isolated distributions in the Ulutau mountains (about 49°N 67°E), west of the Kazakhsky Melkosopochnik, and in the Kalba range northwest of Lake Zaysan (about 49°N 83°E) (Map 7.2.8).

Population: The total population was estimated to be around 8,000 to 10,000 animals. Numbers had increased between 1985 and 1990, due to improved protection and the creation of protected areas. In the Kazakhsky Melkosopochnik, where the greatest increases were seen, there were about 8,000 Kazakhstan argali and areas were said to have been naturally re-populated, but whether this was the result of an increase in numbers, of migration, or both, is not reported. It had also increased in the Tarbagatay and Monrak mountains.

Threats: Poaching, and habitat loss and competition from domestic livestock.



Map 7.2.8. General distributions of Altai argali a) *Ovis ammon ammon*, c) Kazakhstan argali (*O. a. collium*), k) Tien Shan argali (*O. a. karelini*), n) Kara Tau argali (*O. a. nigrimontana*), and p) Marco Polo sheep (*O. a. polii*), in the CIS.

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and classed as Category III in the USSR Red Data Book (Borodin 1984), although relatively recent increase in numbers suggested they were out of danger a few years ago. The subspecies is in Appendix II of CITES along with all other argali, "Endangered" in the U.S. Endangered Species Act of 1973, and banned from import by the European Union. Previously it was illegal to hunt this subspecies, but recently (1994) some hunting was opened to foreign hunters. This argali is found only in two National Parks; Karkaraly and Bayan-Aul (Map 7.2.1, Table 2.1).

Status within country: Not threatened – but only if protection is maintained at least at present levels.

Conservation measures proposed: 1) Establish additional protected areas to represent the subspecies' total range. The two National Parks are relatively close together in the Kazakhsky Melkosopochnik. Suitable areas might include the Ermentau range and Tarbagatay, amongst others. **2)** If its status is shown to be secure based on reliable demographic data, consider a limited and carefully controlled sustainable trophy hunting program for foreign hunters. This could benefit both local people and provide funds for the conservation of the subspecies and its habitat.

Tien Shan argali (*Ovis ammon karelini*)

Distribution: This argali is distributed on the northern flanks of the Tien Shan in northeast Kirgizstan and southeast Kazakhstan (Map 7.2.8), where it occupies a wide variety of habitats from high mountains to desert regions. Its western limit is in the Talass (Talasskiya) Alatau just east of Chimkent, from where it extends east to Lake Issyk-Kul north of the Naryn river. It also stretches into the Kungey Alatau and Zaili Alatau which lie to the north of the Lake Issyk-Kul. Further east the distribution continues into the Ketmen mountains on the border with China, and further north it is found in the low Chu-Ili mountains northwest of Alma-Ata, and in the Dzhungarian Alatau east of Taldy-Kurgan. Tien Shan argali is also found in the low mountains south and south-east of Balkash Lake (the Kyskhash, Arganaty, Arkharly, Dzhambul and Baigora mountains).

Population: The total population is estimated to be ≤2,000 animals and numbers are declining. Around 400 occur in the western Tien Shan, and numbers are low (200 to 300) in the northern Tien Shan and in many places they have disappeared completely. Until recently, the Dzhungarian Alatau was reported to contain 600 to 800 of these argali, but the latest report (E. Koshkarev, *in litt.* 1994) stated that this estimate is too high.

Threats: Mainly poaching not only by locals but also by some officials (Green and Mahon 1995), and domestic livestock which compete for forage and water resources.

Conservation measures taken: Listed as Vulnerable (A2cde,C1+2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), it is in Category II in the USSR Red Data Book (Borodin 1984), in Appendix II of CITES, and listed as "Endangered" in the US Endangered Species Act of 1973. It cannot be imported into the European Union. In Kazakhstan, around 250 live on 10,000ha of the Aksu-Dzhabagly Nature Reserve (Map 7.2.1, Table 7.2.1), and another 100 occupy the Kapchagai Hunting Reserve, while in Kirgizstan, small numbers are found in Naryn and Besh-Aralsk reserves. In 1993, licences to shoot this argali in the Kapchagai Hunting Reserve were available to foreign hunters for US $28,000 (K. Braden, *in litt.* 1994).

Status within country: Endangered.

Conservation measures proposed: 1) Create several protected areas on the southwestern spurs of the Dzhungarian Alatau, and at least one in the Arganaty mountains south of Lake Balkhash. **2)** Establish the captive breeding program as proposed for this subspecies by the staff of the Aksu-Dzhabagly Nature Reserve (K. Braden, pers. comm. 1994). **3)** Control poaching. **4)** Evaluate the sustainability of the trophy-hunting program.

Kara Tau argali (*Ovis ammon nigrimontana*)

Distribution: Restricted to the western part of the Kara Tau (Syrdyarya) mountains of Kazakhstan (about 44°N, 68°E) (Map 7.2.8).

Population: Current population status and size are unknown, but believed to be very small, possibly as low as 250 (Grachev 1982) and probably declining. Before World War II, and for 10 to 15 years after, numbers were higher, but by the end of the 1970s, only about 250 remained, with densities in some areas as low as 0.2 argali/km^2 (Gratchev 1982).

Threats: This subspecies is in very real danger of extinction. Their demise is caused by poaching and competition for resources with domestic livestock.

Conservation measures taken: Listed as Critical (C2b) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and along with other argalis it is in Appendix II of CITES, classed as "Endangered" in the U.S. Endangered Species Act of 1973, and cannot be imported into the European Union. The species is also lumped together with *O. a. karelini* and *O. a. collium*, and listed as "Rare" in the Kazakh Red Data Book (1978). It is found in no protected areas.

Status within country: Endangered.

Conservation measures proposed: 1) Initiate a study to collect basic ecological and population data on this one of the least known subspecies of argali. **2)** Use these data to develop adequate conservation management plans. **3)** Establish immediately the long-planned Karatau Nature Reserve, and **4)** provide animals in this area with full protection. **5)** Take the steps necessary to significantly reduce or eliminate poaching.

Marco Polo sheep or Pamir argali (*Ovis ammon polii*)

Distribution: The Marco Polo sheep lives in areas between 3,500 and 5,500m asl in the Alai, Eastern Pamir, and Inner and Central Tien Shan that run along the border with Afghanistan and China (Map 7.2.8). The western edge of its distribution in the Pamir is around Sarez lake, Bazardara, while the northern part of its range extends just south of Tekes, east of Lake Issyk-Kul (Kazakhstan). However, this argali's current distribution is not completely understood (Luschekina and Fedosenko 1994).

Population: Numbers have declined significantly since World War II. The estimate for total numbers made in the early 1980s, is between 15,000 and 16,000 animals, although others believe there are far fewer. Most of these occur in the Pamir (10,000 to 12,000 – Odinashoev *et al.* 1990; 9,900 to 10,300 – Luschekina and Fedosenko 1994), with around 3,500 in the Internal Tien Shan, and 1,500 in the Central Tien Shan. Numbers in the Pamir of Kirgizstan appear to have declined very recently in some areas, and in others it has totally disappeared, while some sub-populations may have remained stable (Luschekina and Fedosenko 1994). The average density estimated in 11 regions in 1991 was 1.96 argali/km^2 (±4.77 SD; after Luschekina and Fedosenko 1994).

Threats: Poaching, and competition from domestic livestock. Marco Polo sheep is one of the most highly prized subspecies of argali for trophy hunters. The unstable conditions in Tadjikistan make conservation difficult (Luschekina and Fedosenko 1994)

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, and as "Endangered" in the U.S. Endangered Species Act of 1973. Imports are banned into the European Union. There is some uncertainty as to whether it occurs in any protected areas. It may occur in the recently created Narynskiy Nature Reserve in Kirgizstan, which covers about 86,000ha. Marco Polo sheep was totally protected from hunting in Tadjikistan for many years, but recently (since 1987 in Tadjikistan, and since 1990 in Kirgizstan, although harvestable numbers were reduced in 1994 based on census figures) a limited number of hunting licences have been issued to foreign hunters (Luschekina and Fedosenko 1994). In Tadjikistan, hunting outfitters lease hunting areas and receive 20 to 25 licences each year, each worth US$16,000. In Tadjikistan, most of the money generated is used to carry out the hunts, very little is used for conservation other than for aerial censuses, in some cases for provision of salt licks and supplemental feed, and also for wolf control, however, the exact disbursement of funds in Kirgizstan is unknown (Luschekina and Fedosenko 1994).

Status within country: Not threatened, but its status will change unless effective conservation actions are taken.

Conservation measures proposed: 1) Determine the status, distribution and population demography of this argali. **2)** Establish, as quickly as possible, an adequate protected areas network for the taxon, including the national park suggested by Sokov (1989) for the southern Pamir. **3)** Base the evaluation and operation of hunting programs on biological data gathered annually, and closely monitor all populations each year. **4)** Ensure that a significant portion of funds from trophy hunting are used for argali conservation.

Snow sheep (*Ovis nivicola*)

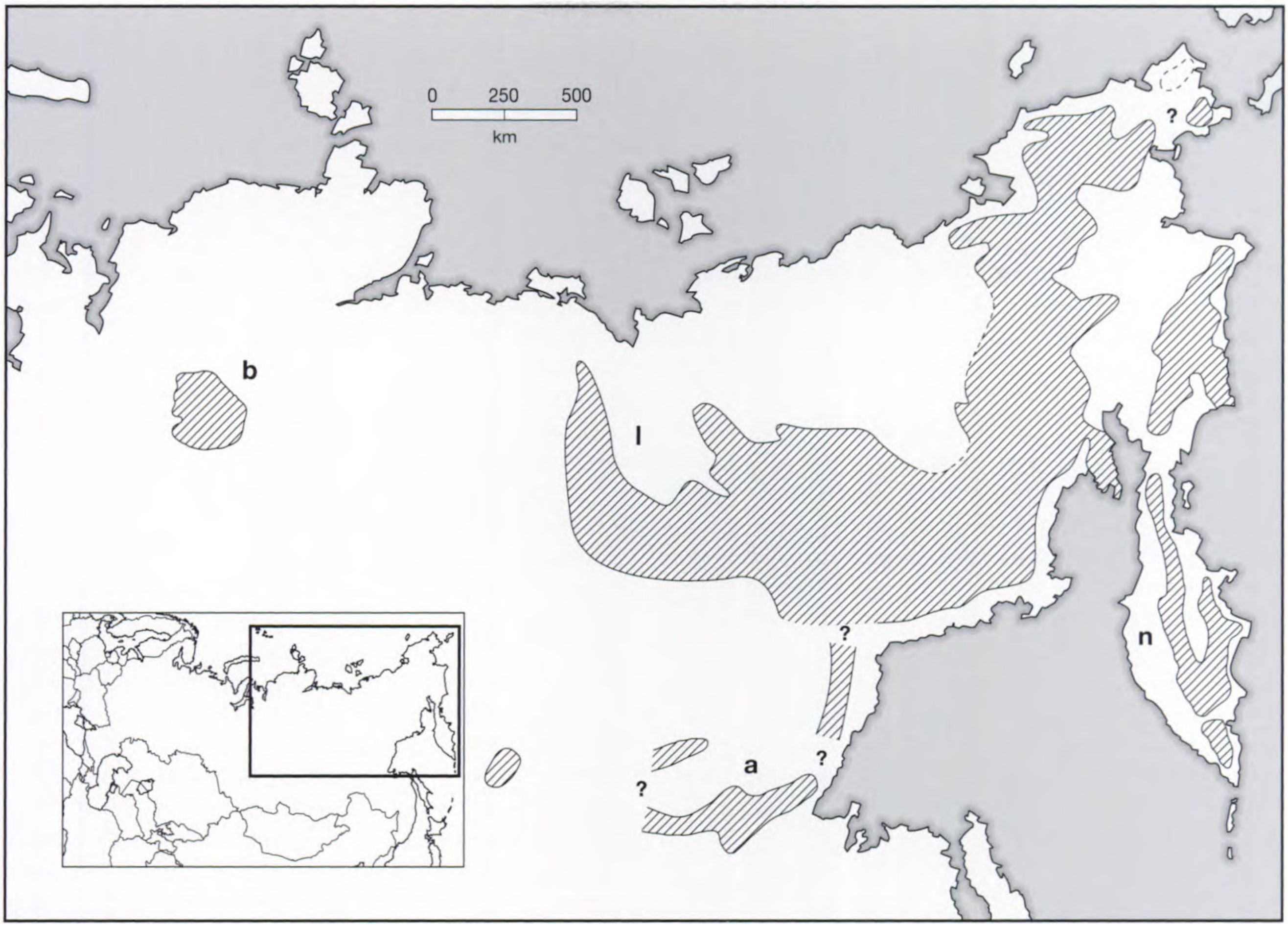
Distribution: The Snow sheep is distributed throughout most of the mountain regions of eastern Siberia (Russia) (Map 7.2.9). The main distribution area begins just east of the Lena river and stretches as far as the Tenkany mountains on the Chukotsk peninsula on the western edge of the Bering strait. This sheep also occurs in the volcanic mountains running down the Kamchatka peninsula, and the southern limit of the species appears to be in the Stanovoi range and Kodar massif, south of the Lena river. In addition, a totally isolated population, referred to Putoran snow sheep (*O. n. borealis*) is restricted to the Putoran mountains south of the Tamyr peninsula (about 66° to 70°N and 92° to 98°E), east of the Yenisey river, and separated from the nearest Yakutian population by about 1,000km (Map 7.2.9).

Population: The total snow sheep population size is estimated to be between 85,000 and 95,000; comprised of 12,000 to 13,000 Kamchatka sheep (*O. n. nivicola*), 55,000 to 60,000 Yakutian sheep (*O. n. lydekkeri*), 10,000 to 12,000 Okhotsk sheep (*O. n. alleni*), 3,000 to 3,500 Koryak sheep (*O. n. koriakorum*), 3,000 to 3,500 Chukotsk sheep (*O. n. tschuktschorum*), and 3,500 Putoran or Norilsk sheep (*O. n. borealis*) (Revin *et al.* 1988). Currently, the numbers of Kamchatka sheep are declining, with Putoran sheep possibly slowly increasing, and the rest believed to be stable.

Threats: Poaching takes at least 6,000 snow sheep annually, but mostly affects animals living close to human settlements. Sheep on the Chukotsk peninsula also compete with reindeer (*Rangifer tarandus*).

Conservation measures taken: Kamchatka sheep (*O. n. nivicola*) is listed as Lower Risk (nt), and Putoran or Norilsk sheep (*O. n. borealis*) is listed Vulnerable (D2) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and as Category III in the USSR Red Data Book (Borodin 1984). Despite this some have been hunted recently by foreign trophy hunters. Sheep in the Koryask and Chukotsk ranges are listed under *O. n. koriakum* as Category II in the Russian Red Data Book (1983). The other subspecies are considered as game animals and a limited number of licences are being sold in Yakutia and Kamchatka, many to foreign hunters.

Approximately 1,300 Putoran sheep are protected in the Putoran Reserve, about 600 of the Kamchatka subspecies occur in Kronotsky Reserve, while for



Map 7.2.9. General distribution of snow sheep (*Ovis nivicola*) in Russia. l) *O. n. lydekkeri*; n) *O. n. nivicola*; b) *O. n. borealis*; a) *O. n. alleni*.

Okhotsk sheep, about 1,700 are protected in the Magadan Reserve and 1,200 in Dzhugdzhur Reserve (Map 7.2.1, Table 7.2.).

Status within country: Not threatened – *O. n. nivicola*, *O. n. alleni* and *O. n. lydekkeri*; Rare – *O. n. tschuktschorum* and *O. n. koriakorum*; Endangered – *O. n. borealis*.

Conservation measures proposed: 1) Establish the several reserves proposed for conservation of the Yakutian subspecies in the Tuora-Siz range (Lower Lena river) and in the Chersky range. Reserves would also be valuable in Chukotsk, Koryak Uplands and in Kamchatka for the conservation of their respective populations. **2)** Undertake censuses of numbers to verify distributions and population estimates. At the same time, **3)** the taxonomy of snow sheep subspecies and their respective distributions require clarification.

Acknowledgements: K. Braden, E. Koshkarev, V. Lukarevsky, E. Mukhina, E. Sievers, A. Smith, O. Tsaruk, and A. Zatoka.

7.3 Mongolia

D.P. Mallon, A. Bold, S. Dulamtseren, R.P. Reading and S. Amgalanbaatar

Introduction

Mongolia covers approximately 1,565,000km², and is bordered on the north by eastern Siberia and to the south by China. The country is predominantly mountainous (average elevation 1,580m asl), interspersed with deserts and rolling steppe. The Altai (Altay), the highest mountains in the country (maximum 4,365m asl), begin at its northwest corner and then run south-eastwards for 1,500km along its southern border. They are sometimes divided into two regions; the western ranges referred to as the Mongolian Altai, and the eastern part, the Gobi Altai. South of the Altai is the desert region known as the Transaltai Gobi. There also are a number of isolated mountain massifs to the south of the Gobi Altai, and in the extreme southeast section of Mongolia lies part of the Great Khingan range. In the central part of the Mongolia are the Khingan mountains whose highest peak reaches 3,900m asl. Between the Altai and the Hangai ranges lies an arid desert region consisting of dry plains and basins, together with numerous lakes, especially in the northwestern part known as the Great Lake basin (Ikh Nuuruudiin Khotgor). More mountains are scattered along the country's northern border, but these tend to be more rounded with forested lower slopes. The main ones are those to the west of Lake Khovsgol, and the Hentii (Hentei) mountains running north from Ulaanbaatar to the border. Finally, the eastern and southeastern regions consist primarily of a low, relatively flat plain with a mean altitude of between 900 to 1,500m asl.

The climate is strongly continental, characterised by severe winters, large annual variations in temperatures, and relatively low humidity and precipitation. Most precipitation falls during summer, but varies from 50mm per year in the south to over 400mm in some of the northern mountain regions. The forests of Mongolia form the southern limit of the Eurasian coniferous forest belt. Desert and semidesert account for more than 40% of the country, while forest-steppe and steppe grassland each cover about 25%. The northern and central mountain regions contain most of Mongolia's forests, but they also grow in the Altai and Hangai (Khangai) mountain areas. Further details of the ecology of the country are summarised by Mallon (1985a).

Current status of Caprinae

Two species occur in Mongolia, the Asiatic or Siberian ibex, (*Capra [ibex] sibirica*) and the argali (*Ovis ammon*). The taxonomy of these two species of Caprinae is not totally clear. Although generally recognised as *C.* [*i.*] *sibirica*, Bannikov (1954) also listed *C. sibirica hagenbecki* in the western Transaltai Gobi, but most authors include *hagenbecki* in *sibirica*. The Altai argali (*O. a. ammon*) is regarded by all authorities to occur in the Mongolian Altai, but several subspecies have been reported in the Transaltai Gobi. In the latest revision of the argali, Geist (1991) agrees with Bannikov (1954) that Gobi argali (*O. a. darwini*) occurs in the Transaltai Gobi, but it is unclear whether argali in the west of the desert zone are also of this subspecies. The taxonomic position of these desert argalis has been unclear, with up to five forms reported. Gobi argali occur over much of this area (Geist 1991), but the identity of argali in the western part of the Transaltai Gobi requires clarification. In this report, all argalis inhabiting the southern desert are considered to be *O. a. darwini.*

Both ibex and argali are distributed along the entire Altai mountains, in other mountain ranges in the western half of the country, and at lower altitudes in desert hills of the Transaltai Gobi. Argali also occur in many isolated hills in the steppe zone of central Mongolia where their range may be expanding. A small, introduced population also inhabits the Hentii mountains.

We estimate that there were around 80,000 ibex in Mongolia at the end of the 1970s, and though recently collected census data do not permit rigorous estimation of current numbers, local people and biologists report fewer ibex in several areas than occurred in the 1970s (S. Amgalanbaatar and R.P. Reading, unpubl. data; G.B. Schaller, *in litt.* 1995). Ibex may receive some natural protection from of the precipitous terrain it occupies.

Argali is less numerous than ibex, but more widespread. Numbers of both subspecies declined between 1940 and 1950, largely as a result of overhunting, but some authors have suggested that legal protection granted in 1953 led to a recovery in numbers (Shagdarsuren 1966; Zevegmid and Dawaa 1973). By the mid-1970s, a total estimate of 40,000 argali (no separate figures were available for individual subspecies) was given in the Mongolian Red Book (Shagdarsuren 1987), which listed the species as Threatened. Similarly, biologists from the Mongolian Hunter's Association estimated 40,000 argali in 1970, and scientists of the Mongolian Academy of Sciences estimated 50,000 animals in 1980 (Amgalanbaatar, in press). Alternatively, Shanyavskii (1976), Gruzdev and Sukhbat (1982), and Krupka (1990), estimated a population of 10,000 to 12,000 argali in Mongolia. Gruzdev *et al.* (1986) later amended their estimate, increasing it to 18,000 to 20,000 animals, a range Luschekina (1994) agreed with in her review of argali in Mongolia. There has been no recent, reliable nation-wide census of argali, but smaller scaled surveys conducted during the past few years, clearly demonstrate continued population decline and fragmentation (Amgalanbaatar 1993, in press; S. Amgalanbaatar and R.P. Reading, unpubl. data, 1995; Amgalanbaatar *et al.* 1993; Reading *et al.* 1995, in review; Schaller 1994). The decline is at least in part the result of renewed illegal hunting and competition from livestock, both of which increased as a result of major political and economic changes in Mongolia following its transformation to a democratic, free-market system, and the break-up of the former USSR. The subsequent weakening of central authority, a severe economic crisis, an increase in the human population growth rate, and the importance of meat in the Mongolian diet, have all combined to increase the amount of illegal hunting.

Competition with livestock prevents argali from utilising the best pastures, causing them to move in search of grazing, thus increasing energy demands, and may force them to use sub-optimal habitats. In the Altai, des Clers (1985) reported that argali were outnumbered 50:1 by livestock, and in places could only feed on their winter ranges at night. Stress is a major problem (Dzieciolowski *et al.* 1980) and disturbance is occurring over their whole range (Dawaa *et al.* 1983). Grazing pressure by domestic livestock is constantly increasing, especially since the removal of food subsidies from the former Soviet Union and the elimination of collectives. Both these, together with the scarcity of most resources in the country, have led to an increase in families following a herding lifestyle, to an increase in livestock numbers, and to many new areas being utilised for grazing (Honhold 1995). In the High Altai mountains of western Mongolia, the number of nomadic herders has increased greatly in recently years. Kazakh minorities from throughout Mongolia, emigrated to Kazakhstan following that country's independence, but most have since returned and, rather than resettling in their former province, have remained in the two western-most provinces of Khovd and Bayan-Olgi (S. Amgalanbaatar and R.P. Reading, unpubl. data, 1995). Since the 1990s, more people have turned to a rural lifestyle causing an increase in livestock numbers and grazing on areas that were argali range. Increased livestock levels also add to the risk of diseases and parasites being transmitted from livestock.

Argali is also susceptible to adverse natural conditions. Starvation-related mortality increases in severe winters when deep snow, or the formation of a frozen crust, prevents them from reaching forage. A drought in the Gobi region in the 1980s, added to the problems created by permanent occupation of water sources by herders and their livestock. Several natural sources of water had still not recovered by late 1995 (Reading *et al.* 1995). Bold and Dorzhzunduy (1976) reported that snow leopard (*Panthera uncia*) numbers increased as a result of readily available prey when ibex and argali populations were debilitated by a 3-year drought. Such an increase in predators would most probably be short-lived. A further problem is inherent in the pattern of argali distribution in Mongolia, which is essentially narrow and linear along the Altai, Hangai and other western mountains, with a series of "island" mountains in the southern deserts. Thus there is no remote or inaccessible core to act as a population reservoir, and because access to their range is possible at many points the susceptibility of argali populations to fragmentation is increased, whether from hunting or from other factors.

General conservation measures taken

Wildlife protection extends as far back as the 13th Century when many forested hills were protected as holy sites. Today, all lands and resources are state owned since being nationalised in 1921, but though there is no private ownership of land, the people retain a legal right to use pasture land and other natural wealth. Some private ownership of land will likely occur in the very near future, but local response to recently failed legislation suggests that this privatisation will be restricted to cities, towns, and some permanent wintering structures. Wildlife declined dramatically in the 1930s and 1940s in the country. In response, conservation measures were taken, beginning in the 1950s and 1960s. Legislation passed in the early 1970s had guided nature protection policy until quite recently. Following democratic transformation, several new laws have been passed or submitted to the Great Khural (Parliament). The most important of these laws include the Protected Areas Law of 1994, the Hunting Law of 1994, and the pending Land Law (Wingard 1995). Both ibex and argali are designated as Rare under the new Hunting Law, which indicates that restrictions on hunting are imposed. In the case of both of these species, animals may only be hunted by foreign hunters with a special permit.

Currently there are three local hunting companies (Mongol An, Sondor, and Juulchin) operating in Mongolia that offer hunts for foreign hunters. All three companies are private, but both Mongol An and Juulchin were formerly state run and maintain close affiliations with the government. Formerly, these hunting companies conducted or financed much of the wildlife survey work in Mongolia, but such efforts have been greatly reduced in recent years. Although Juulchin includes a subsidiary named the Argali Conservation Foundation, it remains solely a business enterprise with none of the money generated going toward monitoring or conservation. These companies effectively set trophy harvest levels and pressure government officials and decision makers to increase the number of animals that can be taken (R. Jackson 1994, *in litt.* to D.M. Shackleton). This is being done despite the fact that the number of foreign hunters may be declining because trophy specimens are becoming scarce. Recently, some hunting camps were closed.

Fees received from foreign trophy hunters can be substantial and are primarily for hunting ibex and argali (Krupka 1988), although wolf (*Canis lupus*), brown bear (*Ursus arctos*), elk (*Cervus elaphus*), Mongolian (*Procapra gutturosa*) and goitered (*Gazella subgutturosa*) gazelles, can also be hunted under licence. Argali from the High Altai bear the largest horns and command the highest trophy fee (US $26,000), while fees for the Gobi argali are slightly less (US $23,000). Despite the licence fees charged, funds are not used for Caprinae conservation, nor for the benefit of local people living in areas where hunting occurs, but instead go to the nation's general funds (Reading *et al.*, in review).

Wildlife conservation is the responsibility of the Ministry of Nature and Environment. Most field research on wildlife, including ibex and argali, has been carried out by scientists of the Institute of General and Experimental Biology of the Mongolian Academy of Sciences, and the Mongolian National and Pedagogical Universities, and recently, by the Forestry and Hunting Institute of the Ministry for Nature and the Environment. They have conducted many joint zoological expeditions with scientists from the former USSR, East Germany, Poland and

Hungary. Additional research was conducted or funded by Mongolian hunting companies.

The WWF-Mongolia Project began in 1991, and is mainly concerned with protected area assessment and planning. The UNDP Mongolia Biodiversity Project is a 3-year program that began in 1993 with funding from the Global Environmental Facility. Its goals initially included an assessment of endangered species, a review of protected areas, training managers and biologists, and funding research on a variety of wildlife species, including ibex and argali. More recently the project changed its focus to capacity building and institutional strengthening. The Wildlife Conservation Society has been conducting joint wildlife research annually since 1989, and currently has an American biologist working on a multi-year project to survey snow leopard and large ungulate populations in the mountains. The German Technical Advisory Group (GTZ) initiated a 10-year project in 1994 to strengthen management of protected areas in the Hentii mountains and South Gobi. A variety of other, smaller conservation research projects have been conducted on large ungulates, including ibex and argali, by a loose affiliation of Mongolian and international organisations, including the Ministry for Nature and the Environment, Mongol An, Nature Conservation International (Berlin, Germany), and the Northern Rockies Conservation Co-operative (Jackson, Wyoming, USA).

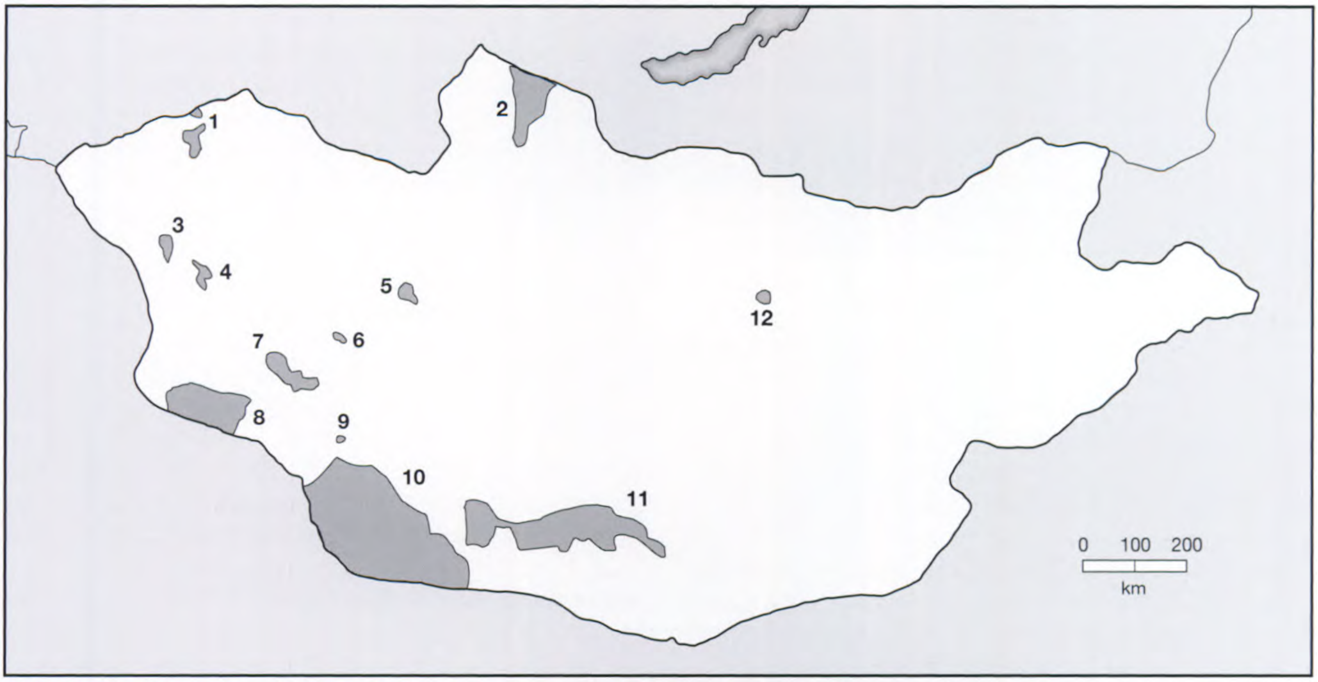
The Mongolian Association for Conservation of Nature and Environment (MACNE) is a voluntary organisation with over 320,000 registered members at national, provincial and local levels, although the number of active members is far less (membership is free and was strongly encouraged under the former communist regime). Its aims are the observance of laws affecting the hunting environment, and popularisation of nature conservation. The Mongolian Hunters Society is an independent body, but is closely associated with hunting companies, especially Mongol An. It co-ordinates hunting and has received financial support from the International Foundation for the Conservation of Game (CIC) to study optimal use of wildlife in reserves (Jigj 1986; IUCN 1992).

Ibex and argali occur in several protected areas in Mongolia (Map 7.3.1). The largest, Great Gobi Protected Area, consists of two sections totalling 5,300,000ha. Great Gobi A, in the Dzungarian Gobi, is designated a National Conservation Park and Great Gobi B, in the Transaltai Gobi, a Strict Protected Area under the Protected Areas Law of 1994. Established in 1976 by decree 283/1976 of the Praesidium of the Great People's Khural (Dash *et al.* 1977), it recently became a Biosphere Reserve with newly established buffer zones. Only biologists, protected area employees, and border guards are permitted in Gobi B and grazing is no longer allowed in the core area and is limited to the buffers except in periods of drought. Gobi Gurvan Saikhan National Conservation Park, established in 1994, covers over 2,170,000ha in the South Gobi, including several mountain ranges and areas of rocky outcrops inhabited by both ibex and argali (Reading *et al.* 1995). Creation of Core Areas and Buffer Zones is planned. The Khokh Serkh (Khuhsyrh) Mountain Strict Protected Area covers 83,500ha in the western part of the High Altai. It was established in 1976 to conserve ibex and argali (des Clers 1988; Dzieciolowski *et al.* 1980). Grazing by livestock was supposedly eliminated by 1982, and advice on management was provided under an agreement with CIC, and with Polish conservation organisations (des Clers 1985). However, G. B. Schaller (*in litt.* 1995) and S. Amgalanbaatar and R.P. Reading (unpubl. data, 1995), found livestock numerous in the area and wild ungulates scarce. In response, the Ministry for Nature and Environment submitted proposals which would fund renewed management efforts in the Protected Area. Other protected areas include small populations of Caprinae in the High Altai Mountains (e.g. a section of Uvs Lake Strict Protected Area), the Hangai Mountains (e.g. Otgontenger Strict Protected Area), the Mountains near Khovsgol lake (e.g. Khovsgol National Conservation Park), and the Transgobi (e.g. Eej Khairkhan National Monument). In 1995, Bayan-Olgi Aimag, or Province, established a provincial protected area for argali. It lies on Bayan-Olgi's northern border and forms a portion of an international argali reserve which extends into the Tuva Autonomous Region of the Russian Federation. We have no data on its boundaries, so it is not shown on Map 7.3.1. Bodgkhan Mountain Strict Protected Area also supports a small herd of introduced ibex. An additional nine new protected areas were created in Mongolia in the spring of 1996, including one in the Altai Mountains and another large one in the Khungai Mountains, both of which are in prime argali habitat, although currently harbor few, if any, animals.

The WWF-Mongolia Project, the UNDP Mongolia Biodiversity Project, and the Ministry for Nature and Environment, have proposed the creation of an extensive protected areas network in the Hangai, High Altai and Gobi Altai ranges, and South Gobi, that would conserve large areas of argali and ibex habitat. Although trophy hunting formerly took place within Mongolia's protected areas, hunting is now prohibited from all of them under the Protected Areas Law of 1994.

General conservation measures proposed

The principal threats to caprins come from illegal hunting and from grazing competition with domestic livestock, together with associated disturbances. Poaching is



Map 7.3.1. Known locations of protected areas with Caprinae in Mongolia, as of late 1995.

1) two units of Uvs Lake Strict Protected Area (2 units total 143,600ha; est. 1993); **2)** Khovsgol Lake National Conservation Park (835,720ha; est. 1992); **3)** Khokh Serkh Mountain Strict Protected Area (74,150ha; est. 1976); **4)** Mankhan Nature Reserve (80,920ha); **5)** Otgontenger Mountain Strict Protected Area (90,750ha); **6)** Khasagt Khairkhan Mountain Strict Protected Area (27,000ha; est. 1965); **7)** Sharga Natural Reserve (316,500ha); **8)** Great Gobi A National Conservation Park (928,190ha; est. 1976); **9)** Eej Khairkhan Mountain National Monument (2,820ha); **10)** Great Gobi B Strict Protected Area (4,642,710ha; est. 1976); **11)** Gobi Gurvan Saikahn National Conservation Park, including Yoliin Am Strict Protected Area (2,171,630ha; est. 1994); and **12)** Bogdkhan Mountain Strict Protected Area (42,720ha).

particularly problematic, because lax enforcement of conservation laws has led to flagrant violations. Local people openly discuss poaching ibex and especially argali (S. Amgalanbaatar and R.P. Reading, unpubl. data, 1995). The difficulties of preventing poaching over such large areas are obvious, especially given the small number of poorly equipped rangers (some protected areas have no rangers) and Nature Inspection Officers (1 per Sum, or county). A new, relatively strong legal framework exists for the protection of ibex and argali (Wingard 1995), but needs to be matched by effective administration and enforcement in the field. Income from the sales of hunting licences and the large fees charged by hunting companies (often well in excess of the licence fee) to foreign hunters, should be a further incentive to ensure the survival of viable populations.

There were 26.8 million head of livestock in Mongolia in 1994 (Honhold 1995). While domestic grazing has been eliminated or restricted in some protected areas such as Great Gobi Strict Protected Area, similar measures are required in other parts of ibex and argali ranges, especially in protected areas in the Hangai Mountains and near Khovsgol. Without planning, the problem can only worsen as more people move to a rural lifestyle and increased numbers of livestock compete with argali and other wild herbivores.

Detailed surveys are required to assess the current status of both species of Caprinae across their ranges in Mongolia. These have begun, but more rigorous, systematic, and complete studies are required. They should be made in conjunction with censuses of other important species such as snow leopard as have been carried out by the Wildlife Conservation Society since 1993. At the same time, it is essential to estimate both the current legal and illegal harvests of the two Caprinae. The taxonomic status of argali in the southern desert regions also requires clarification.

The establishment of more protected areas for ibex and argali is necessary, especially in Hangai, where numbers are low, and also in places where isolated populations exist and that may have developed unique characteristics. New (and existing) protected areas need to be evaluated in terms of seasonal movements, especially for argali which may make significant migrations between ranges. To be effective, a protected area must encompass a population's entire annual movements. Protected areas should be sufficiently large to encompass viable populations and strive to maintain connections between populations. Several new protected areas have been proposed for Mongolia, including several within the current or past distribution of caprins. These will be valuable additions to those already in existence and should be established as quickly as possible.

Protected areas require active management by personnel who are well trained in law enforcement, conservation management, and administration. This will require additional training, as well as hiring new personnel. Staff must not only be well trained but well equipped. Conservation efforts should be coupled with education programs for the public, especially to programs aimed at the herding families. Securing sustainable funding sources is crucial, and some or all of these costs might be offset by ecotourism, and by hunting and fishing fees.

Where populations are surveyed and demographic analysis shows that it can be sustained, trophy hunting programs can play a significant role for the conservation of both species of Caprinae in Mongolia. However, this will require changes to the existing trophy hunting system. Schaller (1994:19) made three proposals:

1) Hunting companies should receive long-term (25 to 30 years) concessions from the government to specific areas. They would be responsible for protecting the area throughout the year and for conducting research necessary to manage the wildlife sustainably. They would not be able to simply deplete the area and move to a new location as is the current practice. Legal measures need to be developed to ensure that abandonment of concessions does not occur because of poor hunting management.
2) A sufficient proportion of the funds generated from sustainable trophy hunting programs must be used to directly benefit both Caprinae conservation (e.g. hire guards, develop waterholes, etc.) and local pastoralists. However, care must taken to ensure that development projects do not cause increases in human and livestock populations in areas important to wild caprins.
3) Detailed records must be kept of each animal killed, noting date and place of kill, weight, age, sex, body and horn measurements, together with other pertinent information. These data will be necessary for sustainable population management and monitoring.

To these recommendations, we add the importance of annually monitoring all hunted populations. It is further suggested (R. Jackson, *in litt.* to D.M. Shackleton) that employees of the hunting companies should be trained in standardised census techniques, and that co-operative surveys with Ministry of Nature and Environment biologists and others should be encouraged (see also **Appendix 1**).

Species accounts

The most detailed accounts of the biology of caprins found in Mongolia are in Bannikov (1954), with some additional information in Mallon (1985a). Useful information on both species in the adjoining areas of the former Soviet Union can be found in Heptner *et al.* (1961), and in other parts of their world range, in Schaller (1977).

Asiatic ibex (*Capra [ibex] sibirica*)

Distribution: Distributed along the whole of the Altai range from the northwest corner of Mongolia, southeast to Khorkh Uul, about 109°10'E (Schaller 1994); along the main ridge of the Hangai mountains; on Turgen Uul and other ranges of northwest Mongolia; and in the mountains on the western side of Lake Khovsgol (Map 7.3.2). Ibex also occurs on many of the mountains of the Transaltai Gobi (Bannikov 1954; Dulamtseren 1970; Mallon 1975b; Sokolov and Orlov 1980). It is most common in the Mongolian Altai. Generally more rare in the Gobi region, ibex is locally common in several areas, including the Segs Tsagaan Bodg ridges, Gurvan Saikhan Mountains, Zoolongiin Mountains, and Nemegt Mountains (Dash *et al.* 1977; Reading *et al.* 1995). Ibex is becoming rare in other regions of the Gobi where once it was reportedly common (Schaller 1994). In the 1980s, about 20 ibex from the Gobi Altai were released in the Bodg Han Uul Reserve, just south of Ulaanbaatar, and well outside the traditional range.

Map 7.3.2. General distribution of Asiatic ibex (*Capra [ibex] sibirica*) in Mongolia (after Academy of Sciences 1990).
i = introduced population.

Population: Bannikov (1954) stated that ibex were significantly more common than argali. At the end of the 1970s, the ibex population in Mongolia was estimated at ca. 80,000. Although no total estimates have been made since then, ibex is subject to the same threats as is argali, and in some areas is reported to have declined (S. Amgalanbaatar and R.P. Reading, unpubl. data, 1995; Schaller 1994; G.B. Schaller, *in litt.*, 1995). The few data on numbers in protected areas do not indicate large populations. In the Khohk Serkh Reserve in the High Altai, the population was estimated at 1,000 in 1979 by Dzieciolowski *et al.* (1980) and at 1,200 by des Clers (1985), while Tulgat and Schaller (1992) estimated 600 in the Great Gobi Desert National Park. In 1989, in a 200km^2 study area west of Tsogt in the Altai, Schaller *et al.* (1994) counted 337 ibex, and estimated there may have been a total of up to 450 animals. Reading *et al.* (1995) sighted 1,218 ibex over 623km^2 in Gobi Gurvan Saikhan National Conservation Park and estimated a total population of 12,166 animals in the Park's 2.17 million ha (5,207km^2 of mountainous areas).

Threats: Grazing competition and disturbance from livestock, and poaching. Ibex is probably less affected than is argali by poaching and competition with livestock, because of the more precipitous and hence less accessible terrain it occupies.

Conservation measures taken: Ibex is a legally protected species, but a limited amount of licensed trophy hunting is permitted. It occurs in 9, possibly 10, protected areas: Bodgkhan Mountains, Eej Khairkhan Mountain, Great Gobi, Gobi Gurvan Saikhan, Khokh Serkh Mountain, Khovsgol Lake, Otgontenger Mountain, probably in Sharga Natural Reserve, Uvs Lake, and Yoliin Valley (Map 7.3.1). From 1984 to 1995, limited hunting was permitted in this latter protected area (Dzieciolowski *et al.* 1980) with 201 being harvested up to 1988 (Krupka 1988). Ibex is listed as Rare under the current Hunting Law, which places restrictions on hunting and prohibits hunting in protected areas starting with the 1996 season.

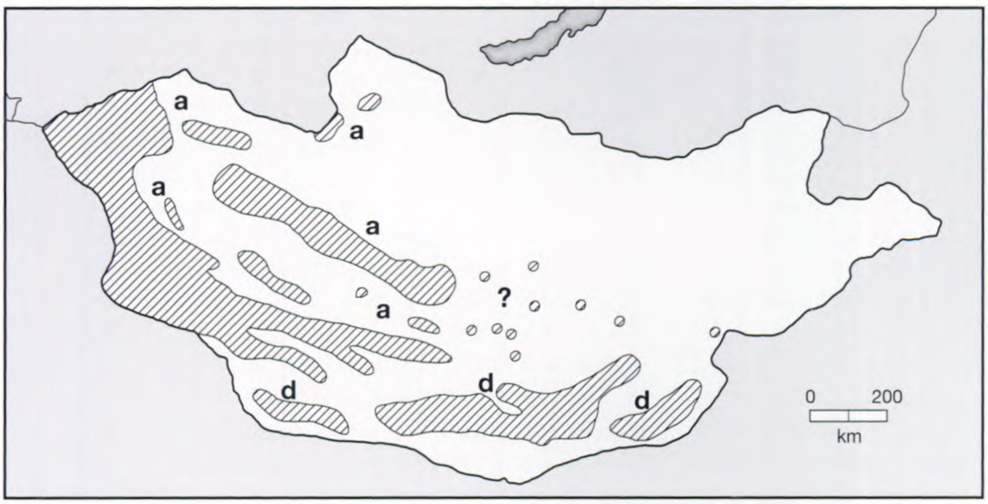
Status within country: Insufficiently Known.

Conservation measures proposed: **1)** Undertake censuses and classification counts of all populations. **2)** Study the ecology and movement patterns of ibex to identify critical habitats. **3)** Hire, train, and equip law enforcement agents, especially for protected areas.

Altai argali (*Ovis ammon ammon*)

Distribution: Altai argali occurs in the High Altai Mountains of western Mongolia and southeast along part of the Altai chain, where it is replaced by Gobi argali (see below); along the main ridge of the Hangai mountains; and in the mountains of north and northwest Mongolia (Bannikov 1954; Geist 1991; Mallon 1985a; Sokolov and Orlov 1980) (Map 7.3.3). Argali became extinct in eastern Hösgvöl and the hills on the north side of the Onon valley during the 19th century, and in the Hentii mountains during the early part of this century (Bannikov 1954). Small, disjunct populations of Altai argali survive in the mountains west of Khovsgol lake, and there is a small reintroduced population in the Hentii mountains.

Population: In several parts of the range, numbers have fallen. However, sporadic surveys and inconsistent methodologies preclude more rigorous assessment. Recent surveys have not been comprehensive enough to permit total population estimation (Amgalanbaatar 1993, in press; Amgalanbaatar *et al.* 1993; S. Amgalanbaatar and R.P Reading, unpubl. data, 1995; Luschekina 1994; Schaller 1994). Population fragmentation over a wide geographic area complicates estimation. Following a 3-month field



Map 7.3.3. General distributions of argali (*Ovis ammon* in Mongolia) (after Academy of Sciences 1990); a) *O. a. ammon*; d) *O. a. darwini*. Actual argali distributions are highly fragmented within the ranges shown here and there are very few in the Khunghai mountains.

survey in the Gobi and the Altai, Schaller reported that argali were absent or rare from most areas of suitable habitat, and that illegal hunting was a serious problem (G.B. Schaller *in litt.* to U.S. Fish and Wildlife Service, quoted in Federal Register, vol. 55, no. 195, p. 40893). During the summer of 1995 Amgalanbaatar and Reading (unpubl. data, 1995) found similar conditions coupled with large numbers of people and livestock in areas formerly sparsely populated. Estimates of argali by subspecies are lacking in Mongolia; however, the total population (i.e. both subspecies) has been estimated. The Mongolian Hunter's Association estimated a total of 40,000 argali in 1970, and scientists from the Mongolian Academy of Sciences believed 50,000 argali inhabited the country in 1980 (Amgalanbaatar, in press). These figures contrast with those of Shanyavskii (1976), Gruzdev and Sukhbat (1982), and Krupka (1990) who suggested population estimates of 10,000 to 12,000. Gruzdev *et al.* (1986) later amended their estimate up to 18,000 to 20,000 individuals. We agree with Luschekina (1994:26) who suggests that "no more than 20,000" argali inhabit Mongolia, and probably far fewer. It is important to note, however, that Altai argali comprise a small proportion of the total number of argali in Mongolia, and populations are highly fragmented and disjunct.

Threats: The main threats to argali in Mongolia (see also **Conservation measures proposed** below) are competition with livestock, and poaching (Gruzdev and Sukhbat 1982; Luschekina 1994; Shagdarsuren *et al.* 1987). Several small, isolated populations, such as those west of Khovsgol Lake, in the Hentii mountains, and north of Khar Lake, are particularly at risk and may already be extinct. Numbers of people and livestock have increased throughout Mongolia, but particularly in the two western provinces (Khovd and Bayan-Olgi) as Kazakh minorities who emigrated to Kazakhstan have recently returned to Mongolia. Most of these people have settled to raise livestock in the west, no matter where they were originally from. Increased stocking levels also add to the risk of diseases and parasites being transmitted from livestock to the argali population.

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Both subspecies are included on Appendix II of CITES, listed as Threatened on the U.S. Endangered Species List (Nowak 1993), and designated Threatened in the Mongolian Red Book (Shagdarsuren 1987). The European Union bans imports of all argali. Argali has been legally protected in Mongolia since 1953, and is currently designated Rare under the Hunting Law of 1994. However, argali can be hunted under licence (Mallon 1985b). It is the most expensive species available to foreign hunters and much sought after as trophies, though recently several hunting camps have been closed and good trophy heads have been declining steadily.

Altai argali occur in 5, possibly 6, protected areas (Map 7.3.1): in the Khasagt Khairkhan (Khasagt-Khayrkha) Mountain Strict Protected Area in the Altai mountains, in the Khokh Serkh Mountain Strict Protected Area in the western part of the High Altai (des Clers 1988; Dzieciolowski *et al.* 1980), in Khovsgol Lake National Conservation Park in north-central Mongolia (but this population may be extinct), in the Otgontenger Mountain Strict Protected Area in the Hangai mountains, in one unit of the Uvs Lake Strict Protected Area in the Altai mountains, probably in Sharga Natural Reserve, and in a new provincial reserve on the northern border of Bayan-Olgi Aimag. In the Khokh Serkh Protected Area, between 600 and 800 argali were estimated between 1979 and 1988 (des Clers 1988; Dzieciolowski *et al.* 1980; Krupka 1988), however, more recent reports suggest that today there are fewer than this number, if any (S. Amgalanbaatar and R.P. Reading, unpubl. data, 1995; G.B. Schaller, *in litt.* 1995). In this reserve, the population reportedly had increased following strict protection measures, an 8-year ban on hunting, and a phased removal of livestock grazing. However, these actions have recently been reversed and today poaching and livestock grazing are common (S. Amgalanbaatar and R.P. Reading, unpubl. data, 1995; G. B. Schaller, *in litt.* 1995). Hunting was formally permitted in some protected areas, but was recently banned by the Hunting Law of 1994. Several additional protected areas have been proposed for the region by the WWF-Mongolia Program, the UNDP Mongolia Biodiversity Project, and the Ministry for Nature and Environment. Several of these proposals have been submitted to Parliament.

Status within country: Indeterminate.

Conservation measures proposed: 1) Strict enforcement of existing legal protective measures is necessary because the argali's vulnerability to hunting in its relatively open, accessible habitat, has increased along with greater availability of motor vehicles and high-powered weapons. Shagdarsuren (1987) recommended that hunting permits be issued only for those areas where argali had been shown to have increased. **2)** Make law enforcement sufficiently rigorous to check and reverse reductions in argali numbers. The argali population reportedly did recover previously from a general decline due to overshooting prior to the 1970s. The increase in numbers seen in the Khokh Serkh Reserve following a hunting ban and original elimination of livestock grazing, also illustrates the possibility of recovery. **3)** Provide compensation schemes to reduce or eliminate grazing by livestock in selected areas. Eliminate livestock grazing from Core Areas, and strictly limit and control it in other zones, of protected areas. **4)** Carry out detailed surveys to assess the current status of argali in

Mongolia and maintain annual trend analyses, especially for hunted or declining populations. **5)** Establish a network of protected areas throughout all parts of its range in Mongolia. **6)** Develop detailed management plans for all argali populations, especially those open to hunting.

Gobi argali (*Ovis ammon darwini*)

Distribution: This argali occurs in the hills, rocky outcrops, and mountains across the whole of the Transaltai Gobi (the desert and semi-desert zones lying south of the Altai range) and portions of the Gobi Altai mountains east almost to 112°E, and also in several isolated ranges of hills in the steppe zone of central Mongolia (Map 7.3.3). The division between ranges of the two subspecies of argali in Mongolia is poorly studied and not clear. In 1990–91, this argali was officially recorded for the first time north of the Tuul river, about 100km southwest of Ulaanbaatar, indicating that it may be extending its range into the steppe zone during recent years.

Population: No separate estimate of argali in this region of Mongolia have been made, but it appears to be relatively common in several places in the east of the desert and semidesert zones. The distribution of this subspecies is, however, highly fragmented and local populations are often very small (e.g. 25 individuals), although seasonal concentrations (e.g. during the rut) may lead to impressions of higher densities (Schaller 1994). Local residents, officials, and biologists report that argali has declined greatly in recent years, in part due to droughts in the 1980s and early 1990s when most scarce water resources were monopolised by pastoralists for their livestock (Reading *et al.* 1995; Schaller 1994). Poaching and competition with domestic livestock are also implicated in the decline (Reading *et al.* 1995, in review). Sukhbat (1975) estimated 3,870 argali and Berdar (1978 in Luschekina 1994) estimated 5,000 in the Gobi Altai mountains. Schaller (1994) believed that there may be between 3,500 and 4,000 argali in small fragmented populations found through the 15,000,000ha area of the eastern South Gobi and western part of the East Gobi that he surveyed in 1994. Similarly, Reading *et al.* (in review) estimated 3,900 ±1,132 animals in small, fragmented populations from a 1994 aerial survey of 20.9 million ha in the same region.

Threats: Competition for resources with livestock, and especially poaching (Luschekina 1994; Reading *et al.* 1995; Shagdarsuren 1987; Zhirnov and Ilyinsky 1986). In addition, the populations of this argali are small and highly fragmented thus increasing its vulnerability to threats.

Conservation measures taken: Listed as Endangered (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). See also Altai argali above. Gobi argali occurs in both sectors of the Great Gobi Protected Area (Mallon 1985b), in the Eej Khairkhan Mountain National Monument of the Transaltai Gobi, and in the Yoliin Valley Strict Protected Area and Gobi Gurvan Saikhan National Conservation Park in the South Gobi (Map 7.3.1). The Great Gobi Protected Area staff estimated 300 animals in the Altai Gobi sector and 400 in the Dzungaria-Gobi sector (Long 1989). Reading *et al.* (1995) estimated 2,977 argali in Gobi Gurvan Saikhan and Yoliin Valley protected areas from ground surveys. Reduction of livestock grazing and enforcement of conservation laws is proposed for the newly created Gobi Gurvan Saikhan National Park. Several additional protected areas have been proposed for the region by the UNDP Mongolia Biodiversity Project, the WWF-Mongolia Program, GTZ's National Park Project, and the Ministry for Nature and Environment. Some of these proposals are currently before Parliament. Hunting organisations have proposed developing artificial water sources in the South Gobi.

Status within country: Indeterminate.

Conservation measures proposed: 1) Apply the same proposals given above for Altai argali. **2)** Develop a management plan to address the problem in the Transaltai Gobi of waterholes being occupied, especially in summer, by domestic stock, causing the Gobi argali to wander large distances in search of water (Dawaa *et al.* 1983; Shagdarsuren 1987). **3)** Consider carefully the proposed development of new water sources. Ensure that any such development does not lead to an increase in numbers of people and livestock in the region, as has happened in the past.

Acknowledgements: R. Jackson, T. McCarthy, G.B. Schaller, and R. Valdez.

7.4 Regional summary

D.M. Shackleton

Together, China, the Commonwealth of Independent States, and Mongolia have the greatest diversity of wild Caprinae in the world with ca. 43% of all the subspecies recognised in Chapter 3. Of the 39 subspecies inhabiting them, 19 are found nowhere else, while for others that also occur in other countries such as argali and takin, essentially all of the world's populations (in terms of both taxa and numbers) occur in these three units. Support for conservation efforts in these political units is vital.

Unfortunately most taxa are threatened to some degree (Table 7.4.1), with many living at very low densities and/or

Table 7.4.1. Summary of conservation status (category of threat[1]) of Caprinae in China, the Commonwealth of Independent States, and Mongolia.

Subspecies	China	CIS	Mongolia	Red List[2]
Serow *Capricornis sumatraensis*				
Southwest China serow *C. s. milneedwardsii*	I	-	-	$\mathrm{VU_{A2cd}}$
Himalayan serow *C. s. thar*	I	-	-	$\mathrm{VU_{A2cd}}$
Red goral *Naemorhedus baileyi*	E	-	-	$\mathrm{VU_{A2cd}}$
Long-tailed goral *Naemorhedus caudatus*				
Grey or Chinese long-tailed goral *N. c. griseus*	I	-	-	$\mathrm{VU_{A2cd}}$
Korean or Amur long-tailed goral *N. c. raddeanus*	I	I	-	$\mathrm{VU_{A2cd}}$
Himalayan goral *Naemorhedus goral*	I			
Caucasian chamois *Rupricapra rupicapra caucasia*	-	V	-	$\mathrm{VU_{C1}}$
Blue sheep *Pseudois nayaur*				$\mathrm{LR_{nt}}$
Hodgson's Blue sheep *P. n. nayaur*	S	-	-	$\mathrm{LR_{nt}}$
Sichuan Blue sheep *P. n. szechuanensis*	K	-	-	$\mathrm{LR_{nt}}$
Dwarf blue sheep *Pseudois schaeferi*	E	-	-	E
Himalayan tahr *Hemitragus jemlahicus*	E	-	-	$\mathrm{VU_{A2cde}}$
Wild goat *Capra aegagrus*				$\mathrm{VU_{A2cde}}$
Persian wild goat *C. a. aegagrus*	-	V	-	$\mathrm{VU_{A2cde}}$
Turkmen, Pasang or Sind wild goat *C. a. blythi*	-	V	-	$\mathrm{VU_{A2cde}}$
Asiatic ibex *Capra [ibex] siberica*	I	S	K	LRlc
Tadjik markhor *Capra falconeri hepteri*	-	E	-	$\mathrm{CR_{C2a}}$
East Caucasian tur *Capra cylindricornus*	-	V	-	$\mathrm{VU_{A1d2de,C1}}$
West Caucasian tur *Capra caucasica*	-	V	-	$\mathrm{EN_{A1d+2cde}}$
Mouflon and Urial *Ovis orientalis*				
Transcaspian urial *O. o. arkal*	-	V	-	$\mathrm{VU_{A2cde}}$
Bukhara urial *O. o. bocharensis*	-	E	-	$\mathrm{EN_{A1cde,C1+2a}}$
Afghan urial *O. o. cycloceros*	-	V	-	$\mathrm{VU_{C1}}$
Armenian mouflon *O. o. gmelinii*	-	E	-	$\mathrm{VU_{A2cde}}$
Severtzov's urial *O. o. severtzovi*	-	E	-	$\mathrm{EN_{A2cde,C2b}}$
Argali *Ovis ammon*				
Altai argali *O. a. ammon*	E	E	I	$\mathrm{VU_{A2cde,C1}}$
Kazakstan argali *O. a. collium*	-	S	-	$\mathrm{VU_{A2cde,C1}}$
Gobi argali *O. a. darwini*	E	-	I	$\mathrm{EN_{C1}}$
Tibetan argali *O. a. hodgsonii*	I	-	-	$\mathrm{VU_{A2cde}}$
Northern Chinese argali *O. a. jubata*	E	-	-	$\mathrm{EN_{C1+2a}}$
Tien Shan argali *O. a. karelini*	E	E	-	$\mathrm{VU_{A2cde}}$
Kara Tau argali *O. a. nigrimontana*	-	E	-	$\mathrm{CR_{C2b}}$
Marco Polo argali *O. a. polii*	E	K	-	$\mathrm{VU_{A2cde,C1}}$
Snow sheep *Ovis nivicola*				
Okhotsk snow sheep *O. n. alleni*	-	R	-	$\mathrm{LR_{lc}}$
Putoran snow sheep *O. n. borealis*	-	E	-	$\mathrm{VU_{D2}}$
Yakut snow sheep *O. n. lydekkeri*	-	S	-	$\mathrm{LR_{lc}}$
Kamchatka snow sheep *O. n. nivicola*	-	S	-	$\mathrm{LR_{nt}}$
Muskoxen *Ovibos moschatus*	-	Ex[3]	-	$\mathrm{LR_{lc}}$
Takin *Budorcas taxicolor*				
Golden takin *B. t. bedfordi*	E	-	-	$\mathrm{EN_{A2cd,C2a,D1}}$
Mishimi takin *B. t. taxicolor*	I	-	-	$\mathrm{EN_{A2cd}}$
Sichuan takin *B. t. tibetanus*	R	-	-	$\mathrm{VU_{A2cd}}$
White's or Bhutan takin *B. t. whitei*	I	-	-	$\mathrm{VU_{A2cde}}$

[1] Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List of Threatened Animals (Groombridge 1993); S = not threatened.
[2] Global category of threat listed in 1996 IUCN Red List of Threatened Animals (IUCN 1996).
[3] Reintroduced.

in small populations. The main threats are poaching and competition with livestock, and for serow, goral and takin, habitat destruction (deforestation) is also a serious problem. Unless strong, long-term conservation term measures are taken, there will be a steady and probably increasing, deterioration in numbers, coupled with increasing population fragmentation. Effective measures may be difficult to achieve because of growing human populations, economic changes (e.g. Mongolia), and political instability and armed conflicts (e.g. in some republics in the CIS). In addition, for species such as argali, there are economic and political pressures to rapidly develop trophy hunting programs. There is no clear evidence that hunting programs developed to date are substantially aiding conservation, other than perhaps that of the specific population being hunted. They do, however, generate foreign currency and commercial enterprise partnerships with western companies. Local people however, need to be obtaining clear benefits. It is difficult to get cooperation if local peoples are banned from hunting what they are told are threatened animals (or have to reduce/lose livestock to reduce competition with the Caprinae), while at the same time, foreigners are allowed to hunt them.

The first task for any program will be to obtain more population estimates, especially where exploitive use in involved. For taxa such as blue sheep and many of the argali, there are problems with current estimates. Many are based on too few transects that together cover relatively small areas, and where reported, variance of density estimates is very high. In addition, choice of transect locations may have introduced sampling errors which will generally result in significant overestimates. This is especially problematic where reported densities are extremely low (<1.0 and even <0.5 animals/km^2). Aerial censuses would be ideal for most Caprinae in open habitats, however, this is usually not an option because of logistic and other restrictions. Censuses are urgently required for conservation and conservation-related hunting programs throughout the CIS, China and Mongolia.

Potential international co-operation

The two areas where international actions would be valuable are in establishment of international protected areas, and co-ordination of conservation policies and actions. China has been active in developing at least one major international protected area (Sagamartha-Qomolungma), and there are several other areas which appear appropriate for similar actions to protect Caprinae. These would involve not just the countries included in this Chapter, but also their neighbours. **The most obvious joint actions include:**

1) Establish a protected area in China to link up with the Great Gobi Protected Area of Mongolia. This would help protect not only Gobi argali and Asiatic ibex, but other species such as khulan, wild Bactrian camel, goitered gazelle, saiga, snow leopard, and the Gobi brown bear considered the most threatened of all the world's brown bears.
2) Implement joint Sino-Kazakhstan surveys and strictly control poaching for Tien Shan argali.
3) An effective working relationship between China and Pakistan needs to be developed for the protection of Marco Polo sheep in the Taxkorgan-Khunjerab area. This could be developed further to include establishment of a Pamir plateau wildlife reserve, involving co-operation between Afghanistan, China, Pakistan and Tadjikistan. The main function of this protected area would be conservation of Marco Polo sheep, Asiatic ibex and snow leopard.
4) Co-ordinate the management of border populations of Altai argali by China, Mongolia and Russia, and develop effective poaching controls.
5) Develop a co-operative effort between Chinese and Myanmar authorities to strictly forbid hunting of Mishmi takin.
6) Develop co-operative conservation measures between China and Bhutan for the Bhutan takin.
7) Co-ordinate conservation among republics and autonomous states within the CIS.

Chapter 8

Indo-Himalayan Region

8.1 Afghanistan

K. Habibi

Introduction

The Republic of Afghanistan encompasses 652,225km², bounded mainly by Iran, Pakistan, Tadjikistan, Turkmenia and Uzbekistan, except where the narrow Wakhan corridor runs 240km northwest to reach the border with China. Most of Afghanistan lies between 600 and 3,050m asl and can be divided into three distinct regions; the Northern plains, the Southwestern plateau and the Central highlands. The central highlands, encompassing about 50% of Afghanistan's total area, are an extension of the Himalayan chain including the Hindu Kush. The central mountains rise above 6,400m asl and form northern and southern drainages, with each side having its own unique floral and faunal elements. The highest mountains, however, are located in the Wakhan corridor, where peaks rise above 6,000m asl. Several sizeable glaciers also occur in this region and over 75% of the land is above 3,000m. Several wide valleys between major mountain ranges provide sites for human habitation and are used seasonally by pastoralists. Around 30% of the country is covered by the Northern plains, extending from the Iranian border eastward to the foothills of the Darwaz peninsula. This region averages around 600m asl, and besides being one of the country's major agricultural area, is also densely populated. The region is part of the Central Asian steppe and is separated from it by the Amu river that runs along the north-central border with Turkmenistan, Uzbekistan and Tadjikistan. The Southwestern plateau averages 915m in altitude and accounts for approximately 20% of Afghanistan. It consists mainly of semi-desert and desert including the vast Regestan desert in the south.

Precipitation is greatest in the mountain regions, increasing from west to east, especially along the border with Pakistan where it comes under the influence of the southeastern monsoon. Monsoon rains drop an average of 400mm of precipitation whereas in the arid lowlands of the south and west, there may be only 76mm of rain per year. Vegetation is naturally scarce in the arid lowlands where rains fall mainly in early spring. By contrast, the mountain slopes are covered at low elevations by mixed, predominantly deciduous hardwood forests of oak, ash, walnut, alder and junipers. Above these are cedar forests up to 1,680 and 2,200m asl, and beyond, tall pine and fir forests whose average upper limit is just over 3,000m asl.

R. Petocz

The Pamir mountains surrounding the Wakhan corridor of northwestern Afghanistan are one of the areas inhabited by Marco Polo sheep (*Ovis ammon polii*) and Asiatic ibex (*Capra [ibex] sibirica*).

Current status of Caprinae

Afghanistan was, and hopefully still is, an important country for Caprinae. There are four species of Caprinae in Afghanistan, comprised of seven subspecies, but due to the current internal difficulties and problems of travel through the country, the status of all but one is Indeterminate. Information concerning Caprinae or any other any wildlife has been almost impossible to obtain since 1979. Data are available only for the period before the 1979 civil war and the subsequent Soviet occupation. Reliable information is still unavailable since the 1988 Soviet withdrawal.

The wild goat (*Capra aegagrus*) inhabited barren, dry rocky mountains in central Afghanistan. It received no protection, and even by the late 1970s, its distribution had been greatly reduced, with scattered populations restricted to remote areas. The Siberian ibex (*Capra [ibex] sibirica*) may still be the best off, although its status is Insufficiently Known. This ibex was found primarily throughout the northern mountains including the Hindu Kush and the Pamir. It was also found in pockets further south, where previously they were referred to as Alpine ibex (*C. ibex ibex*) (Habibi 1977). This is a very unlikely range extension, and animals here are most probably Siberian ibex.

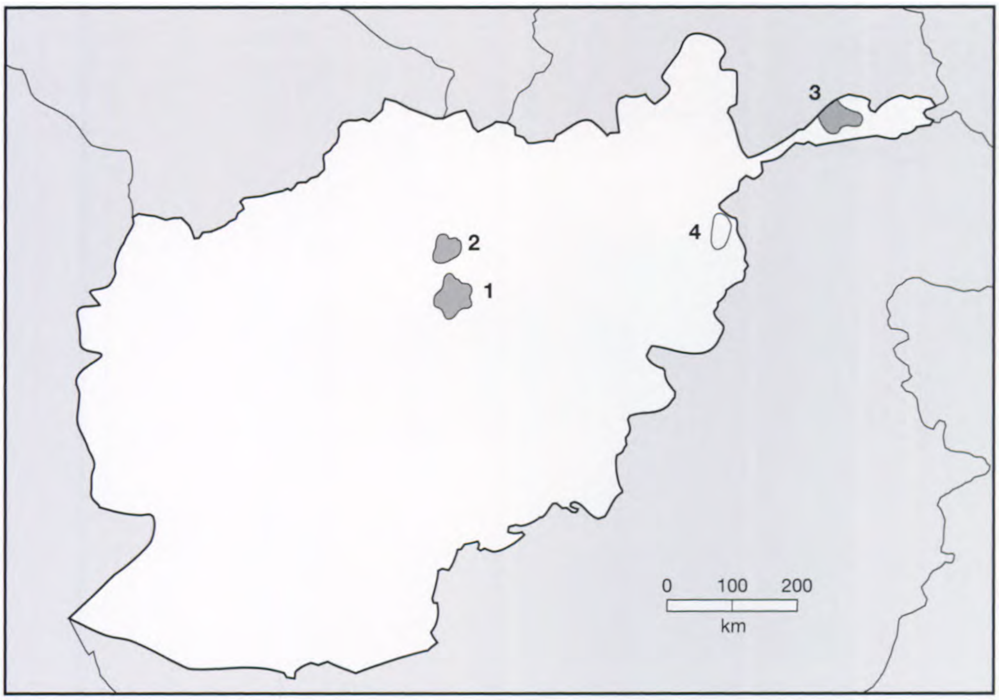
Originally four subspecies of markhor were considered to exist in Afghanistan, but with Schaller's and Khan's (1975) revision, this is reduced to 3. The flare-horned markhor (*Capra falconeri falconeri*), including the previously recognised Kashmir markhor (*C. f. cashmiriensis*), was restricted to forested mountains in eastern Afghanistan. Prior to 1979, the total number was very small and declining. Kabul or straight-horned markhor (*C. f. megaceros*) was restricted to the Kabul Gorge and Kohe Safi, also in the eastern part of the country. Its number prior to 1979, was considered to be even lower than those of the flare-horned markhor. The occurrence of the Tadjik markhor (*C.* f. heptneri) along the border with Tadjikistan is uncertain (Habibi 1977).

Although the Afghan urial (*Ovis orientalis cycloceros*) was distributed at low elevations throughout the Hindu Kush and the mountains of central Afghanistan, numbers were low and populations scattered. Hunting and competition from livestock were major threats. Perhaps most notable of the wild caprins were the populations of Marco Polo sheep (*Ovis ammon polii*) that inhabited the Large and Small Pamir in the Wakhan corridor in the extreme northwest of Afghanistan.

The proliferation of arms among the people and the ineffectiveness of the central government to control unregulated hunting in rural areas, culminated in destruction of wildlife in the early 1980s, as the government lost control over the established protected areas (Alexander 1989). A general lawlessness and food shortages further intensified illegal hunting by both government forces and local inhabitants.

General conservation measures taken

Establishment of royal hunting reserves in the early part of this century was the beginning of wildlife conservation in Afghanistan. However, since that time there has been no legislation allowing for the establishment and management of protected areas. Some areas were gazetted through



Map 8.1.1. Locations of protected areas with Caprinae in Afghanistan, at least prior to 1979.

1) Band-e Amir National Park (41,000ha; est. 1973); **2)** Arjar Valley Wildlife Sanctuary (40,000ha; est. 1978); **3)** Pamir-i-Buzurg (Big Pamir) Wildlife Sanctuary (67,938ha; est. 1978); **4)** the proposed Nuristan National Park.

royal or presidential decrees, and efforts were made to stop unregulated hunting in the 1970s, although foreigners could hunt in certain areas. Afghanistan ratified the World Heritage Convention in 1979 (IUCN 1992a). The Department of Forests and Range, Ministry of Agriculture, was responsible for wildlife conservation and for protected areas, while the Afghan Tourist Organisation was responsible for commercial exploitation (hunting) of wildlife and for the country's single national park.

A number of protected areas containing Caprinae had been established before the outbreak of war in 1979 (Map 8.1.1). The Pamir-i-Buzurg Wildlife Sanctuary was originally established to protect Marco Polo sheep, and was managed to allow limited, guided hunting of this species and of ibex. Before the invasion, up to 13 large male Marco Polo sheep were taken each year (US $13,000 each in 1978) in hunts organised by the Afghan Tourist Organisation. The local Wakhi people were employed as guides, porters, etc., and received substantial economic benefit as incentives to obey grazing restrictions for their livestock (Petocz 1978). One of the program's important aspects was that by involving the local people it encouraged them to preserve local wildlife species. The status of this program is unknown, but very likely does not still exist.

General conservation measures proposed

Clearly, comprehensive censuses must be made throughout the country to determine the status of Afghanistan's Caprinae since the civil war and Soviet activities. In most areas, these censuses may prove extremely hazardous due to the huge number of unexploded military ordnance that resulted from the civil war and Soviet invasion. Serious problems also still exist due to the ongoing armed conflicts between the various Mujahadeen groups and the government.

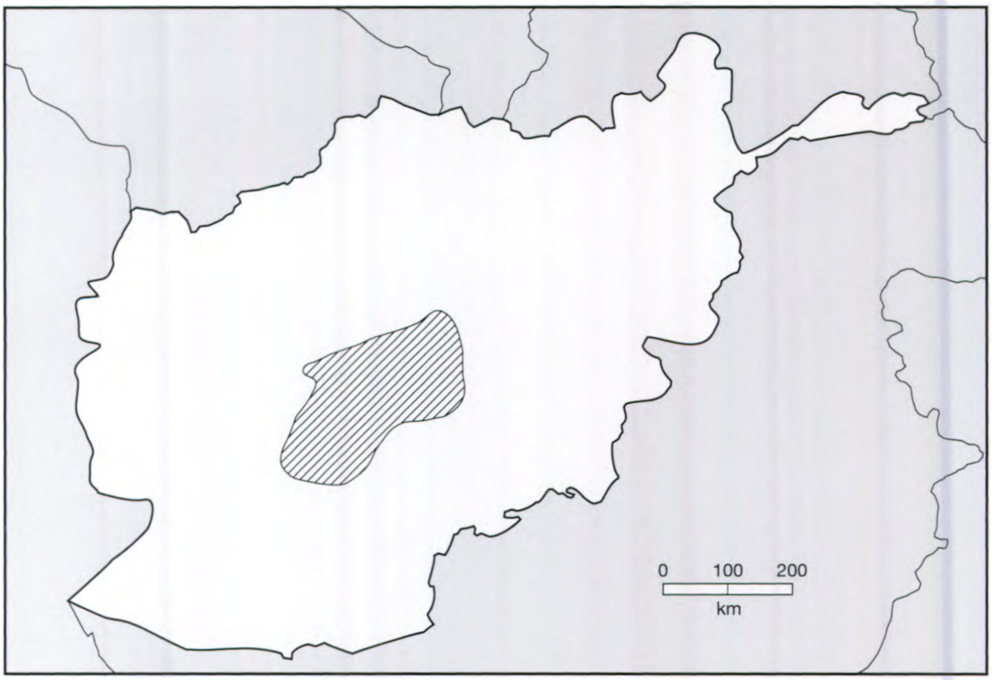
It was recommended that the Pamir-i-Buzurg (Big Pamir) Wildlife Sanctuary be designated a National Park and World Heritage Site (Petocz 1971, 1973). The current status of the Sanctuary is unknown, although most of the local Kirghiz are believed to have left the Wakhan corridor (Habibi 1985). Proposals can only be made once the current situation in the Wakhan corridor is known. This will require new surveys of the Marco Polo sheep, ibex and other large mammals. Ideally, discussions among Afghanistan, Tadjikistan, China and Pakistan, together with IUCN, will be necessary to attempt implementation of trans-frontier Caprinae management. Reinstatement of the Ajar Valley Reserve, which is one of the most important in Afghanistan, should also be a top priority. This wildlife reserve was also proposed as a national park in 1981.

Species accounts

A number of reports and publications deal with the biology of wild caprins found in Afghanistan (e.g. Habibi 1977, 1985; Petocz and Larsson 1977; Petocz and Shank 1983; Petocz *et al.* 1978; Schaller 1977; Sköglandand Petocz 1975).

Wild goat (*Capra aegagrus*)

Distribution: Probably confined to the Hazarajat and Uruzgan mountains in central Afghanistan, including the arid Feroz Koh and Siyah Koh in the headwaters of the Hari Rud, Farah Rud, Helmand and Arghandab rivers



Map 8.1.2. Distribution of wild goat (*Capra aegagrus*) in Afghanistan, prior to 1979.

(Map 8.1.2). No animals were observed by FAO or WWF survey teams, but horns and skulls were occasionally seen at shrines and grave sites. One captive animal seen in 1975 in a private zoo in Kandahar, was reputedly caught in the nearby mountains. The species had probably been reduced to a small portion of its former range by the late 1970s (Habibi 1977).

Population: No estimate of numbers available.

Threats: Overhunting and colonisation of their habitat by livestock resulted in depleted numbers prior to 1979, with small bands of wild goats forced into the most inaccessible parts of the mountain ranges. Reconnaissance surveys were conducted to evaluate the species' distribution patterns in the mid-1970s. The work was discontinued after the start of the civil war.

Conservation measures taken: Wild goat (*Capra aegagrus*) is listed as Vulnerable (A2cde) in the 1996 IUCN List of Threatened Animals (IUCN 1996).

Status within country: Indeterminate.

Conservation measures proposed: Surveys to determine the current status and distribution of the species and to develop conservation strategies.

Siberian ibex (*Capra [ibex] sibirica*)

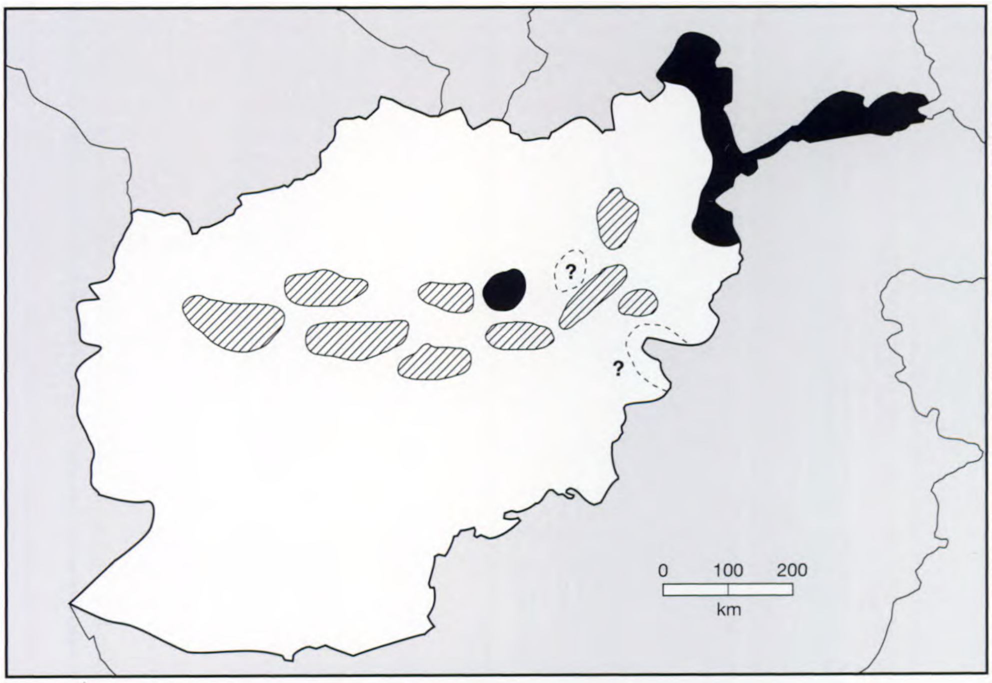
Distribution: This is probably the most widespread wild ungulate in the country. Siberian ibex is found throughout the Hindu Kush, northeast as far as southern Badakhshan, and southward into the Hazarajat mountains. It is also located in pockets in the Spinghar range and some remnant populations in the Kohe Baba range near Kabul. The species also occurs in the Feroz Koh mountains in the northeast, in the mountains of Badakhshan Province and northern Nuristan, throughout the Pamir mountains, in the glaciated mountains south of the Wakhan river, in the Darwaz section of Northern Badakhshan, and in the high mountains of Nuristan bordering Badakhshan (Map 8.1.3). Extensive seasonal movements occur between Nuristan and the neighbouring Badakhshan peaks (Petocz and Larsson 1977).

Population: Before the Soviet occupation, this ibex was considered abundant throughout its range. Last estimates available for the Ajar Valley Reserve found that around 5,000 animals used the area seasonally (Shank *et al.* 1977). More than 4,000 were believed to inhabit the Pamir alone, but their present status is unknown. Other areas have not been censused, but the species appeared to be relatively abundant.

Threats: Prior to the war, Siberian ibex was abundant and hunted throughout its range by local tribesmen. The impact of hunting was believed to be limited.

Conservation measures taken: Protected in Band-e Amir National Park, in the Arjar Valley Wildlife Reserve (Shank *et al.* 1977), and in Pamir-i-Buzurg (Big Pamir) Wildlife Sanctuary, where 685 were counted in 1972.

Status within country: Insufficiently Known.



Map 8.1.3. Distribution of Siberian ibex (*Capra [ibex] sibirica*) in Afghanistan, prior to 1979.

Conservation measures proposed: 1) Surveys to determine the current status and distribution of the species. **2)** Assess conditions in the Ajar Valley Reserve.

Flare-horned or Kashmir markhor (*Capra falconeri falconeri*)

Distribution: Limited to eastern Afghanistan in the high mountainous, monsoon forests of Laghman and Nuristan (Map 8.1.4).

Population: Some 350 markhor were censused in western Nuristan (Petocz 1972), which was considered a small proportion of the animals present. The population was known to be declining steeply 10 years ago.

Threats: Markhor have been traditionally hunted in Nuristan and Laghman, and this may have intensified during the war. Domestic livestock were also increasing 10 years ago, creating competition for forage.

Conservation measures taken: Currently it is classed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and is listed in Appendix I of CITES. Within Afghanistan, the species had no legal protection, nor was it found in any reserves up to the war.

Status within country: Indeterminate.

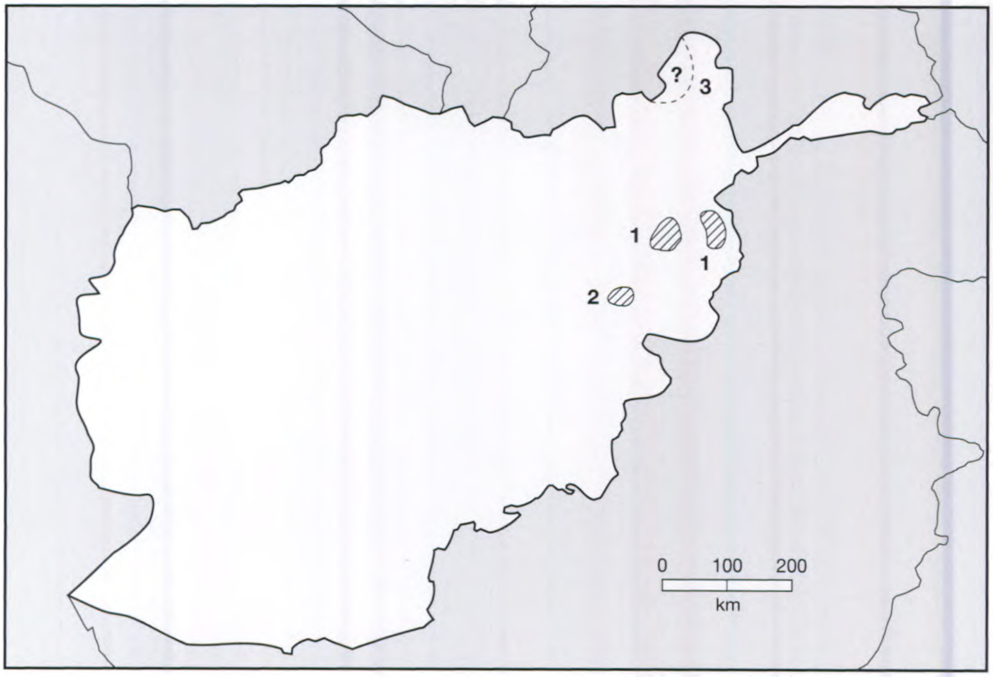
Conservation measures proposed: 1) Census current population numbers, productivity and distributions. **2)** A re-assessment of conservation potentials should be made after population surveys have been made. **3)** Based on these data, consider a series of hunting reserves that have full support of the local people. This is probably the best chance for the flare-horned markhor's survival. It will be critical to the success of such a program that the local people receive a substantial benefit from the operation of such reserves. Nuristan and Laghman are home to some of the toughest tribes in the country, with non-integrated societies that are frequently at odds with each other.

Kabul or straight-horned markhor (*Capra falconeri megaceros*)

Distribution: At least until 1978, this markhor survived only in the Kabul Gorge and the Kohe Safi area of Kapissa, and in some isolated pockets in between (Map 8.1.4). Intensive hunting pressure had forced it into the most inaccessible regions of its once wider range in the mountains of Kapissa and Kabul Provinces.

Population: Very few animals survived even 10 years ago, perhaps 50–80 in the Kohe Safi region, with a few in other isolated pockets.

Threats: Excessive hunting by local people and forage competition with livestock were pushing markhor to the periphery of its range. Such severe pressure was endangering the population towards a slow demise, and its status is unlikely to have improved since.



Map 8.1.4. Distributions of: 1) flare-horned markhor (*Capra falconeri falconeri*), 2) Kabul or straight-horned markhor (*C. f. megaceros*), and 3) Tadjik markhor (*C. f. heptneri*), in Afghanistan, prior to 1979.

Conservation measures taken: Classed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix I of CITES. No measures were taken in the country and the species occurs in no protected areas. It did occur in the proposed Nuristan National Park.

Status within country: Indeterminate (probably Endangered).

Conservation measures proposed: Drastic measures will be required if the Kabul markhor is still alive today. **1)** Carry out surveys to assess numbers and distribution as soon as possible. **2)** Public support for its conservation is essential if it is to survive, but this will be difficult to obtain.

Tadjik markhor (*Capra falconeri heptneri*)

Distribution: This subspecies may possibly exist in the Darwaz peninsula of northern Afghanistan near the border with Tadjikistan (Map 8.1.4). Almost nothing was known of this subspecies or its distribution in Afghanistan before 1979 (Habibi 1977).

Population: No estimate.

Conservation measures taken: Classed as Critical (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix I of CITES. No measures were taken in the country and the species occurs in no protected areas.

Status within country: Indeterminate.

Conservation measures proposed: Surveys to determine if the taxon occurs in Afghanistan.

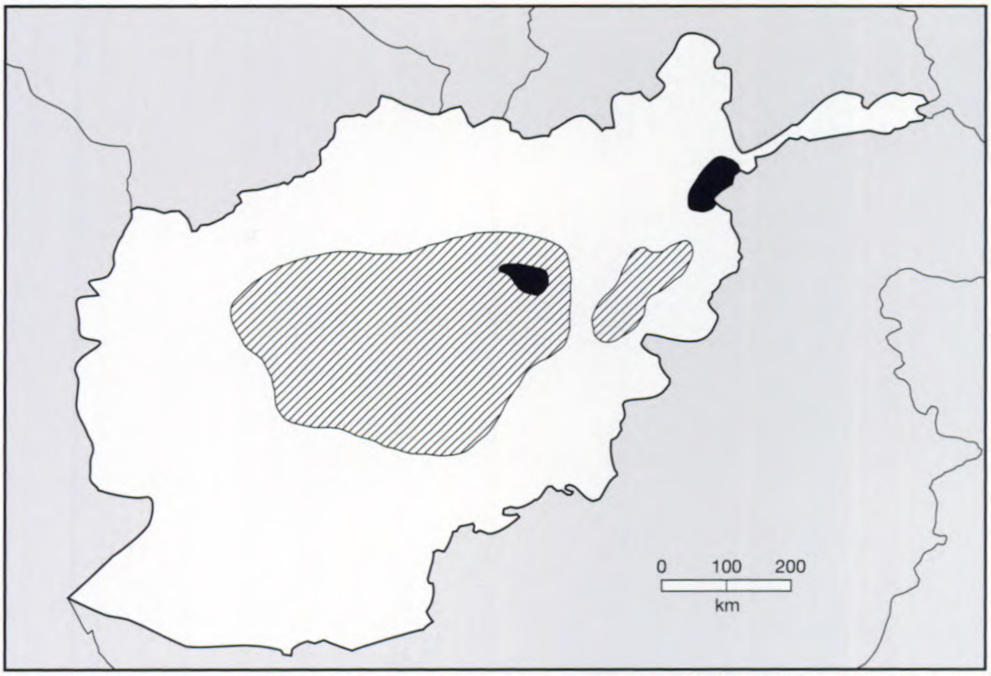
Afghan urial (*Ovis orientalis [vignei] cycloceros*)

Distribution: Urial populations were known to occur throughout the Hindu Kush and the mountains of central Afghanistan, extending from the Zebak mountains in the north to the Seyah Koh range in the southwest (Map 8.1.5). The largest concentration was in the Ajar Valley Reserve, from where animals were known to migrate into distant valleys near the Band-e Amir National Park. Its presence was established in the Zebak ranges during 1976 surveys, but it was not known how far the species ranged into Badakshan. East of Kabul, the urial was found in the Kohe Safi region of Kapisa Province (Petocz 1973). Specimens collected from hunters show that its range extended towards the Lataband Pass area near Kabul. The species was also reported from the Safed Koh range in Herat and Badghis Provinces.

Population: No estimate.

Threats: This urial avoids rugged mountainous terrain where it might gain some protection, and instead competes directly with livestock that are seasonally brought into their habitat. Urial populations near major urban centres have declined significantly due to indiscriminate hunting pressure.

Conservation measures taken: Listed as Vulnerable (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN



Map 8.1.5. Distribution of Afghan urial (*Ovis vignei cycloceros*) in Afghanistan, prior to 1979.

1996) and Appendix I of CITES. Occurs in the Arjar Valley Wildlife Reserve (Shank *et al.* 1977), and seasonally (summer) in Kohe Burocinal and Kohe Argosa nearby the Band-e Amir National Park (Shank and Larsson 1977). In the 1970s, plans were considered to locate a viable urial population to develop a limited hunting reserve involving local participation, as had been achieved for Marco Polo sheep.

Status within country: Indeterminate.

Conservation measures proposed: 1) Carry out extensive surveys of Afghan urial populations and distributions in the Hindu Kush. **2)** Re-consider the options proposed by Petocz (1978).

Marco Polo sheep (*Ovis ammon polii*)

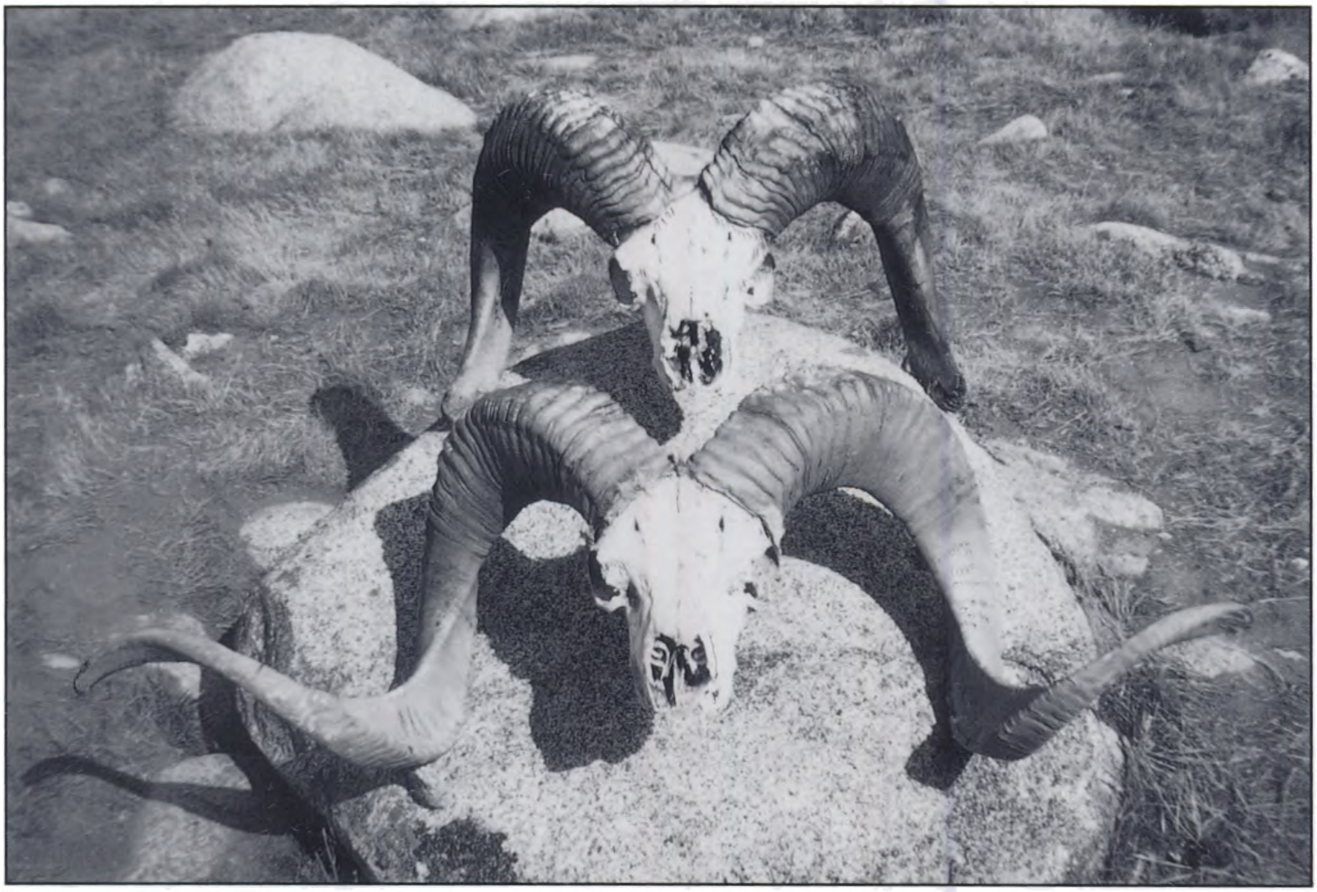
Distribution: This argali occurred throughout most of the eastern sections of the Wakhan Corridor of northeastern Afghanistan, including the Big and Small Pamir mountains, and the Waghjir Valley (Map 8.1.6). The total distribution of this species extends into bordering areas of China, Pakistan and Tadjikistan. Seasonal movements between Afghanistan and Tadjikistan, China and Pakistan occur at various times throughout the year.

Population: In 1978, more than 1,300 Marco Polo sheep used the Afghanistan portion of its range on a seasonal basis. More recent estimates are not available.

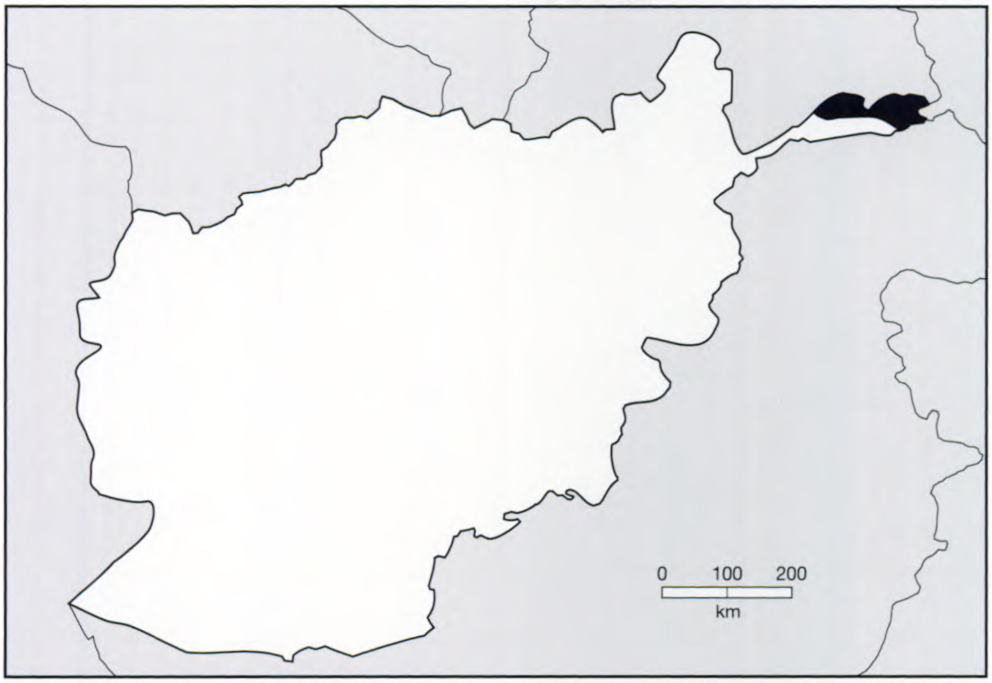
Threats: In 1975, barbed wire fences were erected across several high passes in the Small Pamir by the Soviets. Many of these passes were used as migration routes by Marco Polo sheep, and besides hampering their movements, the fences may increase vulnerability to wolf predation. Before 1979, hunting by local Kirghiz occurred but did not appear to be a problem for the Marco Polo sheep population. However, competition from domestic livestock was considered to have a significant, negative impact (Petocz *et al.* 1978), and led to the development of the hunting-conservation program in co-operation with the local people.

Conservation measures taken: Listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix II of CITES, and as "Endangered" in the U.S. Endangered Species Act of 1973 (Federal Register of June 23, 1992). It is also

Skulls of two male Marco Polo sheep (*Ovis ammon polii*) found in the Pamir mountain of the Wakhan corridor, Afghanistan.



R. Petocz



Map 8.1.6. Distribution of Marco Polo sheep (*Ovis ammon polii*) in Afghanistan, prior to 1979.

included in an import ban by the European Union. Until the start of the war, around 1,300 Marco Polo sheep were protected in the Pamir-i-Buzurg (Big Pamir) Wildlife Sanctuary, where the Afghan Tourist Organisation conducted limited, annual hunts for foreign trophy hunters.

Status within country: Indeterminate.

Conservation measures proposed: 1) Undertake surveys to determine the taxon's current status and numbers. **2)** Determine the status of the Pamir-i-Buzurg Wildlife Sanctuary.

8.2 Bhutan

H. Wollenhaupt, M.J.B. Green, S. Thinley and J. Palden

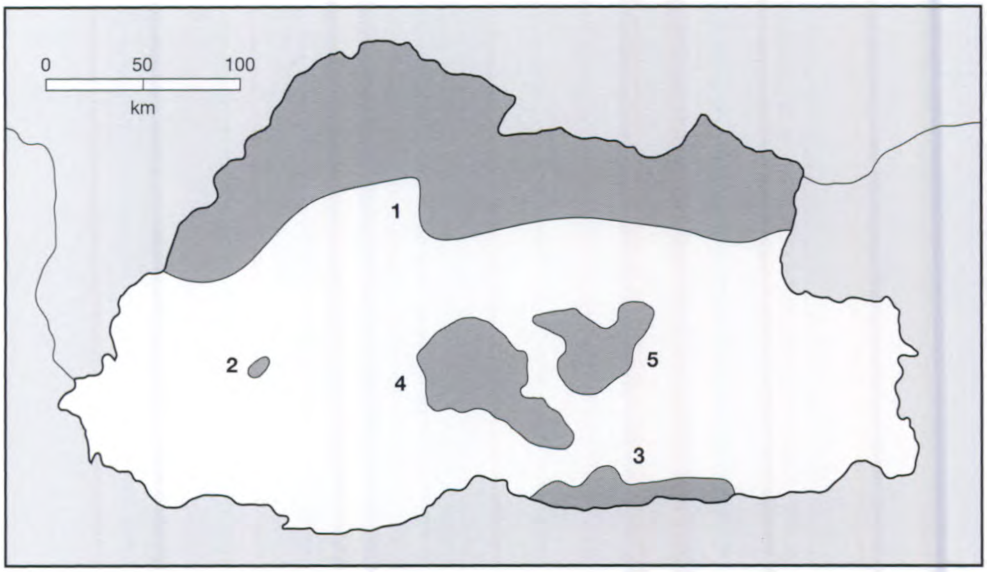
Introduction

The Kingdom of Bhutan covers approximately 46,600km². It is bounded along its 250km northern border by Tibet, and by India to the east, south and west. The Kingdom ranges from 200 to over 7,500m asl, and can be split into three broad physiographic regions. The Great Himalaya run along Bhutan's northern border, where peaks exceed 7,500m asl and high valleys occur between 3,600 and 5,500m asl. The highest peak is Kulakangri (7,554m asl). Immediately south of this is the Lesser Himalaya, whose spurs run north-south to form the watersheds of Bhutan's main rivers. The Duars plain is the third region and comprises a narrow band up to 16km wide along the southern boundary of the country.

Both elevation and exposure to the southwest monsoon, result in habitats ranging from dense forests on high rainfall slopes, to alpine vegetation at higher elevations. There are a number of fertile valleys around 1,500 and 2,800m asl in the Lesser Himalaya region in western and eastern parts of central Bhutan. Much of the Duars plain receives between 5,080 and 7,620mm of rain annually, but some areas, as around Thimphu, may receive only 600mm annually. Originally covered by dense, semi-tropical forest, such habitat is now very limited on the Plain. Bhutan contains faunal representatives of four major biogeographical regions: Palaearctic, Indo-Chinese, Indo-Malayan and Indian Subcontinent (Wollenhaupt 1989a).

Current status of Caprinae

Very little is known about the distributions and numbers of the four species currently found in Bhutan. These are the Himalayan serow (*Capricornis sumatraensis thar*), the Eastern Himalayan goral (*Naemorhedus goral goral*), blue sheep or bharal (*Pseudois nayaur nayaur*), and the Bhutan or White's takin (*Budorcas taxicolor whitei*). Bhutan represents the eastern limit for the world distribution of blue sheep and the western limit of takin. Numbers of blue sheep appear particularly large at present, with herds of up to 100 animals seen in some areas. Despite this, competition with domestic yaks on high alpine pastures may soon lead to a decline in numbers. The takin was named as the



Map 8.2.1. Locations of protected areas with Caprinae in Bhutan.

1) Jigme Dorji National Park (434,900ha; est. 1974/1993); 2) Doga National Park (2,176ha; est. 1974); 3) Royal Manas National Park (102,300ha; est. 1988/1993); 4) Black Mountains National Park (140,000ha; est. 1993); 5) Thrumsingla National Park (76,800ha; est. 1993). [Ed. note – Doga NP has been removed from the current system of protected areas.]

national animal of Bhutan by the Royal Government in 1985. Populations of all four species appear to be healthy at present and none are threatened by hunting due to the influence of Buddhism. However, many land-use practices do threaten Bhutan's wildlife, including its Caprinae. Pressures are greatest on forested areas where agricultural encroachment, illegal logging, forest burning and fuelwood gathering, are destroying important habitats (Mahat 1985).

A fifth caprin species, the Tibetan argali (*Ovis ammon hodgsonii*) occurred in northern Bhutan until quite recently (Blower 1989), but there are no recent records of it still occurring in the country. The occurrence of Himalayan tahr (*Hemitragus jemlahicus*) in Bhutan is also uncertain. The species was said to occur in western Bhutan at the beginning of this century (White 1910), and was reported more recently (Blower 1985a; Holmes 1970). However, surveys in 1989 by Wollenhaupt (unpubl.) found no evidence of it, and there are no tahr specimens in the national museum in Paro.

General conservation measures taken

The Bhutan Forest Act of 1969 was the first legislation enacted to address environmental conservation. It has been superseded by the Forest and Nature Conservation Act of 1995. The current Act provides a broad legal basis for the establishment and management of protected areas, and conservation of plant and animal species. It prohibits hunting of any wild animal, whether or not on government land, except in defense of human life or, on private land, crops or private property. Individual species listed on Schedule I of the Act are afforded complete protection and may only be killed in defense of human life. A special permit from Ministry of Agriculture may be obtained to take any of these species for research or other conservation activities, or management purposes (e.g. control or culling). The Forestry Services Division (FSD) of the Ministry of Agriculture, based in Thimphu, is the main government agency responsible for administration and execution of conservation programs. Day-to-day management and implementation of these programs are carried out by the Nature Conservation Section (NCS), which is the technical section within the FSD. Until 1993, the NCS was known as the Wildlife Division.

By 1978, Bhutan had established an extensive system of protected areas (national parks, wildlife sanctuaries and nature reserves) covering more than 19% of the country. However, this system was not representative of all the major ecosystems of Bhutan because the protected areas were in the southern and northern part of the country, and the temperate zone in the interior was not represented (FMP, 1991). Consequently, the Ministry of Agriculture adopted a revised system of protected areas that did represent most of the country's ecosystems (MacKinnon, 1993). This system consists of nine protected areas covering more than 22% of the country: four national parks (Black Mountain, Jigme Dorji, Thrumsingla and Royal Manas), four wildlife sanctuaries (Kulong Chu, Sakting Wildlife, Khaling-Neoli, and Phipsoo), and one strict nature reserve (Torsa). Faunal surveys conducted in Black Mountain, Jigme Dorji, and Royal Manas National Parks have documented the occurrence of caprins in all three parks (Map 8.2.1).

With the assistance of WWF, the NCS has completed five-year management plans for Royal Manas and Jigme Dorji National Parks, both of which have been approved by government. The plans cover numerous subjects in detail, including developing infrastructure, conducting studies on selected plants and animals, habitats and ecosystems, and providing opportunities for human communities living in and around the parks through integrated conservation and development. A management plan is being developed for Black Mountains National Park with assistance from the Netherlands Government. To date, surveys to collect baseline information on the flora and fauna, land-use, and socio-economics have been conducted with the assistance of WWF.

General conservation measures proposed

A research program for conservation of Bhutan's wildlife has been proposed, that includes studies on all four species of Caprinae (Wollenhaupt 1988b).

Species accounts

Preliminary accounts of the biology and ecology of Caprinae in Bhutan are available (Wollenhaupt 1988d, 1989c, 1990), along with information for them outside Bhutan (Green 1987a; Mead 1989; Schaller 1977; Xiaoming and Hoffmann 1987).

Himalayan serow (*Capricornis sumatraensis thar*)

Distribution: Almost nothing is known of its distribution in Bhutan, other than it can exist in subtropical and temperate zones (Map 8.2.2), and has been recorded in Royal Manas and Black Mountain National Parks (NCS, 1995).

Population: No estimate of numbers or population trends.

Threats: Although officially 64% of Bhutan remains forested, the figure is probably closer to 50% (Sargent 1985), making deforestation one of the main threats to the forest-dwelling serow.

Conservation measures taken: Serow is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Schedule I of Bhutan's Forest and Nature Conservation Act, 1995, and it is in Appendix I of CITES. Himalayan serow is reported in Royal Manas National Park (Map 8.2.1) on the southern border with Assam (Jackson 1981). It also lives in the vast Jigme Dorji National Park (Blower 1989; Wollenhaupt 1988d), which extends across all of northern Bhutan, and in Black Mountains National Park (Blower 1989).

Status within country: Insufficiently Known.

Conservation measures proposed: Surveys to determine numbers and distribution.

Eastern Himalayan goral (*Naemorhedus goral goral*)

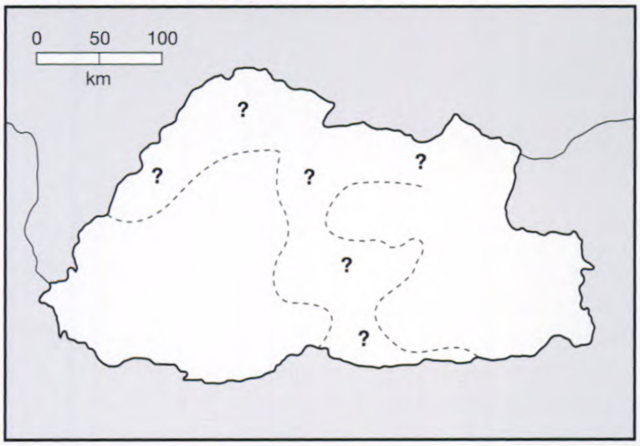
Distribution: Goral occurs throughout the northern third of Bhutan (Map 8.2.3).

Population: No estimate.

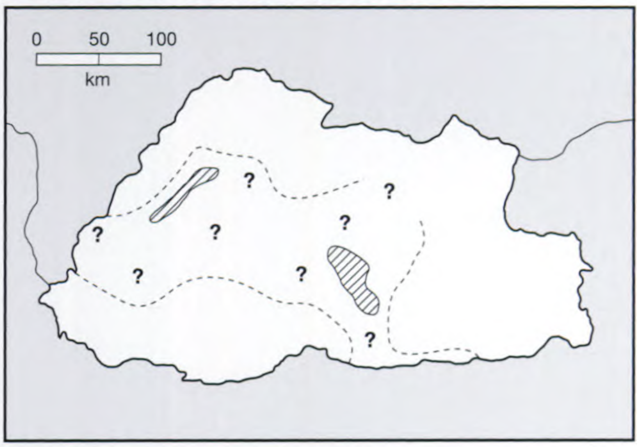
Threats: Although some parts of the range are in reasonable condition, in other areas, its habitat is being destroyed by overgrazing by livestock, and in the area previously in Doga National Park, by grass burning during the dry season (Blower 1985a).

Conservation measures taken: Listed as of Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and included in Appendix I of CITES. Goral in Bhutan is known to occur in Doga, and Royal Manas National Parks (Dorji 1977; Lahan 1986, both cited in Green 1987b), Jigme Dorji National Park (Wollenhaupt

Map 8.2.2. Suspected distribution of Himalayan serow (*Capricornis sumatraensis thar*) in Bhutan.



Map 8.2.3. Suspected distribution of Eastern Himalayan goral (*Naemorhedus goral goral*) in Bhutan.



1989d), and Black Mountains andThrumsingla National Parks (Map 8.2.1). Although Doga National Park was established mainly to protect this goral, the habitat is so degraded by exploitation that the Park is of almost no conservation value for the species (Blower 1986; Wollenhaupt 1989a) and has since been removed from the country's protected areas system.

Status within country: Insufficiently Known.

Conservation measures proposed: Surveys to determine numbers and distribution.

Bharal or blue sheep (*Pseudois nayaur nayaur*)

Distribution: Found throughout northern Bhutan above 4,000 to 4,500m asl (Map 8.2.4).

Population: No estimate.

Threats: The species is not in immediate danger and numbers seem to be increasing due to the expansion of grazing areas for domestic yaks. However, heavy grazing by both species are damaging the fragile, high alpine vegetation, so blue sheep population trends may be reversed in the near future.

Conservation measures taken: Listed as of Lower Risk (nt) in the 1996 IUCN Red List (IUCN 1996). Blue sheep is known to occur in Jigme Dorji National Park (Map 8.2.1).

Status within country: Not threatened.

Conservation measures proposed: With input from local inhabitants, establish integrated alpine forest and grassland reserves in high elevation areas where demand for domestic yak grazing is considerable and deforestation and degradation of alpine areas occur (Wollenhaupt 1989a).

Bhutan or White's takin (*Budorcas taxicolor whitei*)

Distribution: No censuses have been carried out, but it is believed the species occurs in scattered populations throughout the forested and unforested mountain slopes along Bhutan's northern border (Map 8.2.5). One or two populations are known to occur on both sides of the upper catchment of the Mo Chu (Wollenhaupt 1990).

Population: No estimate.

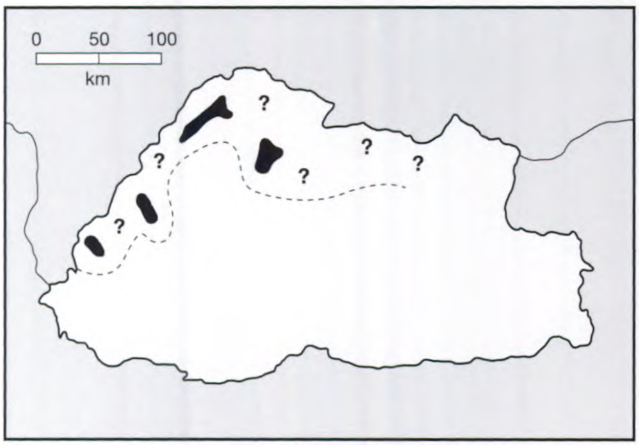
Threats: Competition and disease transmission from domestic livestock, habitat loss (pasture burning), and loss or disruption of migration routes.

Conservation measures taken: Bhutan takin is listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Schedule I of Bhutan's Forest and Nature Conservation Act, 1995, and is in Appendix II of CITES. The species is known to inhabit Jigme Dorji National Park (Map 8.2.1).

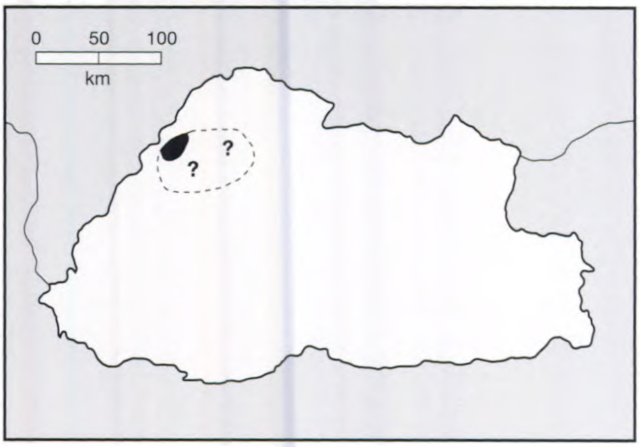
Status within country: Insufficiently Known.

Conservation measures proposed: 1) Undertake surveys of numbers and distributions. 2) Protection of takin habitat is urgently required, and special emphasis should be given to determining and preserving its migration routes between seasonal ranges (Wollenhaupt 1990).

Map 8.2.4. Suspected distribution of blue sheep (*Pseudois nayaur nayaur*) in Bhutan.



Map 8.2.5. Suspected distribution of Bhutan or White's takin (*Budorcas taxicolor whitei*) in Bhutan.



8.3 India

J.L. Fox and A.J.T. Johnsingh

Introduction

The Republic of India encompasses a vast and diverse subcontinent, approximately 3,338,000km² in area, that includes a wide range of habitats varying from permanently snow-covered mountains to lowland wet tropical forests. The country can be divided geographically into three broad but well defined regions; the Himalaya, the Indo-Gangetic plain, and the Peninsula (Map 8.3.1). The Himalaya and associated spur ranges stretch nearly 2,500km across India's northern border from Jammu and Kashmir to Arunachal Pradesh, to cover an area of about 250,000km² within India. As the earth's youngest major mountain system, the Himalaya include some of the highest peaks in the world, 10 of which in India are over 7,600m. With approximately 40,000km² of permanent snowfields in these mountains, India has more area under snow and ice than any other country outside the sub-polar regions. In northeastern India, the Himalaya merge into hilly regions along the border with Myanmar. The Indo-Gangetic plain is a lowland region (80% below 150m asl), about 2,500km long and 240 to 320km wide, formed by the basins of three great rivers: the Indus, Ganges and Brahmaputra. The Plain extends continuously from the Thar (Great Indian) desert in the northwest (itself covering 8% of the country) to the Ganges-Brahmaputra basin in the northeast, and together with the west and southeast lowland coastal plains accounts for more then 50% of India's land area. Peninsular India is dominated by the Deccan plateau and Central highlands (the oldest geological formations of the region), separated from the Indo-Gangetic plain by the Vindhya mountains (450 to 1200m). The Deccan plateau (600m mean elevation) is bounded by the Western and Eastern Ghats; escarpments that fall away to either coast. The Nilgiri hills constitute the southern junction of the Eastern and Western Ghats, with the latter continuing farther south to within 30km of Cape Comorin. With most Caprinae species adapted to the rugged terrain of mountainous regions, it is the Himalayan ranges, the northeastern hills and the southern escarpments that provide habitats for this group within India (Map 8.3.1).

Map 8.3.1. Primary geographic regions **of India.** Caprinae are found in the Himalaya, **the northeastern** hills and the southern escarpments.

India's climate is dominated by the tropical Asian monsoon, a major land-ocean air circulation system that results in India having three main seasons; cool (November to February), hot (March to June), and rainy (June to October). Major climate-related geographic divisions associated with temperature and timing of rainy periods include the northern mountains, Deccan Plateau, west coastal region, southeast coastlands, and the extreme northeast (WCMC 1988b). Mainland India's biological diversity has been categorised into nine major biogeographical zones (Rodgers and Panwar 1988), four of which are important for Caprinae. The descriptions of these zones presented below, are based on characterisations by Rodgers and Panwar (1988) and Champion and Seth (1968). The northernmost "Transhimalayan" zone lies north of the main Himalayan range in Jammu and Kashmir and within the dry inner Himalayan valleys of Himachal Pradesh. Vegetation consists primarily of dry steppe and alpine scrub dominated by xerophytic plants, that reflect the extremely dry and cold climatic conditions The only forest vegetation occurs in the form of stream-side *Salix*, *Populus* and *Hippophae* associations throughout the region, and scattered *Juniperus* and *Betula* woodlands on mountain slopes, primarily in Himachal Pradesh. Annual precipitation does not generally average >500mm and temperatures can fall to below minus 40°C within habitats that support Caprinae. The "Himalayan" zone includes this mountain chain in both the northwestern (southwest Jammu and Kashmir, Himachal Pradesh, northwest Uttar Pradesh) and northeastern (Sikkim, Arunachal Pradesh) parts of the country. It encompasses a complex topography and a mixture of vegetation formations with distinctive altitudinal zonation. Dominant forest types in the northwestern Himalaya include sub-tropical evergreen forests <1000m asl, Chir pine (*Pinus roxburghii*) forest between 1,000 and 1,800m, above which are moist temperate oak (e.g. *Quercus incana*) and conifer associations, followed by mixed conifer and conifer-deciduous associations with *Abies*, *Cedrus*, *Picea*, *Tsuga*, *Taxus*, *Acer* and *Betula*. Higher still, and most prominent in the colder regions of the northwestern Himalaya, dry temperate forests replace the moist temperate vegetation, with *Pinus wallichiana*-dominated forests common between 2,900m and 3,500m. Subalpine patches of *Betula* and *Juniperus* grade into shrublands of *Berberis*, *Lonicera* and *Rhododendron*, with scrub and herbs present to >5,000m. The eastern section of the Himalayan zone is more strongly affected by the monsoon rains, and the vegetation is both denser and richer. There, tropical semi-evergreen forests occur where rainfall is sufficient below 1,000m, above which broad-leaved forests, some with various *Quercus* spp., are most common up to ca. 2,500m. Sub-alpine forests beginning at elevations >3,000m are dominated by *Pinus*, *Betula*, *Rhododendron* and other deciduous species up to 4,600m, where they give way to sparse scrub extending as high as 5,500m on southern aspects. The "North-East India" zone (Assam, Manipur, Meghalaya, Mizorum, Nagaland, Tripura) is characterised by tropical evergreen forests. Giant dipterocarps (*Dipterocarpa macrocarpus*, *Shorea assamica*) are scattered through the forests in the Assam valley, and *Mesua* and *Vatica* are the most common arboreal genera. Tropical and subtropical deciduous forests such as moist sal (*Shorea robusta*) forest occur on hillsides <1,500m, but have been seriously depleted by shifting agriculture. Temperate montane forests (1,300 to 1,500m) in this zone are well represented in the "sacred forests" of the Shillong Plateau, where trees such as *Quercus* and *Castanopsis* are heavily festooned with epiphytes and the dense understorey of herbaceous plants includes genera such as *Asteraceae*, *Begoniaceae*, *Ranunculaceae* and *Rosaceae*. The "Western Ghats" zone of southwest India, along the border of Kerala and Tamil Nadu, constitutes the only Caprinae habitat in southern India. Moist deciduous forests, some with important hardwood species (e.g. *Dalbergia latifolia*, *Pterocarpus marsupium*, *Tectona grandis*), grow between 500 and 800m on both eastern and western margins of the Ghats. Semi-evergreen forests occur in a narrow strip above the moist deciduous forests and below the wet evergreen zone where tropical evergreen forests can still be found in isolated unlogged patches with annual rainfall >2,000mm. The montane vegetation includes the "shola" forest, a closed temperate evergreen formation of *Celtis*, *Elaeocarpus*, *Machilus* and *Meliosma*, that occurs interspersed with grasslands on rolling hills >1,500m.

Current status of Caprinae

India has a relatively diverse array of wild bovids in the Caprinae subfamily, including six genera and a total of 10 species. Nine species occur in the rugged mountains of India's northern Himalayan region, two of which are also present in India's northeastern hilly regions bordering Myanmar. One species endemic to India, inhabits the plateau escarpments near the southwestern tip of the Indian peninsula. The taxonomy of several of the Caprinae species in India is apparently still in some flux, and changes may be expected as more studies are conducted with these animals.

All three tribes of Caprinae are represented within India. The Rupicaprini is represented by two or possibly five species. Two subspecies of serow, known locally as "thar", "emmu", or "sarao", apparently occur within India: Himalayan serow (*Capricornis sumatraensis tahr*) in the main Himalaya, and red serow (*C. s. rubidus*) in southern Assam, Nagaland and possibly other northeastern states. The number of goral taxa in India is also uncertain. Up to three species with as many as four subspecies may be present. The Himalayan goral (*Naemorhedus goral*, represented by *N. g. bedfordi* and *N. g. goral*) occurs in the western and eastern Himalaya, respectively. Evan's long-tailed goral (*N. caudatus evansi*) is apparently found in Nagaland and possibly Assam, while the Burmese red goral (*N. baileyi cranbrooki*) may occur in northeast Arunachal Pradesh. Like serow, goral occur on steep, forested mountain and hill slopes, ranging in elevation from 500m in the Siwalik hills to timberline areas over 4,000m. The forest habitat and solitary habits of both goral (Pendharkar and Goyal 1995) and serow make observation difficult, and no reliable population estimates over large areas have been made to date for either species. Both hunting, and habitat degradation and loss, caused by forestry practices, agriculture and fuelwood gathering, threaten populations of both species. Overall, goral populations are still considered satisfactory in most areas, while the serow is viewed as Indeterminate and more patchily distributed. Because so little is known of the distributions of different subspecies of both goral and serow in India, we provide only a single distribution map for each genus.

Within India, the tribe Caprini is represented by four genera and seven species. Two species of tahr (*Hemitragus* spp.), primitive goats characteristic of timberline regions of India, occur in widely separated areas. The Nilgiri tahr (*H. hylocrius*), known locally as "varaiadu", is endemic to southern India and is considered Endangered. It is restricted to the Western Ghats which form a relatively low elevation escarpment along the western edge of the Deccan Plateau in the southern Indian states of Kerala and Tamil Nadu. The Himalayan tahr (*H. jemlahicus*), variously known as "kaarth", "meshi" and "taheer", occurs in a narrow zone around the timberline along the southern side of the Himalaya in Jammu and Kashmir, Himachal Pradesh, northwestern Uttar Pradesh and parts of Sikkim. Because of the lack of sufficient population information, its status is currently considered to be Indeterminate. The blue sheep (*Pseudois nayaur nayaur*), a sheep-like goat, is present in northern portions of the Himalayan states from Jammu and Kashmir to Arunachal Pradesh. This species, locally called "bharal" or "napo", currently appears in no danger.

True goats and sheep are each represented by two wild species in India. The Asiatic or Siberian ibex (*Capra [ibex] sibirica*), called "(s)kin" or "tangrol", is present only in the Transhimalayan and Himalayan regions of Himachal Pradesh and of Jammu and Kashmir. Its eastern distribution, and the southeastern limit for this species world-wide, is demarcated by the Sutlej River gorge. At least 6,000 ibex are believed to be present in Ladakh (Jammu and Kashmir) and perhaps another 4,000 in other parts of their range in India (Fox *et al.* 1991a, 1992). Except for isolated populations along the boundaries of its range, the ibex is not considered to be in any danger of extinction within India. In contrast, the Astor or straight-horned markhor (*Capra falconeri falconeri*) is threatened with extinction in India, as it is in most other parts of its range. Markhor in northwest India were formerly referred to as Pir Panjal or Kashmir markhor (*C. f. cashmiriensis*) (Schaller and Mirza 1971), but are now included as Astor or straight-horned markhor (Schaller and Kahn 1975; Schaller 1977). In India, Ladakh urial or "shapu" (*Ovis orientalis vignei*) occurs only within a restricted range (about 1,500km^2) in the low arid hills along the Shyok, Nubra and Indus rivers in central Ladakh (Jammu and Kashmir). The total Indian population of these urial is currently estimated at between 1,000 and 1,500 (Fox *et al.* 1991a; Mallon 1991). Its preferred habitats are highly accessible and vulnerable to human disturbance and hunting. Its current status is Endangered. Within India, the Tibetan argali or "nyan" (*Ovis ammon hodgsonii*) inhabits two widely separate areas along the border with China; one in eastern Ladakh (Jammu and Kashmir) and an adjacent small part of northeastern Himachal Pradesh, and the second in northern Sikkim. Argali numbers have been estimated at around 200 in Ladakh (Fox *et al.* 1991a), with probably less than this number surviving in Himachal Pradesh and Sikkim combined. The argali's current Endangered status in India is appropriate and special conservation measures should be taken to ensure the survival of this subspecies in India.

One member of the tribe Ovibovini, the Bhutan or White's takin (*Budorcas taxicolor whitei*), is found in two separate areas of Arunachal Pradesh: along its western border with Bhutan, and along its northeastern border with China. A recent survey, that interviewed people living near and using takin range in eastern Arunachal Pradesh, concluded that this species is present in considerable numbers in some parts of the region (Katti *et al.* 1990). Takin numbers are apparently satisfactory within their limited range in India, but these small populations are still at some risk due to their overall rarity.

The combination of increased human use of some marginal lands in rugged mountainous areas, and a recent series of military conflicts along mountainous border regions, has led to a decline in most Caprinae populations over the past 100 years, especially those in northwestern India. Several species are now threatened with extinction. Declines have been caused by two main factors: hunting and habitat alteration. Wildlife habitat has been lost as a result of people moving into agriculturally marginal areas, and general human population increases. Forests have been cleared for crops, for their timber resources, and to create grazing areas, while understorey or scrub vegetation has often been removed for fuel. Although such habitat alteration may have improved habitats in some areas for an open-forest species such as goral, the increased number of people (hunters) and easier hunting (more open habitats, better firearms, increased access) has probably countered any tendency toward an increase in goral numbers. Grazing lands at all elevations are locally overgrazed, or at the very least, native forage has been significantly altered and reduced. Over large areas, the wild herbivores face increasing competition for food because domestic livestock numbers have increased along with the human populations.

Increased hunting pressure results from several factors. Whereas the increasing human population and its concomitant food needs has probably been influential on a local level, the effect of road building into the mountains has greatly increased access for hunters of non-local origin. The presence of contract logging and road building in many areas of the Indian Himalaya (including protected areas) has significantly affected both the alteration of wildlife habitats and the introduction of hunting by outsiders, from hired labourers to the contracting officials. A third major factor has been a consequence of India's wars with China and Pakistan since independence in 1947. These have resulted in large numbers of military personnel being stationed along many of the northern border areas that formerly were strongholds of various Caprinae species. The presence of the army has had a significant and detrimental impact on Caprinae in many parts of this region (Fox *et al.* 1991a), although over the past 10 years there has been a marked improvement in the attitude of the military towards wildlife conservation. Nevertheless, illegal hunting continues and the recurring conflict between India and Pakistan along their border in Jammu and Kashmir, and continued tensions with China, mean that many northern border areas will continue to harbour large military contingents. Civil control of hunting activity will probably continue to be minimal, and reliable information on Caprinae populations will be difficult to obtain in these areas.

General conservation measures taken

India's conservation history reaches back to at least the third century B.C., with what may be the world's first recorded conservation act proclaimed by Emperor Ashoka in the creation of reserves for wildlife (WCMC 1988b). Over a millennia later, in the late 19th and early 20th

Table 8.3.1. Protected areas with Caprinae in India.

Protected Area[1]	Size (ha)	Date est.	Species[2]
Jammu and Kashmir			
Dachigam NP	141,000	1981	s
Hemis High Altitude NP	410,000	1981	b,i,u,a
Kishtwar NP	31,000	1981	g,h,i
Limber GR	1,200	?	g?,m
Hirapora WS	11,000	1987	m
Lachipora WS	8,000	1987	m
Nandni WS	3,372	1981	g
Overa-Aru WS	42,500	1987	s,g?
Surinsar Mansar WS	3,958	1981	g
Sabu Chukor GR	1,500	1981	b,i
Himachal Pradesh			
Great Himalayan NP	60,561	1984	s,g,h,b,i?
Pin Valley NP	80,736	1987	b,i
Bandi Churdar WS	9,606	1985	g
Chail WS	11,004	1976	g
Chital WS			b
Daranghati WS	2,701	1962	s,g,h,b,i
Darlaghat WS	9,871	1962	g
Gamgul Siya-Behi WS	10,546	1949	s,g,h,i
Kais WS	1,220	1954	b
Kalatop-Khajjiar WS	3,069	1949	s,g
Kanawar WS	6,157	1954	s,g,h,b,i
Khokhan WS	1,760	1954	s,g,h
Kugti WS	33,000	1962	s,g,h,i
Lippa Asrang WS	2,953	1962	g,b,i
Majathal Harsang WS	3,164	1962	g
Manali WS	3,127	1954	s,g,h?,i
Naina Devi WS	3,719	1962	s,g
Nargu WS	24,313	1963	g
Raksham Chitkul WS	3,827	1962	g,b
Renuka WS	478	1964	g
Rupi Bhaba WS	85,414	1982	s,g,h,b,i
Sangla Valley WS			g,b
Sechu Tuan Nala WS	65,532	1962	s,g,h,b,i
Shikari Devi WS	7,119	1962	g
Shilli WS	202	1963	g
Simla Water Catchment WS	951	1958	g
Talra WS	3,616	1962	g
Tirthan WS	6,825	1976	s?,g,h,b,i
Tundah WS	41,948	1962	s,g,h,i
Uttar Pradesh			
Corbett NP	52,082	1936	g
Nanda Devi NP	63,033	1982	s,g,h,b
Rajaji NP	83,153	1988	g
Valley of Flowers NP	8,950	1982	g,h?,b
Govind Pashu Vihar WS	95,312	1954	s,g,h,b
Kedarnath WS	97,524	1972	s,g,h,b
Sikkim			
Khangchendzonga NP	84,950	1977	s,g,h,b,a
Arunachal Pradesh			
Namdapha NP	198,524	1983	s,g?,t
Mehao WS	28,150	1980	t
Kamlang WS	?	?	t
Megahalaya			
Balphakram NP	22,000	1986	s,g
Assam			
Buxa Tiger Reserve	?	?	g?
Kerala			
Eravikulam NP	9,700	1978	n
Silent Valley NP	8,952	1980	n
Parambikulam WS	28,500	1973	n
Tamil Nadu			
Anamalai WS	84,935	1976	n
Kalakad-Mundanthurai Tiger Reserve	79,096	1976	n
Mukurti WS	7,846	1982	n
Srivilliputhur Grizzled Giant Squirrel Sanctuary	48,520	1988	n

[1] NP = national park; WS = Wildlife Sanctuary; GR = game reserve;
[2] s = serow - s; g = goral; n = Nilgiri tahr; h = Himalayan tahr; b = blue sheep; I = Asiatic ibex; u = Ladakh urial; a = Tibetan argali; t = takin. ? = presence unconfirmed.

centuries, modern conservation in India originated with the establishment of large forest reserves to preserve timber, soils and water resources (Rodgers 1985). A number of India's religious and cultural groups also have long-established conservation traditions, examples of which include sacred forests and ponds protected by local communities (Singh 1985). Modern federal conservation laws with uniform legislation were enacted through the Wildlife (Protection) Act of 1972 (categories recognised: I = fully protected; II = protected, but limited special hunting permitted; III = hunting permitted). This Act has been adopted by all states and union territories except Jammu and Kashmir, which enacted its own similar legislation in 1978. The 1972 Act is considered to have important weaknesses associated with its legal designations for various protected areas and is currently under government review (Dwivedi and Kishore 1984; Singh 1986; Padmanaban 1976, cited in Green 1993; Rodgers 1992). Over 50 protected areas contain Caprinae in India (Table 8.3.1). Nevertheless, there has been a de-facto moratorium on sport hunting in the Himalayan regions since 1973. This moratorium has probably been the primary conservation action affecting Caprinae in the past two decades. It has undoubtedly reduced shooting in areas popular for sport hunting. However, illegal hunting (for sport or otherwise) continues to be a major problem, both in military areas and in many protected areas where local hunters or minor officials are increasingly using modern weapons. Illegal hunting coupled with habitat loss and livestock grazing in many of the nominally protected areas, have effectively negated the value of their protected status.

India ratified the World Heritage Convention in 1977 and began participating in UNESCO's Man and Biosphere program in 1982. Thirteen potential biosphere reserves have been identified, with the Nilgiri Biosphere Reserve being the first proposed (WCMC 1988c), and others in the Himalaya suggested more recently (Rodgers and Panwar 1988; Rodgers 1992). The National Wildlife Action Plan (Anon., no date *a*) forms the basis of an Indian nature conservation strategy and was adopted by the Government of India in 1983 following the recommendation of the Indian Board of Wildlife (Anon., no date *a*). Wildlife conservation, along with environmental and forestry programs, currently come under the jurisdiction of the federal Ministry of Environment and Forests, although wildlife protection is mainly the responsibility of the state governments. The Wildlife Institute of India is currently the main advisory body on wildlife issues to the Government, with state wildlife advisory boards, and educational and private institutes providing input to state governments (Saharia and Pillai 1982).

In 1988, the Wildlife Institute of India completed a review of the country's protected area network, assessing its biogeographical diversity and effectiveness in preserving a representative component of the diversity of wildlife and habitats of India. A total of 56 protected areas, including 10 national parks, comprise about 5% of the Himalayan region. However, many of these protected areas have not been properly described and notified under the requirements of the law. Consequently, they lack the necessary resolution of land-use rights for them to be considered bona-fide protected areas (Rodgers and Panwar 1988). An example of this problem can be found in the western Himalayan state of Himachal Pradesh that apparently has a 7% coverage of protected areas. However, although the total area under protection is 3,950km^2, it is distributed over 31 reserves, most of which are quite small. Furthermore, each protected area contains villages and large numbers of livestock, with seasonal livestock densities sometimes exceeding 200 animals/km^2 (Singh *et al.* 1990.). Finally, the lack of trained personnel and monetary resources limits the effectiveness of many of these conservation areas (Rodgers and Panwar 1988). Because of the large number of protected areas containing Caprinae in India, a map is not provided in this report, the reader is directed instead to other publications (Green 1990, 1993; IUCN 1992) for locations of protected areas in India.

India has numerous non-governmental organisations concerned with wildlife conservation. The most important include the Bombay Natural History Society (founded 1883), the Wildlife Preservation Society of India (founded 1958), the World Wide Fund for Nature (India), the Indian Society of Naturalists, and most recently, the Indian National Trust for Art and Cultural Heritage (founded in 1984). An increasing number of small non-governmental organisations are also taking a special interest in Himalayan conservation issues that ultimately affect Caprinae in this region.

General conservation measures proposed

Recent conservation recommendations affecting Caprinae in the Himalayan region, proposed in association with the Wildlife Institute of India's protected area network report (Rodgers and Panwar 1988), include: **1)** increase the size of Dachigam National Park (Jammu and Kashmir); **2)** create a sanctuary for markhor in the Pir Panjal mountains (Jammu and Kashmir); **3)** extend the Overa-Aru Wildlife Sanctuary (Jammu and Kashmir) to link up with wildlife areas in Ladakh near the Nun-Kun massif; **4)** extend or join a number of the small sanctuaries in Himachal Pradesh; **5)** declare core areas as national parks in the Govind Pashu Vihar and Kedarnath Wildlife Sanctuaries (Uttar Pradesh); **6)** create the Pindari Wildlife Sanctuary in Kumaon (Uttar Pradesh) to protect "what is probably the largest population of Himalayan tahr in India"; **7)** establish wildlife sanctuaries for goral in Yamunotri, Dodital and Banog areas of Uttar Pradesh; **8)** extend Khangchendzonga National Park and create a new national park and two wildlife reserves in Sikkim; and **9)** extend or create several parks and reserves in Arunachal Pradesh, including redesignation of Namdapha National Park as a Biosphere Reserve (Rogers and Panwar 1988). A recent evaluation of protected areas for Caprinae species in Ladakh, supports a) the extension of Hemis National Park (including its designation as a Biosphere Reserve), b) re-evaluation of old hunting reserves for the conservation of ibex, and c) reassessment of the current array of proposed protected areas to best effect protection of the endangered Ladakh urial and Tibetan argali (Fox *et al.* 1991a).

Numerous proposals pertaining to northeast India were also made in the report by Rodgers and Panwar (1988), including extensions of existing, or creation of new, protected areas in Meghalaya, Tripura, Nagaland, Manipur and Mizoram. Some of these areas would provide protection for serow, but detailed accounts of wildlife composition in the areas are not yet available and assessment of their conservation value for Caprinae remains to be determined. In the Western Ghats of southern India, proposals affecting Nilgiri tahr have included upgrading the Mukurti and Indira Gandhi Wildlife Sanctuaries to national park status (Davidar 1978; Rice 1990). In fact, detailed proposals are discussed by Rodgers and Panwar (1988) for restructuring the entire system of protected areas in the Western Ghats to form four large conservation units that include seven national parks and six sanctuaries.

Increased state and federal support for field personnel is a critical requirement in these mountain protected areas, both for monitoring wildlife populations and for enforcing laws on natural resource extraction, including hunting. In this regard, the need for a better data base on population numbers for all species is required, especially distributional information for Himalayan tahr throughout their range, and for serow, goral and takin in their northeast ranges. Basic ecological data and habitat requirements are relatively little known for many of the Caprinae species and should be addressed by academic and private research institutions.

Education programs geared toward local and nation-wide school curricula, rural farmers and pastoralists, urban visitors to protected areas, and hunters of different income levels, should be developed and made available in appropriate programs and displays.

Species accounts

Reliable population estimates for Caprinae in India are lacking in most areas and the few figures referred to below must be viewed with caution. Information provided about a species' density, distribution or habitat is often based on anecdotal or very site-specific observations that may be of limited reliability or regional applicability. Many published reports on the biology of Indian Caprinae are available and are referred to below.

Serow (*Capricornis sumatraensis*)

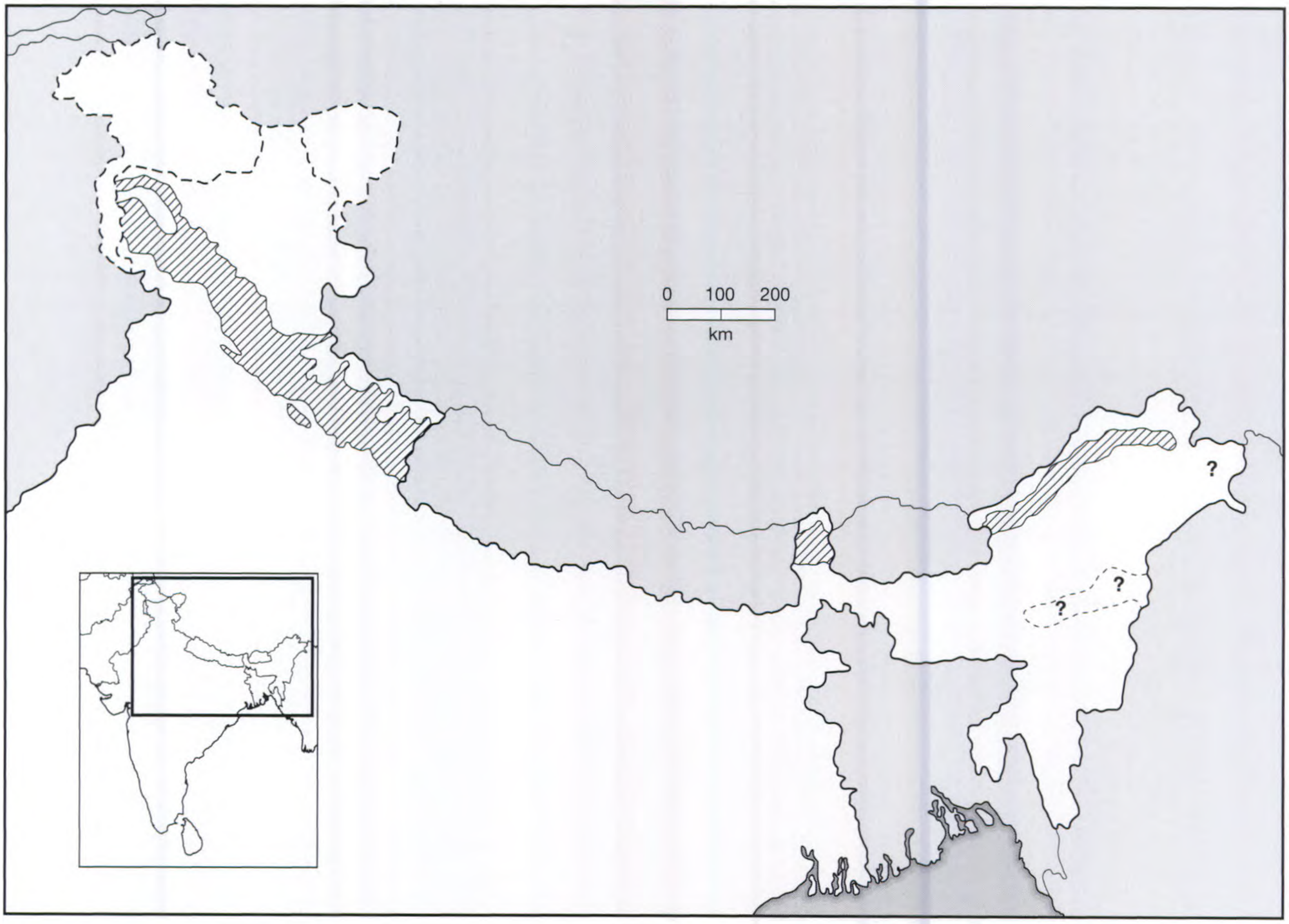
Distribution: The serow is widespread but sparsely distributed throughout the forested southern slopes of the Himalaya in northern India, from Jammu and Kashmir to the Mishmi hills in Arunachal Pradesh, and in the hill states of northeastern India (Prater 1971) (Map 8.3.2). Himalayan serow (*C. s. thar*) is known to be locally present between 300 and 3,000m asl in all Himalayan states (Green 1987b), and is found extensively in the Sutlej and Beas River catchments (Himachal Pradesh) (S. Pandey, *in litt.* 1991). In northeastern India, the red serow (*C. s. rubidus*) apparently occurs south of the Brahmaputra river in hilly tracts in Assam, Meghalaya and Tripura (Green 1987b; Groves and Grubb 1985).

Population: No estimates of population size are available, but density in good habitat within Kedarnath Wildlife Sanctuary (Uttar Pradesh) has been estimated at 1.6 serow/km^2 (Green 1987a).

Threats: Though sometimes heavily hunted by locals for meat and trophies, habitat destruction, especially loss of forest understorey due to clearing for agriculture and to collection of fuelwood, is probably the main threat to serow (Green 1987b). Within some protected areas, serow populations may approach maximum densities of 2 animals/km^2. However, its apparent preferred habitat of steep, thickly vegetated slopes, is so patchily distributed that overall densities are low and serow is relatively rare throughout its range. Serow habitat is generally at higher elevations than the areas of intensive agriculture in the western Himalaya. Here, and in the eastern Himalaya (where cultivation is less extensive anyway), hunting is apparently the most importance influence on serow populations.

Conservation measures taken: The Himalayan serow (*C. s. thar*) is listed as Vulnerable (A2cd) and the Red serow (*S. s. rubidus*) is listed as Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix I of CITES. In India, it is listed in Schedule I (revised March 1987) of the Wildlife (Protection) Act (1972), and is thus totally protected. This status has been accepted by all states except Nagaland. Within India, serow occur in over 50 protected areas, ranging in size from 4km^2 to

Map 8.3.2. Distribution of serow (*Capricornis sumatraensis*) in India.



1,800km², and totalling about 17,000km². However, many of these areas include substantial habitat unsuitable for serow and it is has been suggested that only some 6,000 to 8,000km² of ca. 19,000km² of good serow habitat in India, lies within protected areas (Johnsingh 1991; Johnsingh *et al.* in prep. *b*).

Serow occurs in the following protected areas (Fox *et al.* 1986; Green 1987b; Kumar and Rao 1985; Lamba 1987; S. Pandey, *in litt.* 1991; Singh *et al.* 1990): ***Jammu and Kashmir*** – Dachigam National Park and Overa-Aru Wildlife Sanctuary; ***Himachal Pradesh*** – Great Himalayan National Park and the Daranghati, Gamgul Siya-Behi, Kalatop, Kanawar, Khokhan, Kugti, Manali, Naina Devi, Rupi Bhaba, Sechu Tuan Nala, Tirthan (possibly) and Tundah Wildlife Sanctuaries; ***Uttar Pradesh*** – Nanda Devi National Park, Govind Pashu Vihar and Kedarnath Wildlife Sanctuaries; ***Sikkim*** – Khangchendzonga National Park; ***Arunachal Pradesh*** – Namdapha National Park; and – ***Megahalaya*** – Balphakram National Park. However, the species is considered to be locally threatened even within some of these protected areas (e.g. Great Himalayan National Park and Daranghati, Manali, Tirthan and Tundah Wildlife Sanctuaries) (Table 8.3.1).

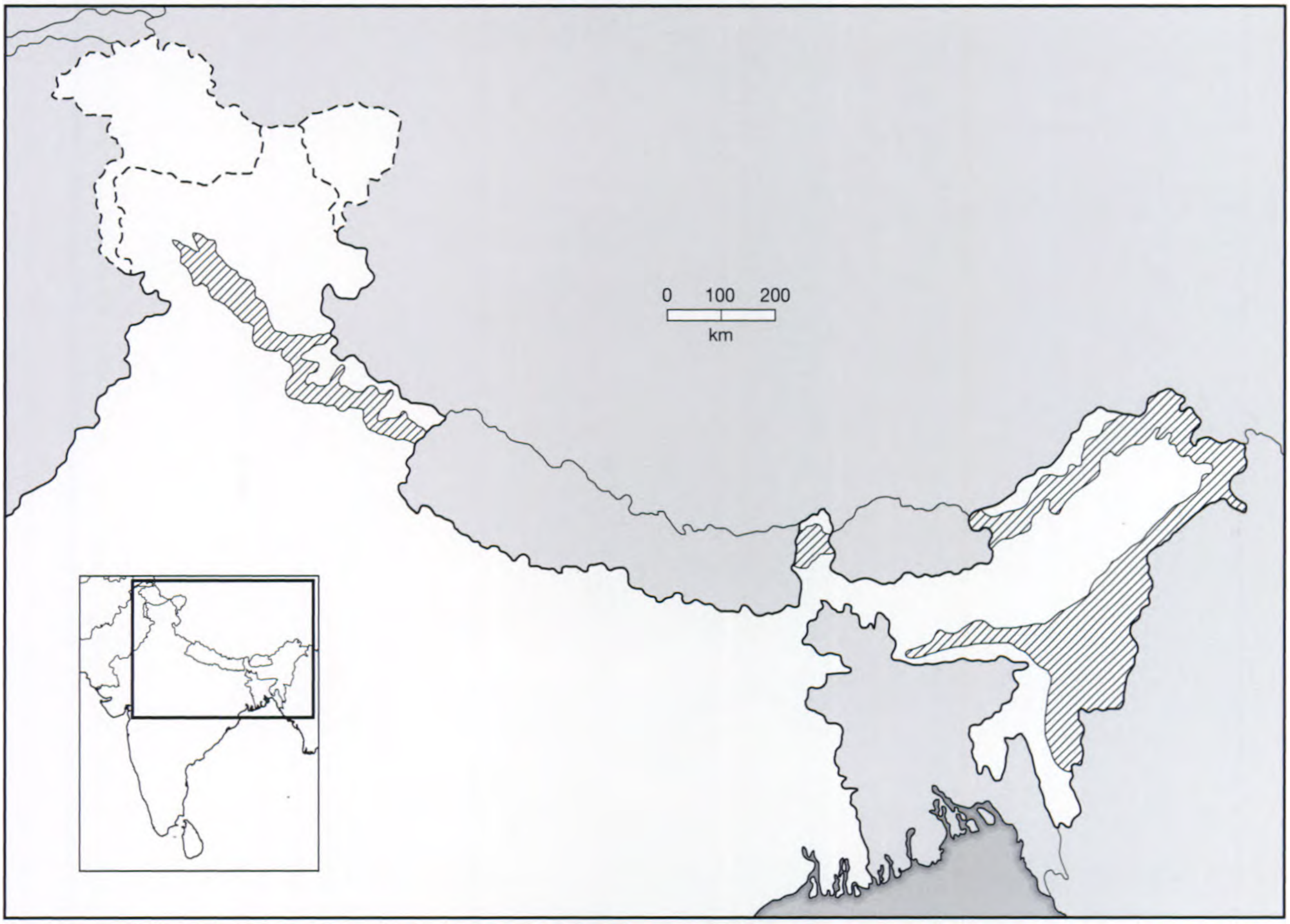
Status within country: Indeterminate.

Conservation measures proposed: 1) Establish the proposed Srikhand National Park, Himachal Pradesh. **2)** Develop a management program for maintaining serow habitat and sustaining hunting outside protected areas. Habitat alteration and hunting will continue to negatively affect serow populations throughout northern India, and because serow is apparently dependent on patches of dense vegetation associated with rugged terrain, the alteration or elimination of such vegetation will be highly detrimental to the species. Management to control habitat alteration, prevention of overhunting outside protected areas, and effective protection in parks and sanctuaries, will be required to maintain viable populations in the future.

Goral (*Naemorhedus* spp.)

Distribution: Goral is found across most of the southern slopes of the Himalaya of northern India from Jammu and Kashmir to eastern Arunachal Pradesh, and in the northeastern states' hills near India's border with Myanmar

Map 8.3.3. Distribution of goral (*Naemorhedus* spp.) in India.



(Prater 1971; Groves and Grubb 1985) (Map 8.3.3). The subspecies *N. goral bedfordi* and *N. g. goral* are apparently separated by Nepal, with the former occurring in Jammu and Kashmir, Himachal Pradesh and Uttar Pradesh, and the latter in Sikkim and Arunachal Pradesh. Long-tailed goral (*N. caudatus evansi*) probably occurs in Nagaland and possibly in Assam, and red goral (*N. baileyi cranbrooki*) may possibly be present in northeast Arunachal Pradesh.

Goral is apparently patchily distributed along the Himalaya mountain ranges in Jammu and Kashmir, with reports of its presence in Dachigam National Park (Johnsingh *et al.* unpubl. data), Kisthwar National Park (Anon., no date *b*) and possibly in the Limber Wildlife Sanctuary. It is still widely distributed and locally common in the Sutlej and Beas River catchments of Himachal Pradesh (Cavallini 1992; Fox *et al.* 1986; Gaston 1986; Gaston *et al.* 1981, 1983; S. Pandey, pers. comm.). Recent reports also confirm its continued presence between 1,600 and 2,100m in the Simla Water Catchment Reserve and the Chail and Majathal Harsang Wildlife Sanctuaries in Himachal Pradesh (Gaston *et al.* 1981, Johnsingh, unpubl. data; Lovari and Apollonio 1993). Goral is also widespread in Uttar Pradesh, extending as far south as the Siwaliks (Bedi 1985) where 285 were recently counted in Corbet National Park (Singh 1985). Current studies in Rajaji National Park indicate a population of 600 to 1,000 occurring in the hills as low as 400m on both sides of the Ganges river (Johnsingh, *et al.* in prep. *a*). Goral is present at elevations of 1,800 to 2,000m in much of Kedarnath Wildlife Sanctuary (Green 1985), 1,680 to 3,600m in Govind Pashu Vihar Wildlife Sanctuary (Fox *et al.* 1986), and 1,900 to 2,500m at Kunj Kharak (northeast of Corbett National Park), Uttar Pradesh. It is found between 900 and 2,750m in the eastern Himalayan states of Sikkim and Arunachal Pradesh. Different subspecies of goral also occur in Nagaland (Rodgers and Panwar 1988) and in the Cachar District (Buxa Tiger Reserve) of Assam (Choudhury 1983), but very little is known of their physical characteristics, status or distribution.

Population: There are no estimates for the total Indian population of goral, but densities have been variously estimated: 2.6/km² in Kedarnath Sanctuary in Uttar Pradesh (Green 1987a), 1.2/km² in Daranghati Sanctuary, 1.5/km² in Rupi Bhaba Sanctuary, and 4.6 to 10.5/km² in Majathal Harsang Wildlife Sanctuary (Lovari and Apollonio 1993), all in Himachal Pradesh (S. Pandey, *in litt.* 1991). Goral densities of 2.4 to 4.0/km² are reported in the hill tracts of Rajaji National Park, Uttar Pradesh (Johnsingh *et al.* in prep. *a*). If suitable habitats are available in the absence of excessive hunting, and even with moderate human disturbance (e.g. grass and fodder cutting) goral can occur in good numbers.

Threats: Within protected areas, goral populations are probably satisfactory. Nevertheless, they are often hunted for meat even within many of the protected areas. The most significant threat to them is severe habitat disturbance and alteration, particularly in the lower portions of the

A.J.T. Johnsingh

A female Western Himalayan goral (*Naemorhedus goral bedfordi*) in Rajaji National Park, Uttar Pradesh, India.

Himalaya and in northeastern India. However, limited disturbance and habitat alteration that creates or maintains some shrub and forest cover, may not be greatly detrimental to the survival of goral populations.

Conservation measures taken: The Western Himalayan goral (*N. goral bedfordi*) and the Eastern Himalayan goral (*N. g. goral*) are listed as Lower Risk (nt) and the red goral (*Naemorhedus baileyi*) of the eastern Himalaya is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and is legally protected under Schedule III (revised March 1987) of the Wildlife (Protection) Act (1972). This allows adult male goral to be hunted under special licence. This status has essentially been applied to all forms of goral and accepted by all states except Nagaland, whereas in Himachal Pradesh goral are legally and completely protected. All species of goral are listed in Appendix I of CITES under *N. goral.*

Some 50 protected areas in India are reported to include some goral (Johnsingh *et al.* in prep. *b*). Recent reports (Bedi 1985; Fox *et al.* 1986; Gaston *et al.* 1981, 1983; Green 1987b; Kumar and Rao 1985; S. Pandey, *in litt.* 1991; Singh 1985; Singh *et al.* 1989; Rodgers and Panwar 1988; Johnsingh *et al.* in prep. *b*) document its presence in the following protected areas: ***Jammu and Kashmir*** – Kishtwar National Park, Nandni and Surinsar Mansar Wildlife Sanctuaries, and possibly in Limber Game Reserve and Overa-Aru Wildlife Sanctuary (latest surveys fail to document species' presence); ***Himachal Pradesh*** – Great Himalayan National Park, Bandi Churdar, Chail, Daranghati, Darlaghat, Gamgul Siahbehi, Kalatop-Khajjiar, Kanawar, Khokhan, Kugti, Lippa Asrang, Majathal, Manali, Naina Devi, Nargu, Raksham Chitkul, Renuka, Rupi Bhaba, Sangla valley, Sechu Tuan Nala, Shikari Devi, Shilli (locally threatened), Simbalbara, Simla Water Catchment, Talra, Tirthan and Tundah (locally threatened) Wildlife Sanctuaries; ***Uttar Pradesh*** – Corbett, Nanda Devi, Rajaji and Valley of Flowers National Parks, Govind Pashu Vihar and Kedarnath Wildlife Sanctuaries; ***Sikkim*** – Khangchendzonga National Park; ***Megahalaya*** – Balphakram National Park; ***Arunachal Pradesh*** – possibly in the Namdapha National Park; and ***Assam*** – possibly in Buxa Tiger Reserve (Table 8.3.1).

Status within country: Not threatened.

Conservation measures proposed: 1) Establish the proposed Srikhand National Park (Himachal Pradesh) which includes the range of *N. g. bedfordi.* 2) Develop a management program for goral living outside protected areas. Habitat alteration and disturbance by heavy grazing and hunting will continue to negatively affect goral populations throughout northern India. However, it is apparently able to survive in areas of substantial human farming and grazing activity, as long as patches of rugged, brush-covered slopes are maintained. 3) Develop a management plan to prevent overhunting in non-protected areas, and to increase effective protection in parks and sanctuaries, if viable populations are to be maintained.

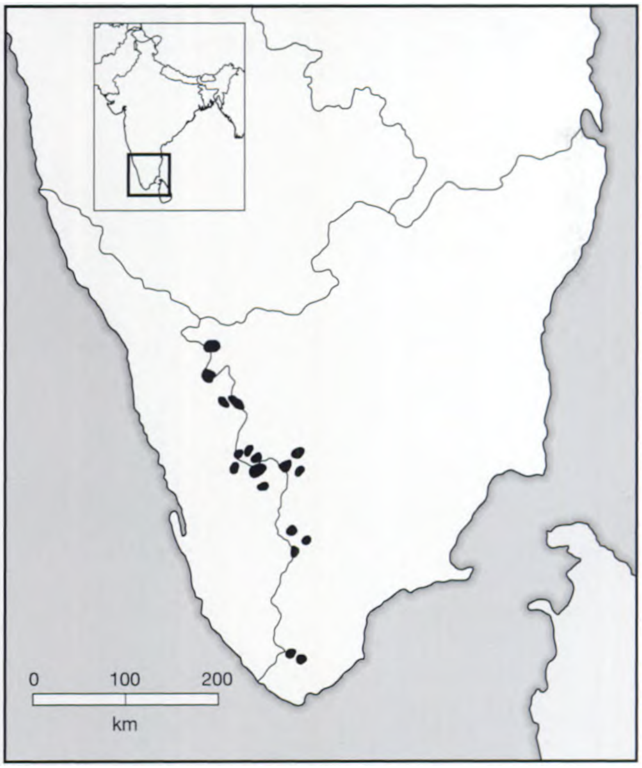
Nilgiri tahr (*Hemitragus hylocrius*)

Distribution: The present distribution of the Nilgiri tahr is limited to the Western Ghats, along the border between Kerala and Tamil Nadu in southern India (Map 8.3.4). At the beginning of this century the range of tahr probably extended northward at least to the Brahmagiri hills of southern Karnataka.

Population: Total numbers are estimated at between 2,000 and 2,500 individuals, and were thought to be stable (Davidar 1978; Rice 1988a, 1990). Current trends, however, indicate a decline (Johnsingh, unpubl. data).

Threats: Currently, the only populations with >300 individuals are in Eravikulam National Park and in the Grass hills in Anamalai. The most recent information from the Nilgiri hills (Mukurti Wildlife Sanctuary), which previously had >300 tahr (Davidar 1978; Rice 1984; Schaller 1971), indicates that only between 75 and 100 individuals remain. Wattle plantations and cattle apparently no longer threaten the Mukurti population, so their decline is

Map 8.3.4. Distribution of Nilgiri tahr (*Hemitragus hylocrius*) in India.



probably due solely to illegal hunting. The status of the other smaller populations (many <100 individuals), which are also subject to continued illegal hunting, can be considered precarious. Similar population decreases and threats to the species were reported in a recent survey in Kalakad-Mundanthurai Tiger Reserve (Rai and Johnsingh 1992).

Conservation measures taken: The Nilgiri tahr is listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and fully protected (Schedule I) by the Indian Wildlife (Protection) Act of 1972. The creation of Eravikulam and Silent Valley National Parks, Mukurti, Anamalai, and Parambikulam Wildlife Sanctuaries, and Srivilliputhur Grizzled Giant Squirrel Sanctuary and the Kalakadu-Mundanthurai Tiger Reserve, together offer an important degree of protection to the Nilgiri Tahr (Table 8.3.1). In addition, institutions such as the Nilgiri Wildlife Association, High Range Wildlife Association, Ramnad District Wildlife Association, Kerala Forest Research Institute, Bombay Natural History Society and the Wildlife Institute of India, are active in promoting conservation of Nilgiri tahr.

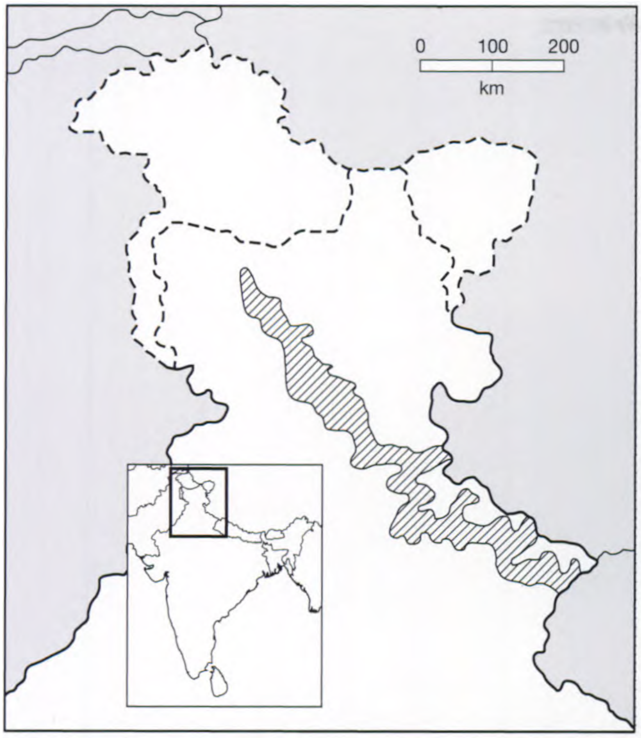
Adult female Nilgiri tahr (*Hemitragus hylocrius*) in the Western Ghats of southern India.

Status within country: Endangered.

Conservation measures proposed: The Nilgiri tahr requires continuous study and monitoring, because its small and isolated populations are extremely vulnerable. With proper conservation, including habitat maintenance and minimising mortality due to hunting, it is possible that with time, the species could be considered no longer threatened, if the following are accomplished: **1)** Maintain status of Endangered in IUCN Red List of Threatened Animals. **2)** Establish the proposed Nilgiri Biosphere Reserve. This would include the Bandipur, Nagarhole and Silent Valley National Parks, the Mudumalai, Mukurti and Wynad Wildlife Sanctuaries, the Bolampatti Reserved Forest and the proposed Karipuzha National Park (WCMC 1988c), and encompass a Nilgiri tahr population of 400 to 450 individuals (Davidar 1978; Rice 1984). An extension to such a reserve has also been proposed (Rice 1990) to include peripheral cliffs used by tahr as escape and birthing terrain. A revised biosphere reserve design of these conservation units has been suggested by Rodgers and Panwar (1988). **3)** Enact management proposals that include the systematic monitoring of tahr populations, as well as possible re-introductions (Rice 1988a, 1990; Rai and Johnsingh 1992). There is good potential for re-introductions in areas such as the Kalakadu-Mundanthurai Tiger Reserve where several highlands had small populations of tahr some 20 to 40 years ago, but today are very small or non-existent (Rai and Johnsingh 1992). **4)** Consider low impact recreational use (e.g. trekking, fishing) of suitable areas, especially where such activities would benefit (and compensate) the local economy for restrictions on traditional activities such as hunting by local inhabitants. **5)** Co-ordinate Nilgiri tahr with other wildlife and habitat conservation efforts, because the Western Ghats are one of India's major wildlife areas.

Himalayan tahr (*Hemitragus jemlahicus*)

Distribution: The Himalayan tahr occurs in timberline regions across the southern forested slopes of the Himalaya from Jammu and Kashmir to Sikkim (Map 8.3.5). It is patchily distributed from south-central Kashmir, eastward through the southern part of Kulu District (Himachal Pradesh) between 2,000 and 3,270m (Gaston *et al.* 1981, 1983), and more widely present at similar elevations through northern Uttar Pradesh to the Nepalese border. Small numbers are also found in east and west Sikkim near the borders with Nepal and Bhutan.



Map 8.3.5. Distribution of Himalayan tahr (*Hemitragus jemlahicus*) in India.

Population: No total population estimate is available, although recent counts include about 130 individuals in the Kanawar Wildlife Sanctuary and >100 in the Great Himalayan National Park, both in Himachal Pradesh (Gaston *et al.* in press; S. Pandey, pers. comm.). Density estimates include 2.3/km^2 in the Daranghati Sanctuary (Himachal Pradesh) (S. Pandey, pers. comm.), and 17/km^2 in part of Kedernath Wildlife Sanctuary (Uttar Pradesh) (S. Sathyakumar, pers. comm.).

Threats: Himalayan tahr is sometimes hunted for meat, and there is apparently significant competition with livestock for summer grazing in some areas. Nevertheless, many areas of prime tahr habitat are sufficiently isolated, rugged and seasonally snow-covered, that the degree of disturbance, livestock grazing and habitat alteration by humans are minimised.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Protected areas with Himalayan tahr (Fox *et al.* 1986; Gaston *et al.* 1981, 1983; Green 1987b; Lamba 1987; S. Pandey, *in litt.* 1991; Singh *et al.* 1990) include: ***Jammu and Kashmir*** – Kishtwar National Park; ***Himachal Pradesh*** – Great Himalayan National Park (possibly), and Daranghati (locally threatened), Gamgul Siahbehi, Kanawar, Khokhan, Kugti, Manali (locally threatened or extinct), Rupi Bhaba, Sechu Tuan Nala, Tirthan and Tundah (locally threatened) Wildlife Sanctuaries; ***Uttar Pradesh*** – Nanda Devi and (probably) Valley of Flowers National Parks, Govind Pashu Vihar and Kedarnath Wildlife Sanctuaries; and ***Sikkim*** – Khangchendzonga National Park (Table 8.3.1).

Status within country: Indeterminate.

Himalayan tahr occurs in a very narrow band along timberline areas in the Himalaya, and although still present over much of its historical range, the lack of population data precludes a satisfactory status designation within its relatively restricted range.

Conservation measures proposed: 1) Extend the Great Himalayan National Park as proposed. **2)** Establish the proposed Srikhand National Park (Himachal Pradesh).

Blue sheep (*Pseudois nayaur nayaur*)

Distribution: Blue sheep is fairly continuously distributed in the northern Himalayan and Transhimalayan regions of India, although the extent of its eastern distribution along the northern border of Arunachal Pradesh is still unknown (Map 8.3.6). It is relatively common in many areas of eastern Ladakh (Jammu and Kashmir), and in parts of Spiti and the upper Parbati valley in northern Himachal Pradesh (Fox *et al.* 1986; S. Pandey, pers. comm.). Blue sheep is known to occur in the Govind Pashu Vihar Wildlife Sanctuary and Nanda Devi National Park, and near Badrinath (Uttar Pradesh), on the slopes of the Khangchendzonga massif (Sikkim), and in eastern Arunachal Pradesh. Very recently, blue sheep presence has been confirmed in the northwestern corner of Arunachal Pradesh near its border with Bhutan and China (Singh, in press).

Population: Population estimates for blue sheep include a minimum of 11,000 in Ladakh (Jammu and Kashmir) (Fox *et al.* 1991a; Mallon 1991). Population estimates are given for a number of protected and other areas in Ladakh by Fox *et al.* (1991a). In 1986, about 90 blue sheep were seen in the upper Parbati valley (Himachal Pradesh) and 50 in the Govind Pashu Vihar Wildlife Sanctuary (Uttar Pradesh) (Fox 1987). Population densities ranged from 1.0 to 1.9/km^2 in Ladakh, with 1.6/km^2 considered to be good over large areas of central Ladakh (Fox *et al.* 1991a, c).

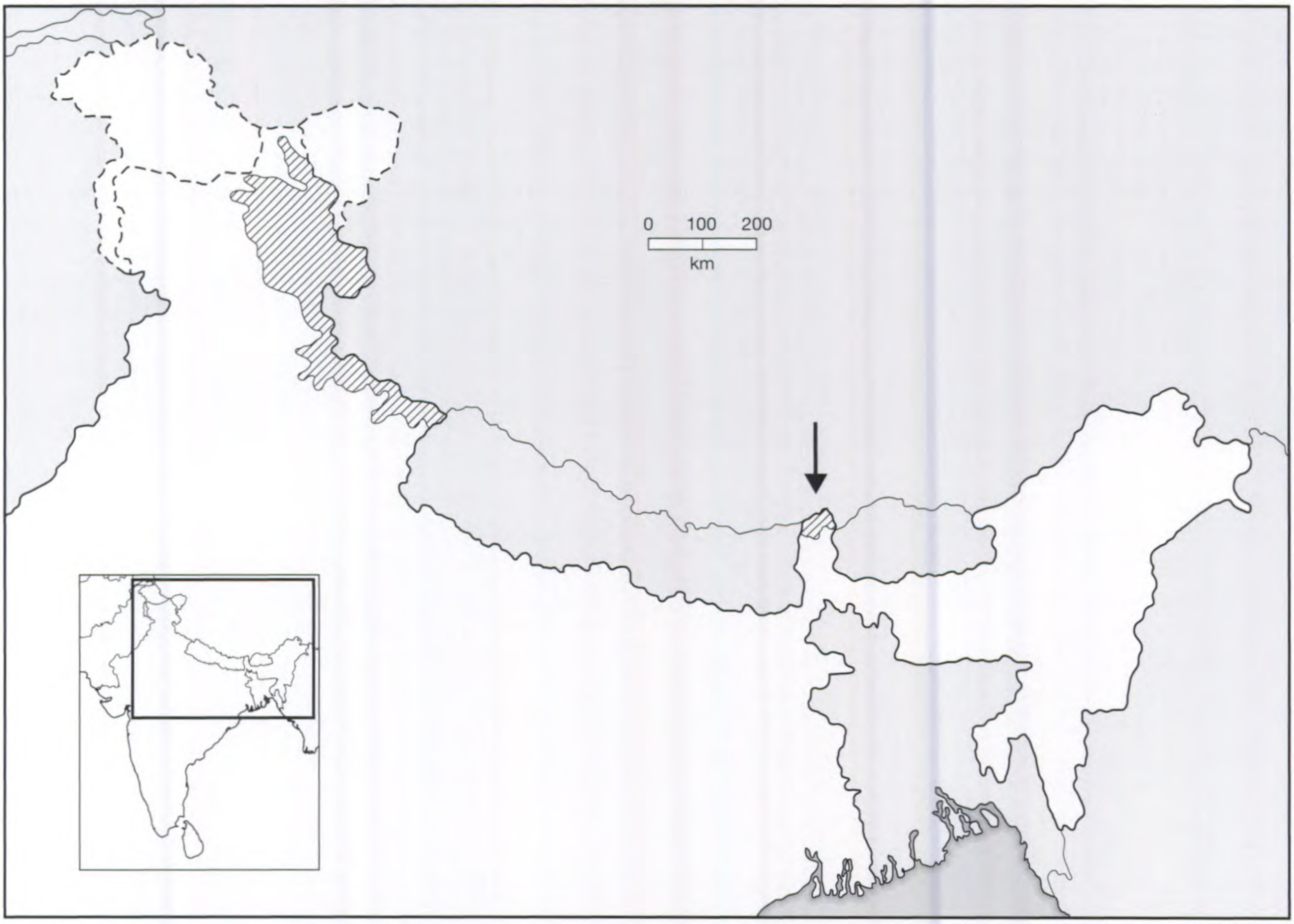
Threats: Localised overhunting, including that by the army in remote outposts.

Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN

A group of Tibetan blue sheep or bharal (*Pseudois nayaur nayaur*) in January at 4,500m, Hemis National Park, India.

J. Fox

Map 8.3.6. Distribution of blue sheep (*Pseudois nayaur*) in India.



1996). Blue sheep occurs in several national parks and many other protected areas in northern India (Fox 1987; Fox *et al.* 1986, 1991a; Gaston *et al.* 1981, 1983; Green 1987b; Pandey, in prep.; Singh *et al.* 1990) including: ***Jammu and Kashmir*** – Hemis National Park and Sabu Chukor Wildlife Reserve; ***Himachal Pradesh*** – Great Himalayan and Pin Valley National Parks and Chital, Daranghati, Kais, Kanawar, Lippa Asrang, Rakshum, Rupi Bhaba, Sangla Valley (includes previous Rakcha-Chitkul WS), Sechu Tuan Nala, and Tirthan (locally threatened) Wildlife Sanctuaries; ***Uttar Pradesh*** – Nanda Devi and Valley of Flowers National Parks, and Govind Pashu Vihar and Kedarnath Wildlife Sanctuaries; ***Sikkim*** – Khangchendzonga National Park; and their unlikely presence in Namdapha National Park of northeastern Arunachal Pradesh needs to be checked (Table 8.3.1).

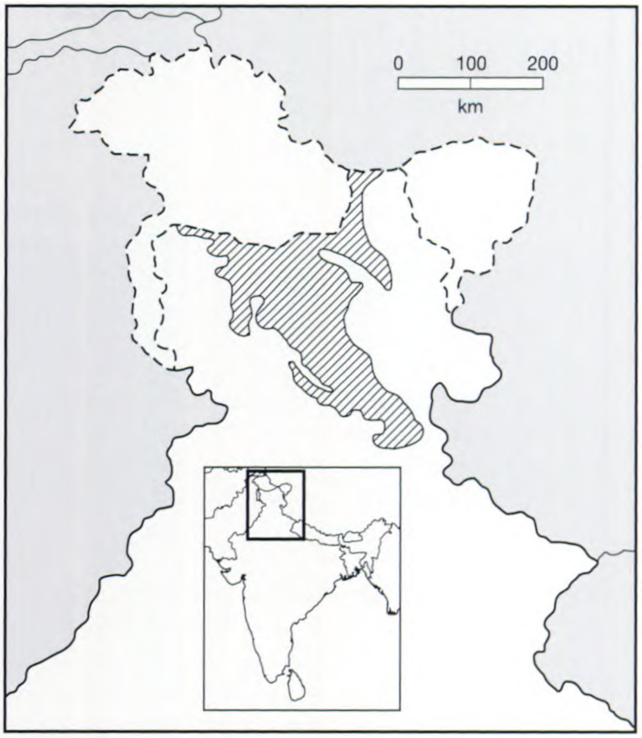
Status within country: Not threatened.

Although not threatened in the Transhimalayan region, the blue sheep is possibly locally threatened in its more patchily distributed populations on the southern slopes of the Himalayas.

Conservation measures proposed: 1) Establish the proposed Changtang, Gya-Miru, Karakoram, and Lung Nag Wildlife Sanctuaries (Jammu and Kashmir), and the extensions to the Great Himalayan National Park and the proposed Srikhand National Park (Himachal Pradesh). **2)** Determine if blue sheep occur along the northern border of Arunachal Pradesh. **3)** Make the control of illegal hunting of this species the primary management priority to maintain viable populations under current land use regimes. **4)** Monitor changes in livestock grazing practices that could affect competition with blue sheep.

Asiatic ibex (*Capra [ibex] sibirica*)

Distribution: Asiatic ibex occurs in the Karakoram, Transhimalayan and Himalayan regions of Jammu and Kashmir, and in the Transhimalayan and Himalayan regions of Himachal Pradesh, as far east as the Sutlej river (Fox 1987; Fox *et al.* 1992; Gaston *et al.* 1981; Pandey 1993) (Map 8.3.7). The species occurs in the western half of Ladakh, in the Shyok valley of northern Ladakh, along the Ladakh range to 45km southeast of Leh, and along both sides of the main Himalayan range eastward to Shingo La pass (Fox *et al.* 1991a, 1992; Mallon 1991). It is present along the southern side of the Himalaya in Jammu and Kashmir from the Zoji La pass eastwards to Himachal Pradesh, where it occurs throughout much of Lahul and Spiti, in the upper Beas and Parbati catchments, and east to the Sutlej river (Fox *et al.* 1992; Pandey 1993).



Map 8.3.7. Distribution of Asiatic ibex (*Capra [ibex] sibirica*) in India.

Population: Recent population estimates include a minimum of 6,000 in Ladakh (Fox *et al.* 1991a) and perhaps another 4,000 on the south side of the main Himalaya in Jammu and Kashmir and Himachal Pradesh, and in the Pir Panjal range of Himachal Pradesh (Fox *et al.* 1992). Recent counts of ibex in protected areas include 330 in the Kanji-Boodkharbu, 225 in Lungnag, 250 in Rangdum, and 174 in Rizong Wildlife Sanctuaries (Jammu and Kashmir) (Fox *et al.* 1991a), and 174 in the Pin Valley National Park (Himachal Pradesh) where Pandey (1993) estimated a density of 2.3 ibex/km^2 in 1989.

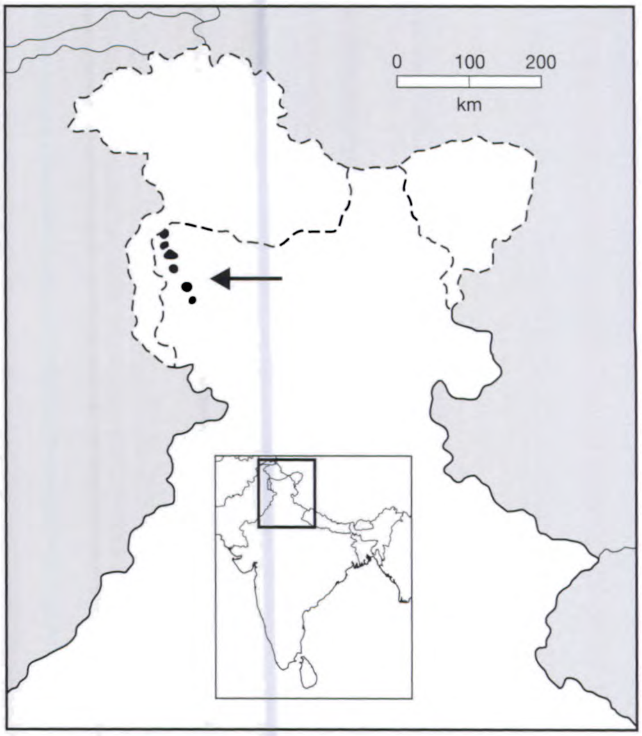
Threats: Hunting is the major threat to the species, especially where new roads increase accessibility and modern weapons improve efficiency for hunters. Increased grazing and disturbance from livestock are apparent in some areas (Fox *et al.* 1986, 1994; Pandey 1993), whereas in others these activities may be decreasing (Fox *et al.* unpubl. data). The rugged habitats used by ibex will probably insulate them from excessive competition by livestock so that hunting will remain the primary human influence on populations throughout their range. The possible hybridisation of ibex with domestic goats, as reported in the Spiti valley (Johnsingh, unpubl. data), needs to be verified and monitored.

Conservation measures taken: Asiatic ibex is found in several protected areas in the western Himalayan region of India (Fox *et al.* 1986, 1991a, 1994; Gaston *et al.* 1981, 1983; Singh *et al.* 1990) including: ***Jammu and Kashmir*** – Kishtwar and Hemis National Parks and Kanji, Boodkharbu, Tongri, Rangdum, Karakoram, Lung Nag, Rizong Sabu, and Chukor Wildlife Sanctuaries; ***Himachal Pradesh*** – Pin Valley and Great Himalayan (possibly) National Parks and the Daranghati (possibly), Gamgul Siya-Behi, Kanawar, Kugti (locally threatened), Lippa Asrang, Manali (locally threatened), Rupi Bhaba, Sechu Tuan Nala, Tirthan and Tundah (locally threatened) Wildlife Sanctuaries (Table 8.3.1).

Status within country: Not threatened (but see below).

Although not threatened in Transhimalayan Ladakh and the inner Himalayan valleys of Himachal Pradesh, Asiatic ibex can be considered Vulnerable on the south side of the Pir Panjal and in areas on the south side of the Himalaya in Jammu and Kashmir.

Conservation measures proposed: A study recently initiated by the Wildlife Institute of India on ibex in the Pin Valley National Park is expected to provide valuable information for the conservation of this species in Himachal Pradesh.



Map 8.3.8. Distribution of **Astor markhor (*Capra falconeri falconeri*)** in India.

Astor or straight-horned markhor (*Capra falconeri falconeri*)

Distribution: Within India, markhor is restricted to part of the Pir Panjal range in southwestern Jammu and Kashmir. Populations are scattered throughout this range starting from just east of the Banihal pass (50km from the Chenab river) on the Jammu-Srinagar highway westward to the disputed border with Pakistan (Map 8.3.8). Populations are known from recent surveys to still occur in catchments of the Limber and Lachipora rivers in the Jhelum Valley Forest Division, and around Shupiyan to the south of Srinagar.

Population: Just over 20 years ago, markhor were estimated to total 250 to 300 animals in India (Schaller and Khan 1975). There have been no recent population estimation surveys except to confirm their continued presence in the Limber, Lachipora and Shupiya valleys, but the total population is still believed to be ca. 200 to 300 individuals (M.S. Bacha, pers. comm.).

Threats: The continued existence of markhor in India is threatened by hunting and some habitat alteration. The small population of markhor in India justifies its Endangered status. The primary current threat related to hunting is increasing in association with the civil unrest and armed conflict present in the region of its habitat along India's border with Pakistan. Thus, the main threat to markhor in India is their value as food within areas of armed conflict, although their high value as a trophy species also makes them sought after by both military and civilian sport hunters.

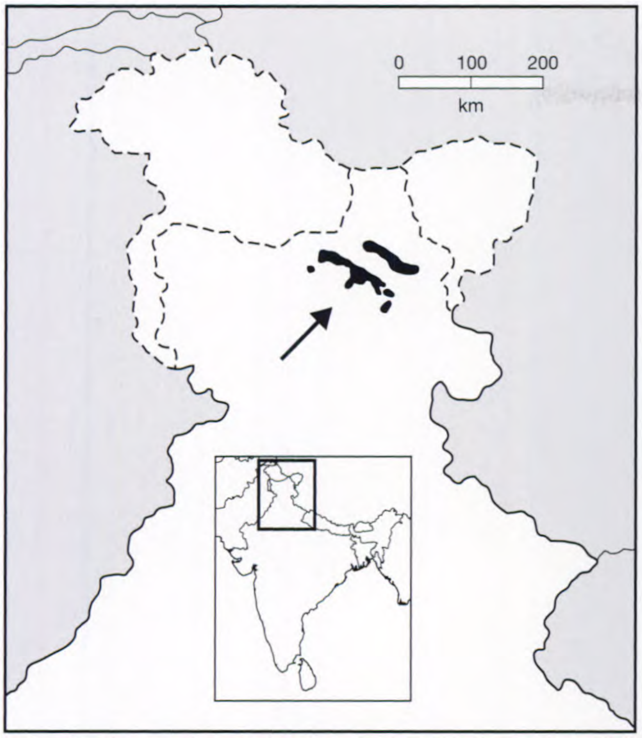
Conservation measures taken: Over its entire range, the Astor markhor is listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and is a fully protected (Schedule I) species in Jammu and Kashmir's Wildlife (Protection) Act of 1978 (Ganhar 1979). Currently, markhor in India occurs in only three small protected areas: the Limber Game Reserve, and the Lachipora and Hirapora Wildlife Sanctuaries (Table 8.3.1).

Status within country: Endangered

Conservation measures proposed: 1) A new survey, with subsequent monitoring, is urgently needed to reassess the current status of the Astor markhor in India. However, this will have to await the easing of political tension and violence in the area. **2)** Consider future re-introductions to previously inhabited ranges in the Pir Panjal mountains.

Ladakh urial (*Ovis orientalis [vignei] vignei*)

Distribution: In India, this urial occurs only in Ladakh (Jammu and Kashmir), where it is distributed discontinuously in a narrow band along the valley-bottom, to the foothill boundary of the Indus and Shyok-Nubra



Map 8.3.9. Distribution of Ladakh urial (*Ovis orientalis vignei*) in India.

rivers, and some of their major tributaries (Map 8.3.9). Most urial are found along the Indus valley westward from the village of Likchey to that of Khalsi, with additional herds around the junction of the Nubra and Shyok valleys (Fox *et al.* 1991a; Mallon 1983, 1991).

Population: The total population is estimated to be between 1,000 and 1,500 animals (Fox *et al.* 1991a; Mallon 1983, 1991). The Ladakh urial has declined dramatically in the last 60 years, especially during the military conflicts between 1947 and 1962 (Fox *et al.* 1991a; Mallon 1983).

Threats: Hunting has been relatively strictly controlled recently (especially in the Indus valley), but the urial's habitat is very accessible and susceptible to overuse by livestock herding and other human activities. Urial occupy the low relatively accessible areas along the major valley corridors, all of which have, or soon will have, roads. The resulting effects of increased hunting and eventual human settlement associated with irrigation projects and increased livestock numbers, will require effective conservation and management actions if Ladakh urial is to survive (Fox *et al.* 1994). Its future status thus remains questionable due to increasing development activities in the major valleys of Ladakh.

Conservation measures taken: The Ladakh urial is listed as Endangered (A2cde,C1+2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, as a threatened species by the Government of India, and is a fully protected (Schedule I) species in Jammu and Kashmir's Wildlife (Protection) Act of 1978 (Ganhar 1979). Some illegal hunting probably still takes place, although such activity is now apparently well controlled in the upper Indus valley area near Leh. Hemis National Park (Jammu and Kashmir) contains the only urial population currently found in a protected area in India.

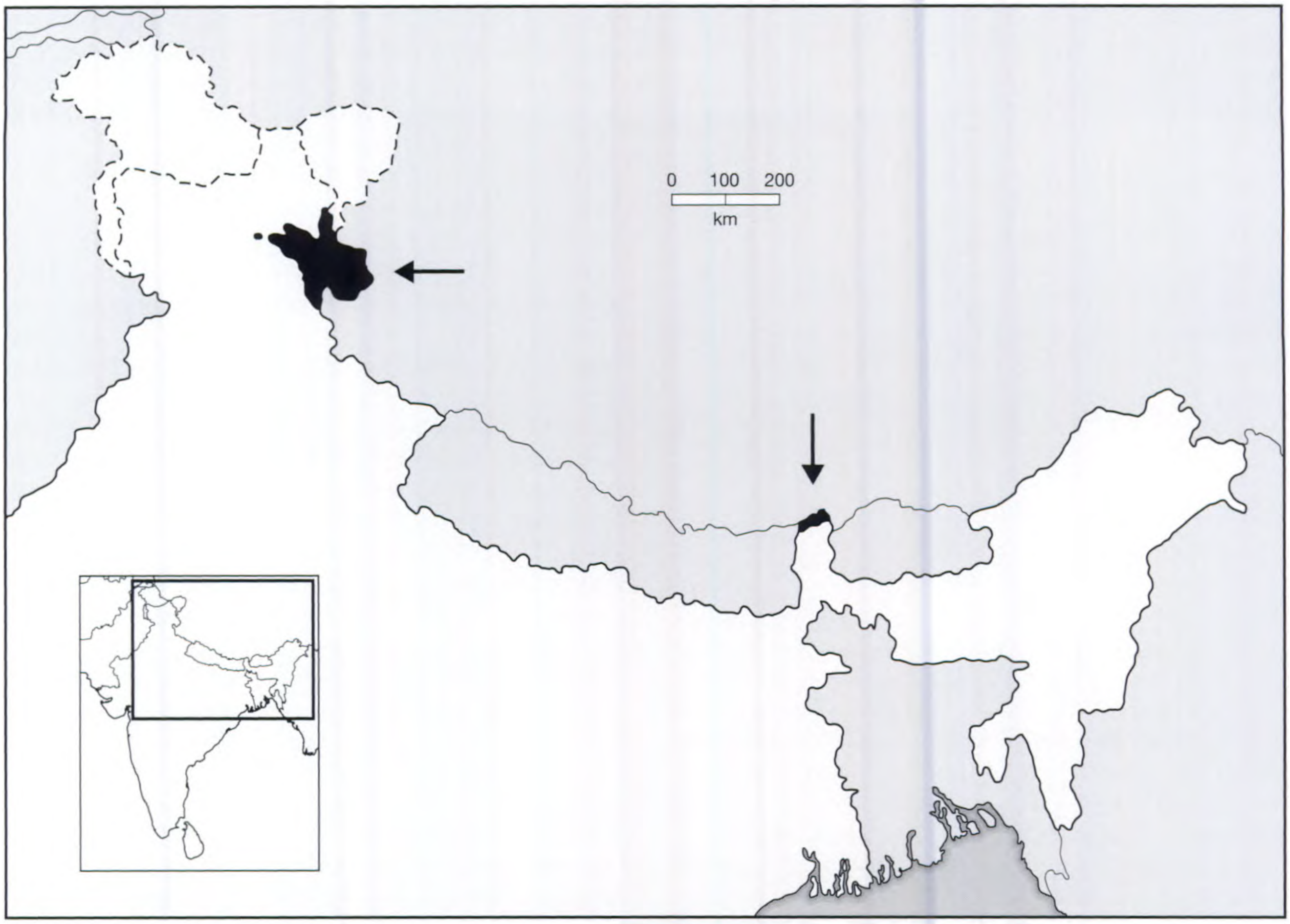
Status within country: Endangered.

Conservation measures proposed: **1)** Increase the number of protected areas and establish those proposed ones in which Ladakh urial are known to inhabit in Jammu and Kashmir, including the Gya-Miru (121 urial counted in 1984), Rizong (145 counted in 1984) and Karakorum Wildlife Sanctuaries (Fox *et al.* 1991a). Gya-Miru includes the easternmost known distribution of the species. **2)** Enlarge Hemis National Park to include areas of critical habitat along the Indus river west of its confluence with the Zanskar river. This step is very important for urial conservation. **3)** Increase measures to combat poaching by road labourers and construction officials along the new road running between two important subpopulations in the Hemis National Park, (Fox 1987; Fox *et al.* 1991a; Mallon and Bacha 1989). Develop a management strategy to **4)** strictly control hunting and **5)** minimise competition from livestock grazing.

If the above proposed sanctuaries are notified and adequately protected, and if livestock grazing is well managed, they should begin to provide the necessary protection for more than half of the remaining Ladakh urial and their range in India. However, because of the linear distribution of urial along major valleys, and its close proximity to human activity, the inclusion of critical urial habitat within the central core areas of large conservation units is not practical. Alternatively, "mini-core areas" may be required to target the protection of small areas of critical urial habitat.

Tibetan argali (*Ovis ammon hodgsonii*)

Distribution: Tibetan argali occurs in two separate regions of northern India (Map 8.3.10), both of which encompass populations that are very sparsely distributed. Most occur in mountains of the eastern plateau of Ladakh, from the south side of the Indus approximately opposite Upshi, eastwards to the border with Tibet (China), and usually above 4,500m elevation (Fox *et al.* 1991a; Osborne *et al.* 1983; Schaller 1977). Argali is also present in adjacent areas across the southeastern border of Ladakh in the Spiti region of Himachal Pradesh (S. Pandey, pers. comm.). An isolated herd (currently about 10 individuals) has lived for the past 14 years southwest of Leh (Ladakh) in the vicinity of the 4,900m Kanda La pass (Fox *et al.* 1991b).



Map 8.3.10. Distribution of Tibetan argali (*Ovis ammon hodgsonii*) in India.

The second region in India where argali occurs in small numbers or as occasional transients, is along the northern border regions in Sikkim and perhaps in Arunachal Pradesh.

Population: Approximately 200 argali are believed to remain in Ladakh (Dar 1984; Fox, *et al.* 1991a; Mallon 1985c), and there are probably no more than this number elsewhere in Himachal Pradesh and Sikkim.

Threats: The two main threats to the argali's survival are illegal hunting, and livestock grazing creating both food competition and disturbance. Most argali habitat is in areas that have been subject to widespread military presence since the early 1960s. The total population of argali appears to have decreased with sport hunting in the late 1800s, and then more dramatically over the last 30 years of military presence (Fox *et al.* 1991a). With a shift over the past 10 years in the army's attitude towards conservation of Ladakh's wildlife, hunting has declined substantially and argali may be coming back in some areas. As government efforts intensify to increase the efficiency of the livestock industry in the Transhimalaya, argali recovery may be slowed by increased competition for food from livestock. Although the army currently forbids hunting of this species, illegal hunting probably still takes place. The last official trophy hunt for argali by a foreigner took place in 1972.

Conservation measures taken: Tibetan argali is listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, as a threatened species by the Government of India and is a fully protected (Schedule I) species under Jammu and Kashmir's Wildlife (Protection) Act of 1978. Tibetan argali is also listed as an endangered subspecies by the U.S. Fish and Wildlife Service, and cannot be imported into Europe. India has two protected areas with Tibetan argali: Hemis National Park (Jammu and Kashmir) (Fox *et al.* 1991a), and Khangchendzonga National Park (Sikkim) (Table 8.3.1).

Status within country: Endangered.

Conservation measures proposed: 1) Establish the proposed Gya-Miru, Rupshu and Changtang Wildlife Sanctuaries (Jammu and Kashmir). **2)** Survey distributions and population estimates, and gather basic ecological information, for developing detailed conservation plans for argali. **3)** Maintain a strict hunting ban; this is most essential especially in areas of military presence. **4)** Consider re-introductions to former ranges (Fox *et al.* 1991a).

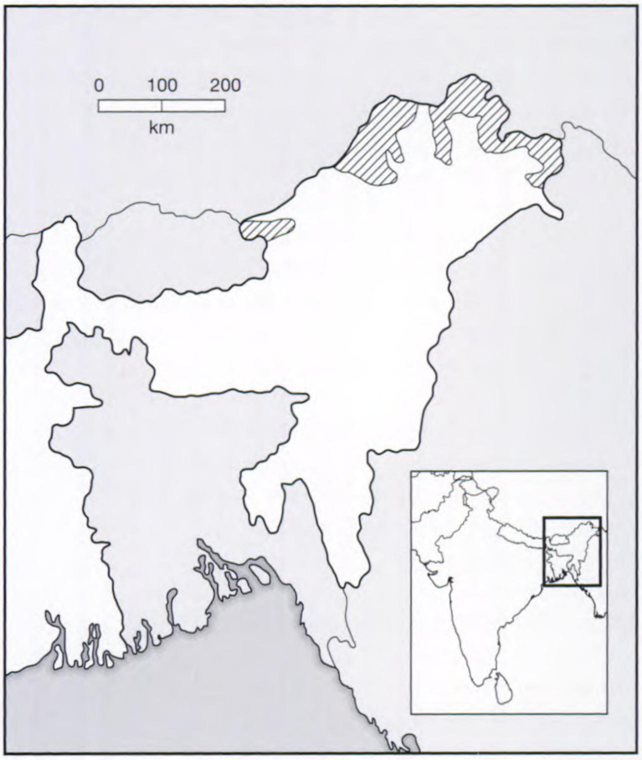
Bhutan or White's takin (*Budorcas taxicolor whitei*)

Distribution: Within India, takin is found only in Arunachal Pradesh, both along its western border with Bhutan and its northeastern border with China and Myanmar (Map 8.3.11). There it inhabits sub-tropical to subalpine forests, mainly between 2,000 and 3,500m, but sometimes venturing as low as 1,500m, or up to areas above timberline.

Population: No estimate of the total population of takin is available for India.

Threats: Major threats come primarily from habitat loss resulting from activities such as timber harvesting, cane and bamboo cutting and road construction, all associated with human populations that continue to encroach on areas occupied by takin. Local people are also known to hunt takin regularly, both within and outside protected areas. Recent surveys of takin found evidence of hunting in the Siang Valley and Kamlang Wildlife Sanctuary but only limited sign of the animals themselves, whereas in Mehao Wildlife Sanctuary, considerable numbers of takin tracks and droppings, and evidence of hunting were found (Katti *et al.* 1990). Current levels of hunting by local residents may not represent a significant influence on takin populations (Katti *et al.* 1990).

Map 8.3.11. Distribution of Bhutan or White's takin (*Budorcas taxicolor whitei*) in India.



Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix II of CITES. Takin occurs in three protected areas (Katti *et al.* 1990; Rogers and Panwar 1988): Namdapha National Park, and Mehao and Kamlang Wildlife Sanctuaries (Arunachal Pradesh) (Table 8.3.1).

Status within country: Indeterminate.

Recent survey reports indicate that takin status is satisfactory within its limited range in India, but is at some risk due to its rarity.

Conservation measures proposed: 1) Establish the proposed biosphere reserve that encompasses the Namdapha National Park and several additional protected areas in northeastern Arunachal Pradesh. If adequately protected, these would significantly increase the number and size of effective conservation areas for takin. **2)** Carry out detailed surveys, including population estimates, and then develop specific conservation plans for the species. At the same time, the rate of habitat alteration must be evaluated. Subsequently, the necessary steps should be taken to control or prevent habitat loss in critical areas. **3)** Continually reassess human populations and their increased access in the takin distribution area since the species is commonly hunted by locals.

Acknowledgements: The accounts of species status presented here are a compilation of information from numerous sources, to whom we would like to extend our sincere appreciation. We would especially like to thank M.S. Bacha, R.S. Chundawat, P.J. Garson, M.J.B. Green, R. Kaul, D.P. Mallon, C. Nurbu, S. Pandey, C.G. Rice, S. Sathyakumar, and F.B. Swengel for their help in providing information on Caprinae in different parts of India.

8.4 Nepal

P. Wegge and M.K. Oli

Introduction

Running for approximately 800km along the southern flanks of the Himalaya, the Kingdom of Nepal covers an area of 141,414km². About 75% of Nepal is covered in mountains, making it one of the most rugged mountainous countries in the world. It can be divided along its east-west axis into four geographic regions. In the south, along its border with India, lies the Terai, a low, flat and fertile landscape that is the northern extension of the Gangetic Plain, and which varies in width from about 25 to >32km. The southern part is a rich agricultural area, while the remaining northern area consists of forests, undulating hills up to 330m asl, and marshy river bottoms rich in wildlife. Immediately north of the Terai are the steep, forested Siwaliks that rise in almost perpendicular escarpments to an elevation of nearly 2,000m. These rugged foothills are intersected by broad basins ca. 120m asl. Next comes the Midlands region, a densely populated area with a complex system of ranges up to 3,000m asl. This region includes the Kathmandu and Pokhara valleys, and covers roughly 33% of the country. Finally, along its northern border with Tibet, lies the Himalayan mountain range itself. Here, permanent snow and ice predominate, and peaks are thrust more than 8,000m asl, including Mount Everest (8,848m), the highest peak in the world, and nine other peaks over 8,050m elevation. The mountain region of Nepal can be subdivided into the Outer Himalaya, whose ranges extend southwards from the main chain, and the Greater Himalaya that form the border with Tibet (China). Together these two mountain regions cover a little more than 40% of Nepal.

Elevation, naturally, has a significant effect on the climate despite the country's subtropical latitude. It varies between subtropical monsoon conditions in the Terai and Siwaliks, through warm temperate conditions around 1,200 to 2,200m elevations in the mid-mountain complex, a cool temperate climate at higher altitudes (2,200 to 3,400m), to alpine conditions along the slopes (4,300 to 4,800m) of the Himalaya. Annual rainfall varies with longitude, with progressively more rain falling in the eastern part of the country. Eastern Terai and the south-facing slopes of the Annapurna and Dhaulagiri massifs are the wettest regions, receiving >3,500mm of rain annually, mainly during the monsoon period (May to October). Less than 1,000mm of precipitation falls in the western mountains. The inner valleys of the Great Himalaya, shielded by the outer mountain ranges, have a continental, dry climate with <500mm of rain falling each year in the districts of Dolpo and Mustang. Vegetation is equally varied. The Terai and lower Siwaliks (Churia foothills) are dominated by tropical, deciduous vegetation, with forests of khair (*Acacia catechu*), sissoo (*Dalbergia sissoo*) and sal (*Shorea robusta*), *Terminalia* spp, simal (*Bombax ceiba*), *Trewia* spp. and others. Mixed forests of pines, oaks, *Castanopsis* spp., *Schima* spp., rhododendrons, poplars, walnuts and larch, grow between 1,500 and 3,000m asl in the higher Siwaliks and remnant forests of the Midlands. Nepal's Midlands region has little remaining natural vegetation. Mixed fir and birch stands, together with rhododendrons, alder and bamboo, grow between 3,000 and 3,500m asl. Below timberline, along the Great Himalaya, are rich forests of birch, cypress, fir, juniper and spruce, while alpine grasslands are found just below snowline with its bare rock and scree (4,500 to 5,000m asl). Due to a more arid and continental climate in the west and the inner valleys, the timberline is also lower there than it is further east.

Current status of Caprinae

Nepal has five species of native wild Caprinae. Both Eastern Himalayan goral (*Naemorhedus goral goral*) and Himalayan serow (*Capricornis sumatraensis thar*) inhabit forested mountain slopes throughout the country. It should be noted that the latter species is called "thar" in Nepali. Blue sheep (*Pseudois nayaur nayaur*), known as "naur" in Nepal and sometimes "bharal", is distributed relatively continuously across the country north of the Greater Himalaya, with a southerly range extension on the southern slopes of the Dhaulagiri Massif. Himalayan tahr (*Hemitragus jemlahicus*) was formerly widespread between 1,500 and 5,000m asl, but its current distribution has become broken by human development. The last species, the Tibetan argali (*Ovis ammon hodgsonii*) or "nyan", appears to be a seasonal visitor to Nepal and its exact status requires clarification. However, a recent (1996) sighting by P. Wegge and R. Shrestha documented that it does occur in Upper Mustang near the border with Tibet.

In general, goral seems to be more adaptable to human disturbances than the other two forest-dwelling caprins. Serow is more dependent on dense and lush understorey vegetation commonly found in steep, upland ravines, and will also occupy shrubland and secondary forests as long as they are situated in deeply dissected, rocky gorges and ravines. Outside protected areas, serow is most often found in areas between 2,200 and 3,300m asl, where south-flowing rivers have cut deep gorges through the Himalaya. Tahr, by contrast, occupies the more solid, precipitous cliffs, usually associated with drainage systems, and also uses subalpine and alpine grasslands. Going from east to west, serow probably has its widest distribution in the more lush, eastern parts of the country, whereas goral is more common in the drier, grass-dominated slopes of the west. All three species are found throughout the whole length of the country.

Although some illegal hunting also takes place even within protected areas, populations of all Caprinae species are reported to be either stable or increasing in all protected areas in Nepal (DNPWC Wardens, pers. comm. 1990). Outside protected areas, the growing human population is placing increasing pressure on Nepal's Caprinae through habitat destruction (logging, fuelwood and fodder gathering, agriculture) and competition with livestock. In those areas, conservation measures will have to be carefully implemented. Most Caprinae in Nepal are not threatened; only Tibetan argali is Indeterminate and serow is Insufficiently Known.

Research and field surveys have been conducted primarily on two species. Green (1978, 1979) studied the ecology and feeding behaviour of tahr in Langtang National Park, and Schaller (1973a) made some general observations of this species in eastern Nepal. Following Schaller's (1973b) pioneer investigations on blue sheep in eastern Nepal, and in what is now Shey-Phoksundo National Park (Schaller 1974), Wegge (1976, 1979) studied this species in more detail to establish the Dhorpatan Hunting Reserve. This work was continued by Wilson (1981, 1984), and later by Sherpa and Oli (1988), Wegge and Oli (1988), and Oli (1991) in the Annapurna Conservation Area, and in Kanchenjunga in easternmost Nepal (Wegge 1991). A field study of the feeding ecology of this species in Shey-Phoksundo National Park is nearing completion (K. Shah, in prep.), as is a management plan for the park (M.N. Sherpa, in prep.). No systematic studies have yet been made of goral and serow, however, Bauer (1990b) recently compared habitat interactions and grazing competition between livestock and the four main Caprinae species at several locations in Nepal. There is an urgent need to update the status and distribution of all five species, and ecological information on goral and serow is especially required.

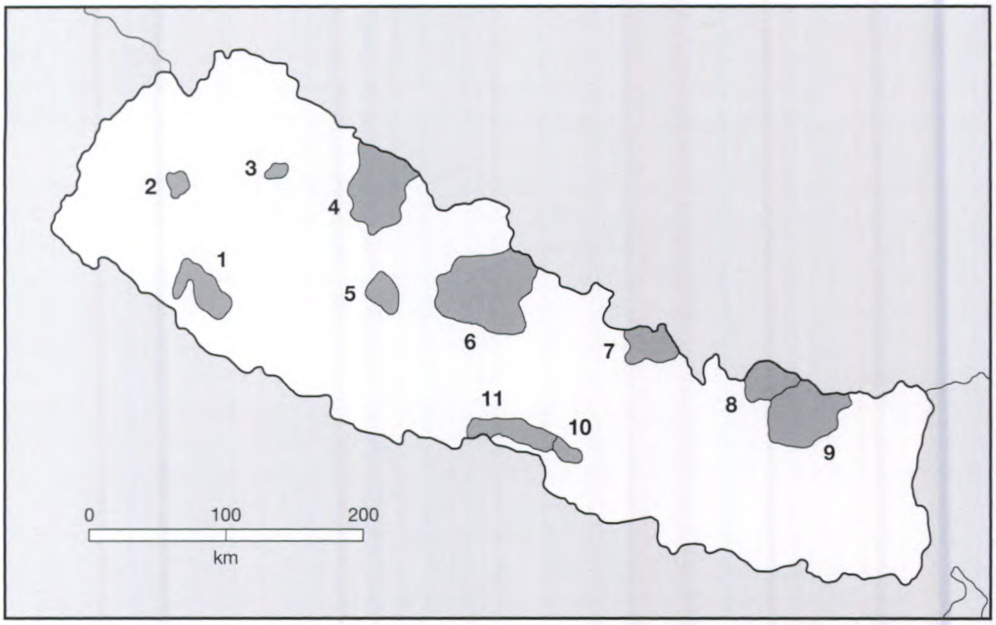
General conservation measures taken

Nepal has an excellent record of conservation, having established numerous National Parks and other natural reserves to protect its diverse and important fauna. In 1973, the National Parks and Wildlife Conservation Act 2029 was introduced to give a legal basis to the country's conservation program. The National Parks and Wildlife Protection Regulations were drawn up in 1974 to control hunting and restrict trade in wild animals in accordance with CITES. Establishment of national parks and wildlife reserves began in 1976, and by 1992 there were seven national parks and three wildlife reserves comprising a total of 9% of the country. Protected areas are administered by the Department of National Parks and Wildlife Conservation (DNPWC) within the Ministry of Forests and Soil Conservation, although the Royal Nepal Army has responsibility for provision of wildlife guards and law enforcement (Green 1993).

Legislation on protected areas covers four categories: Wildlife Reserves, Nature Reserves, Hunting Reserves and National Parks. Wildlife reserves, unlike national parks are not developed for tourism, while nature reserves protect areas of unusual ecological importance, permitting no form of human disturbance except controlled scientific collecting. A hunting reserve is managed on a sustained-yield basis for sport hunting. In 1983, the Government of Nepal, in conjunction with IUCN, produced a prospectus for a National Conservation Strategy (NCS) (IUCN 1983). Subsequently adopted by the Government, this NCS is now being implemented with assistance from IUCN, USAID, CIDA and the Government of Switzerland. The establishment of protected areas is a result of long-term assistance provided by an FAO/UNDP conservation programme. The King Mahendra Trust for Nature Conservation has been an efficient catalyst for conservation by linking environmental protection to sustainable development and the needs of the local people. The Annapurna Conservation Area Project (ACAP) is such a model program. The 260,000ha project area is divided into different land-use zones, and includes low-level human disturbance areas with viable populations of the four main native caprins. A similar, multi-purpose conservation area, Makalu-Barun National Park and Conservation Area, has recently been developed adjoining Sagarmatha National Park in eastern Nepal. This 233,000ha area, consisting of a large national park surrounded by a multipurpose conservation zone, is mainly mountainous and contains viable populations of goral, serow and tahr (Jackson 1990). With formal establishment of the Annapurna Conservation Area, the total protected areas system in Nepal will cover nearly 11% of the country. The proportion of protected areas in the mountains (containing the main caprin habitats) will then be almost 20%.

Caprinae are found in each of Nepal's seven National Parks, in Dhorpatan Hunting Reserve and in two wildlife reserves (Map 8.4.1). Sagarmatha National Park and adjoining Makalu-Barun National Park and Conservation Area, along with Langtang National Park, border the huge Qomolangma (Mt. Everest) Nature Preserve (3,338,000ha) in Tibet (China). Together, these four protected areas harbour all five species of Caprinae in Nepal (Jackson 1991) and can be expected to benefit both these and other wildlife found along the Sino-Nepal border. Qomolangma Nature Preserve was established in Tibet in 1989 (Taylor-Ide *et al.* 1992) with partial support from the Woodlands Mountain Institute (WMI; a US-based organisation also involved in the management of the Conservation Area surrounding Makalu-Barun National Park). There now appears to be some level of indirect co-operation between Nepal and China. In addition to these gazetted protected areas, the area around Annapurna in the midwestern mountains contains Caprinae, and is under development as a conservation area, though it is not yet legally gazetted.

Dhorpatan Hunting Reserve is the only such reserve in Nepal. It is noted for its blue sheep (700–740 in a 96,000ha area, Wilson 1981), but also includes goral, serow and tahr. The Reserve is used by foreign hunters who shoot trophy animals under a controlled harvesting scheme. During the 1988–89 season, the following licences were issued in the Reserve: 25 blue sheep; 13 Himalayan tahr; five serow; seven goral. These provided a total fee for the government (excluding charges to professional outfitters) of approximately Rs 400,000 (US$ 16,000). However, in 1992,



Map 8.4.1. Locations of protected areas with Caprinae in Nepal.

1) Royal Bardia National Park (96,800ha; est. 1989); **2)** Khaptad National Park (22,500ha; est. 1985); **3)** Lake Rara National Park (10,600ha; est. 1976); **4)** Shey-Phoksundo National Park (355,500ha; est. 1984); **5)** Dhorpatan Hunting Reserve (132,500ha; est. 1978); **6)** Proposed Annapurna Conservation Area (266,000ha); **7)** Langtang National Park (171,000ha; est. 1976); **8)** Sagarmatha National Park (144,800ha; est. 1976, World Heritage Site 1979); **9)** Makalu-Barun National Park and Conservation Area (233,000ha; est. 1992); **10)** Parsa Wildlife Reserve (49,900ha; est. 1984); **11)** Royal Chitwan National Park (92,000ha; est. 1973).

hunting of goral and serow was closed throughout the whole country, as was hunting of blue sheep, except in Dhorpatan Hunting Reserve where the annual number of permits for both tahr and blue sheep was reduced. At the same time, licence fees for hunting all other legal game species were increased greatly. In 1992, the government revenues from trophy hunting of blue sheep (14 animals) and tahr (13) were approximately US $24,000; an amount which greatly exceeded the total management cost of the Reserve.

Although Caprinae appear well represented in Nepal's National Park system, their degree of protection may be limited if conditions in Langtang are typical, and continue today. In the early 1980s, enforcement of Park regulations was not strict, though there were signs of improvement in 1986. Problems occur because non-residents bring their livestock into the Park, thereby increasing pressure on grazing resources already in use by the residents. Although illegal to cut or fell live trees for firewood except by permit, the allowance of deadwood gathering encourages tree girdling. Also, the Kyangjin Cheese Factory only pays a nominal sum for an unlimited supply of firewood. Frustrations about the use of the Park's natural resources by local residents, must eventually be resolved.

Livestock grazing is probably also the main source of conflicts in other protected areas, but the extent of competition with wild species has not yet been determined. Green (1979) suggested that livestock compete with Himalayan tahr, while Wegge (1976) and Wegge and Oli (1988) implied that grazing competition between livestock and blue sheep is not serious in the Dhorpatan Hunting Reserve or in the Annapurna Conservation Area. A recent study in Dhorpatan gives additional support to this latter view (Austergard and Haugland 1993). In the border areas with Tibet, Buddhist religious beliefs still provide some level of protection from poaching, but excessive livestock numbers may be causing serious habitat degradation in Shey-Phoksundo National Park, especially around Shey Gompa and surrounding villages (Schaller 1974).

Outside protected areas, wild Caprinae suffer from both habitat destruction and poaching, and these have probably eliminated tahr from much of its former distribution in the Midlands. Nevertheless, both serow and goral, and to a lesser extent tahr, seem to have coped somewhat with high human population densities and still occur in scattered populations along the mountain slopes from east to west. As expected, the most viable populations of Caprinae are found in the most inaccessible parts of their natural range, and in areas now legally established for their protection. Village Development Committee (VDC, formerly "panchayat") Forests and VDC Protected Forests Regulations were established to provide local authorities with partial control of forests for sustainable use of their resources (timber, fodder and firewood). The Soil Conservation Management Act (1982) was enacted to protect watersheds. While not directly affecting Caprinae, these two actions do benefit them indirectly through the partial protection provided to their habitats.

Non-government organisations concerned with conservation in Nepal include the Nepal Nature Conservation Society, an independent government registered society which encourages local interest in conservation, and the King Mahendra Trust for Nature Conservation, an autonomous non-government organisation created in 1984 to conserve and manage natural resources to improve the quality of life for the human population. The International Centre for

Integrated Mountain Development (ICIMOD) is based in Nepal, where it studies economically and environmentally sound means of developing the Himalayan region (Green 1993). Two more international non-government agencies recently opened offices in Kathmandu, IUCN Regional Office and WWF-US, both of which provide technical and financial support towards protected areas management.

General conservation measures proposed

The most common threats facing all Caprinae within and outside protected areas in Nepal are degradation and fragmentation of habitat that are the result of logging, agriculture, livestock grazing, and illegal hunting. Clearly these problems need to be addressed quickly and effectively controlled in Nepal. Trophy hunting on a sustainable basis may be continued, or possibly expanded, if based on scientific information and proper monitoring (see **Appendix 1**). There is also an urgent need for the objective assessment of the status and distribution of all species of Caprinae in Nepal.

Goral, and to a lesser extent blue sheep and tahr, were traditionally harvested by local villagers as a supplementary food source. Current hunting regulations largely prohibit this form of wildlife utilisation. In many areas, populations are believed to be still productive enough to sustain low-level harvesting. Hence there is a need to develop more flexible management guidelines, including a monitoring program, to provide for controlled, sustained legal utilisation of wildlife resources to support local subsistence economies. The present problem of widespread poaching is largely the result of a very strict legislation (due to inadequate demographic information on local wildlife populations), coupled with a complicated bureaucratic procedure required for locals to obtain legal hunting permits.

Species accounts

Several accounts of the ecology and behaviour of most species of Caprinae in Nepal are available (e.g. Bauer 1990b; Green 1978, 1979, 1981; Oli 1991; Schaller 1977; Wegge 1976, 1979; Wilson 1981, 1984). For more general information see Green (1987), Mead (1989), Rice (1986), and Xiaoming and Hoffmann (1987).

Eastern Himalayan goral (*Naemorhedus goral goral*)

Distribution: Widely distributed on the forested slopes up to the timberline, throughout Nepal (Map 8.4.2).

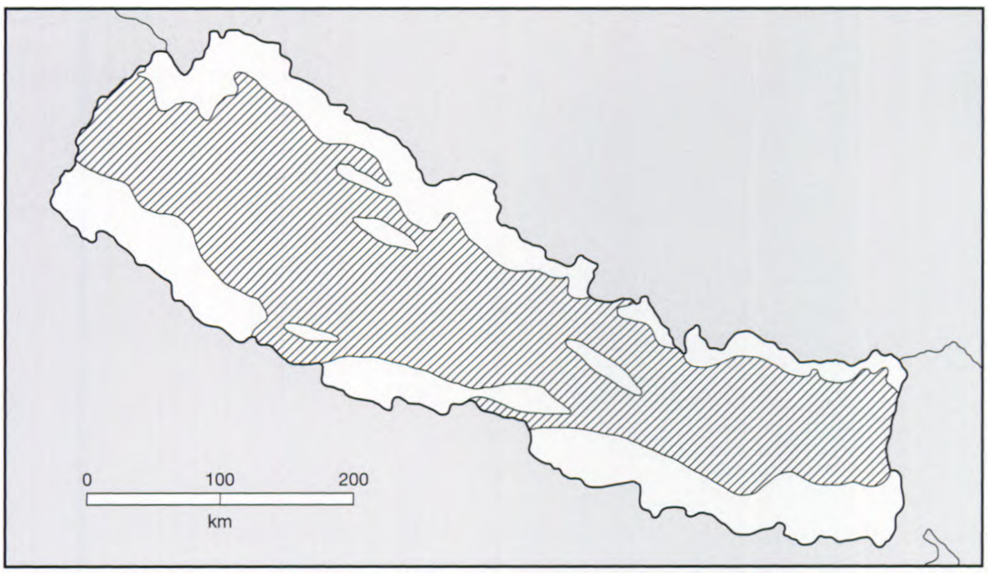
Population: No estimates of population size or trend are available. Its forested habitat makes censusing populations difficult.

Threats: Poaching, and habitat destruction resulting from logging, agriculture and livestock grazing.

Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Listed in Appendix I of CITES. Goral occurs in eight National Parks (Khaptad, Lake Rara, Langtang, Makalu-Barun (and Conservation Area), Royal Bardia, Royal Chitwan, Sagarmatha, and Shey-Phoksundo), as well as within the Annapurna Conservation Area, Dhorpatan Hunting Reserve and Parsa Wildlife Reserve (Map 8.4.1).

Status within country: Not threatened.

Conservation measures proposed: 1) In some areas, consider a management program for sustainable, low level,



Map 8.4.2. Distribution of Himalayan goral (*Naemorhedus goral goral*) in Nepal.

subsistence hunting by local villagers and trophy hunting, after goral population censuses and productivity studies have been made. Basic research on the relationship between habitat type and goral abundance is vital if subsistence cropping is to be promoted. **2)** DNPWC could perhaps conduct a case study of this relationship within one of the park buffer zones. This would not only provide the much needed data, but also might deflect some of the local concern about crop damage caused by this species (R. Jackson, *in litt.* 1993).

Himalayan serow (*Capricornis sumatraensis thar*)

Distribution: Serow is probably widespread throughout the forested mountain slopes of Nepal (Map 8.4.3).

Population: No estimate; habitat and secretive behaviour make estimating population numbers very difficult.

Threats: Serow requires more dense habitat than goral and hence is likely to be more susceptible to deforestation and removal of understorey vegetation. In winters with heavy snowfalls, avalanches can cause considerable mortality within some serow populations. Poaching is also a problem.

Conservation measures taken: Serow is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix I of CITES. It occurs in the following National Parks: Royal Chitwan, Lake Rara, Langtang, Sagarmatha, Makalu-Barun (and Conservation Area), Khaptad, and Shey-Phoksundo (Map 8.4.1). It is also found within the Annapurna Conservation Area, and in Dhorpatan Hunting Reserve. The species probably occurs in Parsa Wildlife Reserve, and possibly also in Royal Bardia National Park, but these need to be confirmed.

Status within country: Insufficiently Known.

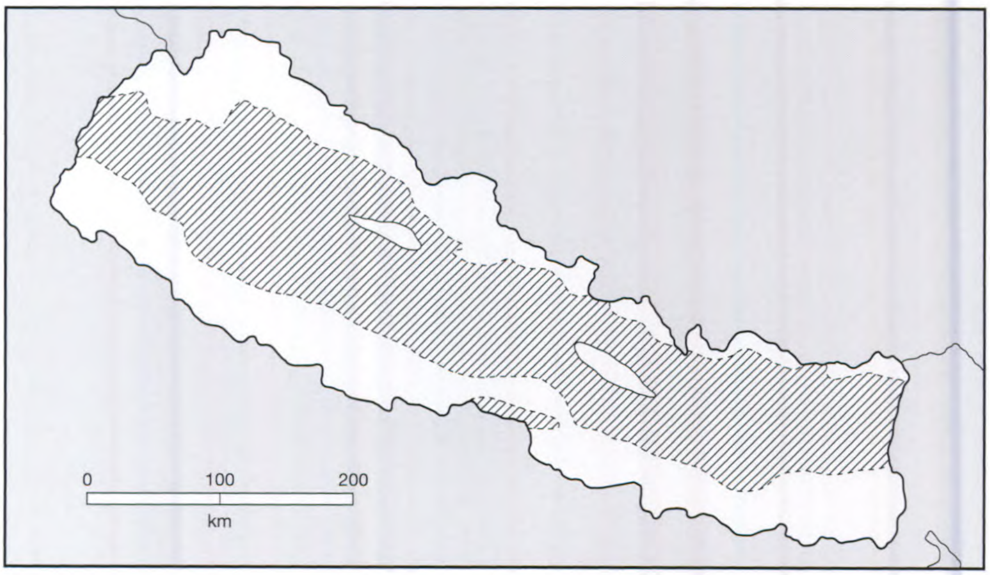
Conservation measures proposed: 1) Conduct censuses and **2)** studies of population demographics, to **3)** develop specific conservation plans.

Blue sheep (*Pseudois nayaur nayaur*)

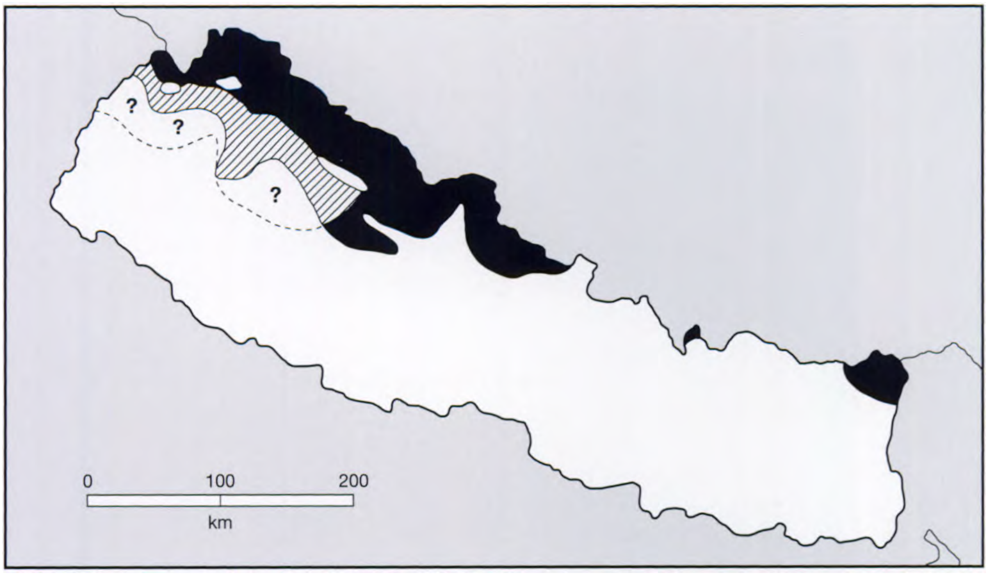
Distribution: Fairly continuously distributed to the north of the Greater Himalaya from the border with India and Tibet in the extreme northwest, eastwards through Dolpo and Mustang to Gorkha district in north-central Nepal (Map 8.4.4). It then re-occurs in Nepal in at least two isolated areas: in Lamobogar, and on the southwestern slopes of Kanchenjunga near the border with Sikkim (India) (Schaller 1977; Wegge 1991). These two are probably connected with more extensive populations across the border in Tibet.

Population: In areas where the species has been systematically censused, crude density estimates range from 0.8 to 10.2 blue sheep/km^2, although densities as high as 15 to 20 animals/km^2 have been reported in Langu Valley, Shey-Phoksundo National Park (Jackson and Ahlborn 1989). The total occupied distribution range can be estimated at a minimum of 15,000km^2, which puts the total population of blue sheep in Nepal at a conservative estimate of 10,000 animals.

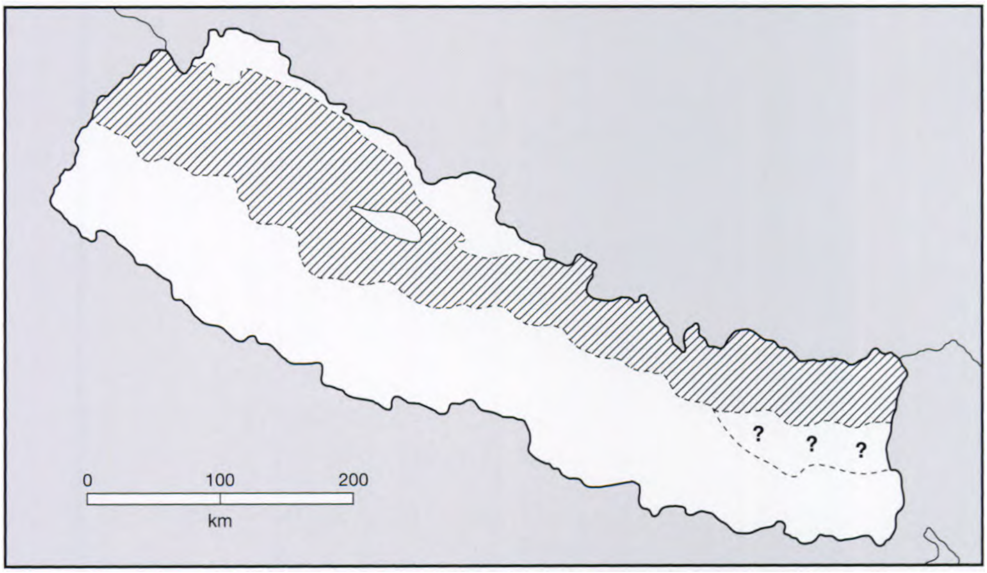
Threats: Although in some areas religious beliefs protect blue sheep from poaching, excessive competition from



Map 8.4.3. Distribution of Himalayan serow (*Capricornis sumatraensis tahr*) in Nepal.



Map 8.4.4. Distribution of blue sheep (*Pseudois nayaur nayaur*) in Nepal.



Map 8.4.5. Distribution of Himalayan tahr (*Hemitragus jemlahicus*) in Nepal.

livestock grazing may cause habitat degradation in much of its natural range.

Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Blue sheep is found in Shey-Phoksundo National Park and in the Annapurna Conservation Area (Map 8.4.1). It is the main big game species in the Dhorpatan Hunting Reserve.

Status within country: Not threatened.

Conservation measures proposed: 1) Maintain the current, closely controlled legal hunting program, and **2)** consider a regulated program of sustainable, low-level subsistence hunting by local villagers in some areas. At the same time, **3)** steps should be taken to halt or reverse the habitat destruction caused by livestock grazing in the blue sheep's natural habitat.

Himalayan tahr (*Hemitragus jemlahicus*)

Distribution: Formerly the Himalayan tahr had a continuous distribution throughout Nepal between 1,500 and 5,200m asl., but this is now being increasingly disrupted by activities related to human encroachment (Green 1978, 1979). Tahr inhabits temperate to subalpine forests up to treeline, between 2,500 and 5,200m asl (Map 8.4.5). Schaller (1977) mapped 14 locations of tahr, and there are undoubtedly more.

Population: There are no available estimates for the total Nepalese population of tahr. Green (1978) estimated their ecological density in Langtang National Park to be between 6.8 to 25.0 tahr/km², and Bauer (1988) estimated a combined minimum number of 1,000 tahr for Sagamartha (see also Lovari 1992), Makalu-Barun (and Conservation Area) and Langtang National Parks.

Threats: Typically, threats come from an expanding human population and accompanying increases in livestock, habitat loss, poaching and access. As a result of these factors, tahr populations are becoming increasingly isolated. Avalanches during winters with high snowfall also can be a significant mortality factor for tahr.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Probably a significant proportion of Nepal's tahr populations occur within protected areas, but it is also believed to be widespread in smaller, scattered populations outside reserves. The species is known to occur in Langtang, Lake Rara, Sagamartha, Makalu-Barun (and Conservation Area) and Shey-Phoksundo National Parks, in the Annapurna Conservation Area, and in Dhorpatan Hunting Reserve (Map 8.4.1). It may also occur in Khaptad National Park in the Midlands (Bauer 1988).

Status within country: Not threatened.

While not threatened at present, unless specific plans for their conservation and management are developed and acted upon, their status may soon change.

Conservation measures proposed: As with blue sheep, **1)** maintain the current, closely controlled, legal hunting program, and **2)** consider a regulated program of low-level subsistence hunting by local villagers. **3)** It will also be necessary to study the impact of the increasing fragmentation of tahr populations. The first steps to address this issue would be to begin in selected areas by mapping tahr habitat features such as cliffs (using 1:50,000 topographic maps), followed by ground surveys to validate the species' presence/absence.

Tibetan argali (*Ovis ammon hodgsonii*)

Distribution: Formerly occurred in the Dolpo region north of the Dhaulagiri range along the border with Tibet. Interviews with livestock herders suggested that a small resident population may still exist in this region (R. Jackson, unpubl.). Its presence in Upper Mustang near the border was confirmed in a recent (1996) survey by P. Wegge and R. Shrestha (unpubl.). Also, there are unsubstantiated reports of a small remnant population, probably moving seasonally between Tibet and Nepal, in the rugged mountain border range north of Manaslu Himal (M.K. Oli, unpubl.) (Map 8.4.6).

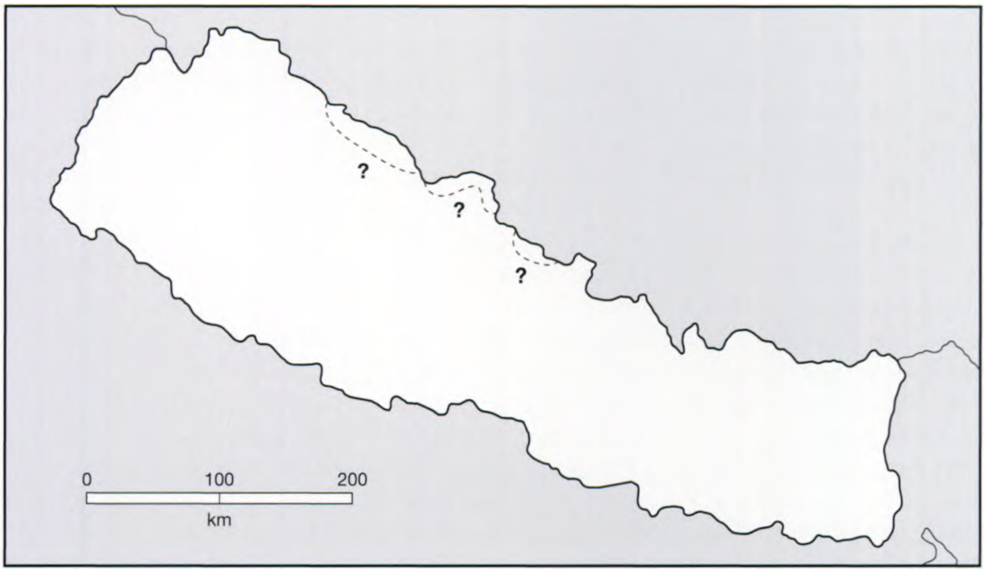
Population: No estimate.

Threats: Poaching.

Conservation measures taken: Listed as Vulnerable (A2cde) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and as "Endangered" in

F. Vollmar (WWF)

Himalayan tahr (*Hemitragus jemlahicus*) in captivity.



Map 8.4.6. Distribution of nyan or Tibetan argali (*Ovis ammon hodgsonii*) in Nepal. [Ed. note – recent observations have been made in Upper Mustang.]

the U.S. Endangered Species Act of 1973 (Federal Register of June 23, 1992). Imports of this species are banned by the European Union. As occasional visitors to Nepal, this argali may occur periodically in Shey-Phoksundo National Park (Map 8.4.1).

Status within country: Indeterminate.

Tibetan argali is probably Endangered. It was found throughout the northern areas of Mustang and Dolpo, but these animals were decimated in the late 1960s and early 1970s by Tibetan Khampa guerrilla fighters seeking refuge from the Chinese army (R. Jackson, *in litt.* 1993).

Conservation measures proposed: As soon as possible, determine the status of Tibetan argali in Shey-Phoksundo National Park, in the Mustang and Dolpo district, and in the area north of Manaslu.

Acknowledgements: J. Fox, M.J.B. Green, R. Jackson

8.5 Pakistan

R. Hess, K. Bollmann, G. Rasool, A.A. Chaudhry, A.T. Virk and A. Ahmad

Introduction

The Islamic Republic of Pakistan is the seventh largest country in Asia, covering approximately 800,000km². Six biophysiographic regions can be recognised. **1)** The north is covered by the great mountain ranges of the Himalaya, the Karakoram and the Hindu Kush. These ranges extend in a 320km-wide belt along the northern border of Pakistan, averaging 5,000 to 6,000m asl. The highest mountains are K2 (8,611m), Nanga Parbat (8,126m) and Tirich Mir (7,690m). The inner mountains are outside the influence of the monsoons, and hence most of the ecosystems are arid and relatively unproductive. Outside this huge, glaciated area, most of northern Pakistan is covered mainly by semidesert-Artemisia steppe and alpine meadows, with a smaller part forested. The main human settlements are located within the semi-desert and steppe areas, and are surrounded by irrigated fields. A forest belt, found between 1,000 and 1,400m to 3,500 and 3,900m asl, has its lower limit determined by low precipitation and its upper limit by low temperatures. It consists mainly of forest steppe and dry temperate coniferous forest, with sub-alpine scrub and birch forest at the higher elevations (Roberts 1977). **2)** The southern edge of this immense mountain system, the outer Himalayan foothills, is in the path of the monsoon. Himalayan moist temperate forest, sub-tropical pine forest, dry sclerophylous and tropical deciduous forest are the natural cover of these foothills, but many are denuded or in the process of denudation. **3)** Along the southern edge of the Himalayan foothills lies the Submontane plateau. This region includes the Trans-Indus plains, the Potwar plateau, and the Salt range. Subtropical and tropical thorn forests are the natural vegetation types in these areas. **4)** The Indus plain, covering 518,000km² of the eastern and central parts of the country, runs inland from the coast about 1100km northeast to meet the Submontane plateau. This Plain forms a dominant physiographic feature over a large part of the country. Except for the Thal desert between the Indus and Chenab rivers, the Plain is an area of fertile, alluvial agricultural land inhabited by the bulk of Pakistan's human population. **5)** The Baluchistan plateau, sharply separated from the Indus plain by the Suleiman range in the northeast and the Kirthar range in the southeast, comprises the southwestern half of Pakistan. The arid plateau, with 70 to 300mm annual precipitation, is crossed by broken mountain ridges running northeast-southwest. The main part of the Plateau lies between 1,200 and 1,800m asl. It includes a great variety of physical features such as sandy deserts, basin areas, steep valleys and mountain ranges whose highest elevations reach ca. 3,500m. Arid sub-tropical and tropical thorn forests are the main vegetation types. **6)** The Desert region, adjacent to the deserts of western India, covers the east (Cholistan desert) and southeast corner (Thar desert) of the country. The annual rainfall is very variable and unpredictable, and amounts to 70 to 400mm annually, depending as it does on the occurrence of the monsoon. The desert is a barren land of scattered, stunted, thorn bushes such as *Prosopis cineraria* in Tharparker, *Calligonum polygonoides* in Cholistan, and *Haloxylon ammodendron* in Chagae and Kharan Districts.

Pakistan lies on the western margin of the monsoon region of the Indian Subcontinent. Despite these monsoon winds, the country has an arid subtropical climate. There are annual fluctuations in the amount and frequency of the rainfall, with a maximum in the months of July and August. Moreover, the effectiveness of the monsoon rainfall for the vegetation is reduced because it takes place in the late summer when much is lost to evaporation. Only the southern slopes of the Himalaya and the Submontane plateau regularly receive 700 to 1,000mm annual rainfall. For further details see Champion *et al.* (1966), Kureshi (1978), Malik and Schimmel (1976) and Roberts (1977).

Current status of Caprinae

Pakistan is one of the most important countries for Caprinae conservation. It is home to seven species with 11 subspecies of Caprinae, that occupy an array of habitats from the hills in the southern deserts to the high alpine areas of the Himalaya. However, most now survive in small scattered populations, and almost all face the same threats from illegal shooting and, indirectly, from an increasing human population with its demands for grazing lands and fuelwood. Currently, 10 of the 11 subspecies in Pakistan are threatened, with eight classed as Endangered.

Western Himalayan goral (*Naemorhedus goral bedfordi*) is the least known of Pakistan's Caprinae, occurring only in the outer Himalayan foothills. There, it occurs from about 800m up to 1950m asl, in habitats with precipitous cliffs in association with scattered chir pine (*Pinus roxburghii*) and a dense cover of thorny bushes (Roberts 1977). According to the Zoological Survey Department's (1986) map, Himalayan tahr (*Hemitragus jemlahicus*) can be found at the easternmost edge of the Poonch District of Azad Jammu and Kashmir. However, Quayyum (1985) does not mention its occurrence and Roberts (1977) doubted a recent report of this species in Pakistan.

Wild goat (*Capra aegagrus*) is scattered throughout the arid and often isolated mountain ranges of southern Baluchistan and southwestern Sind. Two forms are recognised in Pakistan. The scimitar-horned Sind wild goat (*C. a. blythi*), known locally as Sind ibex, was given subspecific status by Hume (1875) and distinguished from the wild goat (*C. a. aegagrus*) living in Iran and Turkey. Other authors (e.g. Roberts 1967b; Schaller and Laurie 1974; Valdez 1985) argue that the minor differences between them probably do not justify subspecific distinction. Pakistan's second wild goat is the Chiltan goat (*C. a. chialtanensis*). This form has twisted horns and occurs at the species' northern limit in the Chiltan hills, southwest of Quetta. The Chiltan wild goat was first described by Lydekker (1913) as a subspecies of markhor, (*Capra falconeri chialtanensis*), and subsequently was hypothesised to be a hybrid either between markhor and domestic goat (Burrard 1925; Dollmann and Burlace 1935) or between markhor and wild goat (Roberts 1969; Epstein 1972; Valdez 1985). However, in Schaller's and Khan's (1975; see also Schaller 1977) revision of markhor (see below) following field studies in Baluchistan and northern Pakistan, the Chiltan animals were considered a wild goat. Until further studies are carried out, we accept this interpretation, with the Chiltan goat being distinguished from Sind ibex by its horn shape. Asiatic or Siberian ibex (*Capra [ibex] sibirica*) may be relatively, the most abundant wild Caprin in Pakistan. This is an animal of the high alpine zone throughout the Himalaya, and its distribution is probably limited by high snow cover during winter. It makes seasonal movements, living in summer at higher elevations than in winter. Roberts (1969, 1977) described five subspecies of markhor (*Capra falconeri*) in Pakistan, while Schaller and Khan (1975) recognised only two. We have followed the latter authors, accepting Kashmir and Astor forms as flare-horned markhor (*C. f. falconeri*), Kabul and Suleiman forms as straight-horned markhor (*C. f. megaceros*), and Chiltan markhor as a wild goat. Most of the world's population of markhor live in Pakistan where it prefers lower altitudes, though it occurs often in the same general areas as the Asiatic ibex. Both markhor use steep slopes, loosely covered by bushes or open forests, providing readily available rock bluffs as escape terrain. The flare-horned markhor inhabits elevations from 1700 to 3200m asl, which is below those used most often by Asiatic ibex. Like the ibex, markhor also moves between summer and winter ranges (Hess, in press).

Two species with very limited ranges in Pakistan are blue sheep (*Pseudois nayaur*), and Marco Polo sheep (*Ovis ammon polii*). Both are restricted to areas along the northern border with China. Urial (*Ovis orientalis*) on the other hand, are the most widespread of Pakistan's caprins, though not in terms of numbers. Urial sheep generally live in arid habitats, scattered throughout the country from around Skardu in the north, southwards, west of the Jhelum river, through Baluchistan and southwestern Sind. Populations tend to be small and scattered, and so individually are vulnerable to the many threats which face most of Pakistan's Caprinae. Following Schaller (1977), we recognise three subspecies of urial in Pakistan: Afghan urial (*O. o. cycloceros*), Punjab urial (*O. o. punjabiensis*), and Ladakh urial (*O. o. vignei*). The taxonomic status of urial in Baluchistan and in southwestern Sind is disputed, and other authors have divided them differently. Roberts (1967a, 1977, 1985) refers them to Baluchistan urial (*O. o. blanfordi*), Schaller (1977) as Afghan urial (*O. o. cycloceros*), and Valdez (1988) differentiates between the Afghan urial (*O. o. cycloceros*) distributed in Baluchistan north of Quetta, and the Baluchistan urial (*O. o. blanfordi*) distributed in Baluchistan south of Quetta and in Sind west of the Indus. However, there is no description of any difference in appearance of the populations north and south of Quetta, nor are there any geomorphological or habitat barriers. Until a genetic and/or morphological study has been done, the latter distinction does not seem justified. Therefore we follow Schaller (1977) because the name *O. o. cycloceros* has priority over *O. o. blanfordi*.

General conservation measures taken

Pakistan became an independent sovereign state in 1947, and wildlife conservation legislation inherited from British India was superseded by the now obsolete West Pakistan Wildlife Protection Ordinance of 1959, and the West Pakistan Wildlife Protection Rules of 1960 (Green 1990, 1993; Grimwood 1969). A Wildlife Enquiry Committee was set up in 1968 to review the existing legislation, based on recommendations resulting from wildlife surveys organised by WWF (Mountfort and Poore 1967, 1968). Following the Committee's 1971 recommendation, a National Council for Conservation of Wildlife (NCCW) was established in 1974 under the Chairmanship of the Minister of Food, Agriculture and Co-operatives. The NCCW, headed by a Conservator of Wildlife who assists the Inspector General of Forests in an advisory capacity, is responsible for co-ordinating the formulation and implementation of wildlife policies at federal and provincial levels, co-ordinating activities with international agencies, and promoting conservation generally. Actual wildlife management, however, is undertaken by provincial forest (wildlife) departments (Green 1990, 1993) via district staff.

The Wildlife Enquiry Committee also drafted conservation legislation that was later adopted through various provincial acts and ordinances: Sind Wildlife Protection Ordinance, 1972; Punjab Wildlife (Protection, Preservation, Conservation and Management) Act, 1974; Baluchistan Wildlife Protection Act, 1974; North West Frontier Province Wildlife (Protection, Preservation, Conservation and Management) Act, 1975; Northern Areas Wildlife Preservation Act, 1975; Azad State of Jammu and Kashmir Wildlife Preservation Act, 1975; and Islamabad Wildlife (Protection, Preservation, Conservation and) Act, 1979. These statutes provide the basis for the creation and management of various categories of protected areas: National Parks (NP), Wildlife or Game Sanctuaries (WS) (wildlife areas in the Northern Areas Act), Game Reserves (GR) (controlled hunting areas in the Northern Areas Act), and private game reserves (in the Punjab, North West Frontier Province, and Islamabad Acts) (Green 1990).

The total area of all protected areas is 7,238,584ha, approximately 9% of the country's surface. Definitions of the three types of government protected areas are given by Green (1990, 1993), and by Malik (1991). Wildlife sanctuaries provide a higher degree of protection for wildlife than do game reserves in which controlled hunting is permitted (IUCN 1987b). The management organisation of protected areas differs from province to province (Malik 1991). Chitral district, with an area of 14,850km^2, contains one National Park, one Wildlife Sanctuary and five Game Reserves (Green 1990), and had 67 Game-watchers in 1987 (Imtiaz Hussain, Range Forest Officer, Chitral, pers. comm. 1987 to R. Hess). Compared to other areas, this density of game watchers is rather high. Sind and Punjab have separate wildlife departments, while in Baluchistan, Azad Jammu and Kashmir, North West Frontier Province (NWFP), and Northern Areas, wildlife is administered by a branch of the provincial forest departments.

Nine of Pakistan's 11 national parks (Green 1990) contain wild Caprinae (Table 8.5.1). The occurrence and purpose of conserving Caprinae were some of the main reasons for establishing these parks, and they play a crucial role in the survival of several species. Kirthar National Park contains the largest population of Sind wild goat in Pakistan, while probably the largest population of flare-horned markhor in the world is in Chitral Gol National Park. Khunjerab National Park on Pakistan's border with China, contains Pakistan's main population of Marco Polo sheep and also a large part of the country's blue sheep's population (Rasool 1981, 1986; Schaller 1976; Wegge 1988, 1989). The Chiltan wild goat in Hazarganji-Chiltan National Park is probably the only remaining population of this subspecies left in the world, while Margalla Hills National Parks protects a small population of goral which may have increased in numbers recently (Maqsood 1989). At least 12 Punjab urial still occur in Chinji National Park (Punjab Province) (Chaudhry and Sarwar 1988), but we have no information on the numbers of Caprinae in the National Parks of Dhrun and Hingol (Province of Baluchistan) which harbour Sind wild goat.

Unfortunately, many of the conservation measures prescribed are not realised for most of the protected areas with Caprinae, primarily because they lie far from the nearest Wildlife Conservation and Management Centre. Even among the national parks, the differences in the types of management and wildlife control that are practised are enormous. For example, the overall authority for Kirthar National Park is vested in the Sind Wildlife Management Board, which has a force of about 100 wildlife guards who control the management plan and utilisation of the Park by the local people. However, there are several human activities detrimental to the management plan: livestock grazing and grass cutting in wildlife core areas, extension of irrigated cultivation, tree felling, and poaching (Bollmann 1989; Green 1990, 1993; Holloway and Khan 1973). Hazarganji-Chiltan National Park is under the ordinance of the Baluchistan Forest Department (under the Baluchistan Wildlife Protection Act 1974), and like Khunjerab NP, is managed by an independent administration (Malik 1991). Efforts to protect the Park, including construction of a 30-km boundary fencing (Green 1990) along the two most vulnerable portions of the Park's boundary, have resulted in a recovery of the vegetation, witnessed by the sharp contrast between the area within the Park and the heavily grazed landscape outside. As the

Table 8.5.1. Protected areas with Caprinae in Pakistan.

ID[1] Protected area[2]	Size (ha)	Date est.	Species[3]
***NWFP*[4]**			
62) Agram-Basti WS	29,866	1983	i
63) Borraka WS	2,025	1976	a
61) Chitral Gol NP	7,750	1984	fm,l
- Daggar GR	?	?	g
70) Drosh Gol GR	2,061	1979	fm
71) Gahirat (Gehrait) Gol GR	4,800	1979	fm
- Giddar Baik WS	?	?	g,i
73) Goleen Gol GR	49,750	1982	fm, i
77) Makhunal (= Makhnial) GR	4,148	1977	g
64) Manglot WS	715	1976	g
65) Manshi WS	2,321	1977	g
79) Nizampur GR	780	1976	g,a
80) Purit Gol-Chinar Gol GR	6,446	1979	fm
83) Rakh Topi GR	17,600	1984	a
66) Sheikh Buddin NP	15,540	1977	sm,a?
87) Sudham GR	11,500	1984	g
- Surrana GR	?	?	g,a
92) Totalai GR	17,000	1984	g,fm
- Tushi (Tooshi) GR	1,545	1979	fm
Azad Jammu and Kashmir			
2) Ghamot GR	27,283	1982	g,i
3) Hillan GR	423	1982	fm
4) Machiara GR	13,537	1982	g,i
-Mahu Dand WS	?	1992	i
5) Mauji (= Moji) GR	3,861	1982	fm
7) Phala GR	324	1982	fm
8) Qazi Nag GR	4,832	1982	g,fm
1) Salkhala WS	810	1982	g
Federal Capital Territory			
42) Margalla Hills NP	17,386	1980	g
Baluchistan			
14) Buzi Makola WS	145,101	1972	w
15) Chorani WS	19,433	1972	w,a
11) Dhrun NP	167,700	1988	w,a
16) Dureji WS	178,259	1972	w,a
17) Gut WS	165,992	1983	w
12) Hazarganji-Chiltan NP	15,555	1980	a?
13) Hingol NP	156,004	1988	w,a
***Baluchistan** ... continued*			
19) Khurkhera WS	18,345	1972	w,a
20) Koh-E-Gish WS	24,356	1969	w
22) Masalakh (Maslakh) WS	46,559	1968	a
23) Ragai Rakshan WS	125,425	1971	w,a
24) Ras Koh WS	99,489	1962	w,a
26) Sashan (Shahshan) WS	29,555	1972	a?
27) Ziarat Juniper WS	32,247	1971	a
Sind			
139) Kirthar NP	308,733	1974	w,a
184) Sumbak-Surjan-Eri-Hothiano GR	40,632	1976	w
Northern Areas			
51) Askor Nallah GR	12,955	1975	i,fm
46) Astor WS	41,452	1975	i,fm
47) Baltistan WS	41,457	1975	i,fm
52) Chassi-Bowshdar GR	37,053	1975	i
53) Danyore GR	65,036	1975	i,fm,l
48) Kargah WS	44,308	1975	i,fm
45) Khunjerab NP	226,913	1975	i,b,mp
54) Kilik-Mintaka GR	65,036	1975	i,mp
49) Naltar WS	27,206	1975	i,fm
55) Nar (Ghoro) Nallah GR	7,255	1975	i,l
56) Nazbar Nallah GR	33,425	1975	i
57) Pakura (Pakora) Nallah GR	7,515	1975	i
50) Satpara WS	31,093	1975	i,l
58) Sherqillah GR	16,842	1975	i,fm
59) Tangir GR	14,251	1975	fm
Punjab			
94) Chinji NP	6,095	1987	p
102) Chhumbi Surla WS	55,945	1978	p
126) Diljabba Domeli GR	118,106	1972	p
- Jalalpur Sharif WS	?	?	p
138) Kala Bagh GS	1,550	1966	p
131) Kala Chitta GR	132,611	1983	p
133) Khari Murat GR	5,618	1964	p
- Rakh Kundal WS	?	?	p
116) Sodhi GR	5,820	1983	p

[1] Numbers refer to numbers on maps in IUCN Directory of South Asian Protected Areas (Green 1990).
[2] NP = national park; WS = wildlife sanctuary; GR = game reserve.
[3] Species: g = goral; w = wild goat; i = ibex; fm = flare-horned markhor; sm = straight-horned markhor; b = blue sheep; a = Afghan urial; p = Punjab urial; l = Ladakh urial; mp = Marco Polo sheep; ? = presence of a taxon uncertain.
[4] NWFP = North West Frontier Province

result of better control since the establishment of the Park in 1980, the population of Chiltan goat had increased (Virk 1991). Unfortunately, under the current political situation, conditions in the National Park have since deteriorated.

Pakistan ratified the Convention Concerning the Protection of the World Cultural and Natural Heritage in 1976, and in 1983 enacted the Environmental Protection Ordinance (JRC 1990). The National Conservation Strategy marked a further move away from simple regulation and protection measures towards a holistic view of environmental issues. The National Conservation Strategy, now in its implementation phase, has seven objectives (one of which is the preservation of biodiversity) and 14 conservation goals for Pakistan to the year 2000. It attempts to involve experts, planners, and concerned individuals and groups (Kabraji 1986; Rao 1986, 1987; JRC 1989, 1990; Green 1990). In 1981, the Federal Cabinet decided to ban all killing, hunting, capturing and export of wild mammals (and their parts, products and derivatives) for a period of three years. Official hunting licences for all species of wild *Capra* in Pakistan were given to a few trophy hunters between 1985 and 1987. In September 1992, the Prime Minister of Pakistan banned hunting of all mammals until 1994. Hunting permits can, however, be issued, but only on the express approval of the Prime Minister.

The Zoological Survey Department of Pakistan collects mainly data on status, distribution and taxonomy of Pakistan's animals and publishes inventories, checklists and distribution maps [e.g. Wildlife Pakistan (no date but probably 1985); Wildlife of Azad State of Jammu and Kashmir (1986); Wildlife of North West Frontier Province (1987); Wildlife of Pakistan Punjab Province (1986).; and the Wildlife of Baluchistan (no date)]. The Sind Wildlife Management Board, in co-operation with the Zoological Survey Department, published "Wildlife of Pakistan Sind Province" (no date). The Pakistan Forest Institute has also carried out surveys on habitat, population status, and threats to the survival of many Caprinae. Results of these studies have been published in their annual reports. Studies have been conducted on Punjab urial by researchers at the Punjab Wildlife Research centre (Faisalabad), with results published in Zoological Congress Proceedings and annual reports.

A number of major problems relating to wildlife conservation in the country have been discussed by several authors (Grimwood 1972; Halle and Johnson 1984; Malik 1991; Rao 1984; Sale 1986), including inadequate habitat protection and hunting control within protected areas, lack of a sustained-yield basis for hunting in game reserves, and too great of an emphasis on forestry and recreation in protected areas. Despite the general legal protection of wild mammals, enforcement is often very difficult to achieve (Edge and Olson-Edge 1987; Hess, in press) for several reasons: **1)** the remoteness of many of the areas occupied by caprins makes control difficult; **2)** the political situation in these remote areas is often uncertain, and the policies of the central government are often administered by local political structures with conflicting aims; **3)** there is little or no understanding by locals of conservation measures, because they have always hunted either for food, commerce or sport; **4)** the endangered status of a local Caprin population is not recognised as critical by local people; and **5)** economic constraints, that are a general cause of non-acceptance of conservation measures in Pakistan (e.g. see Rieger 1981).

IUCN-Pakistan is one of the three major NGO's concerned with the environment in Pakistan. It works at several levels, with central and provincial governments, other NGO's, and other concerned groups. Its activities cover the entire spectrum of conservation and development issues, as well as field programs. All its projects are carried out in partnership with local organisations (JRC 1989, 1990). IUCN-Pakistan is about to launch a project entitled "Maintaining Biological Diversity in Pakistan with Rural Community Development". The Journalist's Resource Centre for the Environment (JRC) created in 1988, aims to centralise environmental material on Pakistan, produce information to raise public awareness, promote the National Conservation Strategy, and act as a communication unit for IUCN-Pakistan (JRC 1990). World Wide Fund for Nature - Pakistan (WWF-Pakistan) is the third major environmental NGO, with offices in Gilgit, Islamabad, Karachi, Lahore, Peshawar and Quetta.

Several major conservation projects, involving Caprinae and local communities, have been developed in recent years. WWF-Pakistan is currently implementing several field projects to protect Asiatic ibex, straight-horned markhor, blue sheep, urial, and Marco Polo sheep. One of the most successful examples of these sustainable wildlife management projects is in the Bar valley (District Gilgit). Here, WWF-Pakistan and the local administration made an agreement with the village council. With the help of the local people, the goal of this agreement is to control ibex hunting and to protect the habitat in general. As compensation for losses, locals receive financial benefits and employment opportunities, and are also participating in future incomes generated by the new management. Another conservation-based development project has been initiated by WWF-Pakistan. This protects straight-horned markhor in the tribal area of the Suleiman mountain range (Baluchistan). The local people are helped to develop new or improved sources of income under the condition that they do not kill markhor or cut any living trees. Unless local people can be sufficiently motivated, the problem of tree girdling to kill and thus "overcome" this rule, may have to be addressed. Tree girdling is known to be practised in other countries where such a restriction is in effect. Currently, a 20km^2 area of markhor habitat is being protected, with plans to increase the area to nearly 100km^2 in the next five years. One of the more recent projects, previously mentioned, "Maintaining Biodiversity in Pakistan with Rural Community Development" was initiated in 1991 in the NWFP and Northern Areas (Edwards 1995). It involves IUCN-Pakistan, UNDP, IUCN-US, the Government of Pakistan, and Aga Khan Rural Support Program (AKRSP). The primary objectives are to assist rural villages to develop and implement biodiversity management that involves sustainable use, and to develop linkages with rural villages and government and NGO's that will maintain conservation actions and avoid over-exploitation. Local communities are active participants at all levels beginning with the planning stages through to the receiving and disbursement of benefits. The planned biodiversity actions include conservation of habitat and other natural resources, as well as sustainable-use programs that may include limited trophy hunting by foreign hunters (Edwards 1995).

The Pakistan Wildlife Conservation Foundation is a charity established in 1979 with the objective of providing funds for wildlife conservation in accordance with the policies of the National Council for Conservation of Wildlife. Additional NGO's include the Wildlife Conservation Society of Pakistan, and the Fish and Environmental Society of Pakistan (Green 1990, 1993). Belour Advisory and Social Development Organisation (BASDO) is also actively working in the Northern Areas with objectives that include increasing awareness among local communities about the importance of biodiversity. There is a wealth of development organisations in Pakistan, but in general their importance for conservation is limited. An exception is the Aga Khan Rural Support Program that co-operates with IUCN in some projects in northern Pakistan (see above). The Program is involved in educating rural communities in the management and use of their renewable resources through Village Organisations (VO) to develop sustainable economies. AKRSP has recently added "Natural Resource Management" as a new activity (Edwards 1995).

General conservation measures proposed

The current distribution pattern of wildlife in Pakistan is to some extent a consequence of persecution by humans. Except for northern Pakistan, most of the remaining wildlife in the country is in the mountainous regions west of the Indus, simply because here there are fewer people and therefore less disturbances than elsewhere (Green 1993). Moreover, there is little Caprinae habitat east of the Indus. In decreasing importance, the following threats to Caprinae must be considered: **1)** overhunting and poaching, **2)** habitat degradation (including extension of cultivated areas), and **3)** resulting population fragmentation and isolation. [Remarks on habitat destruction are noted in the **Species accounts** following]

It is obvious that action must be taken immediately to conserve Caprinae in Pakistan, because most taxa are threatened. Where resources such as manpower, funds, etc., are limited, the following approaches should prove effective. A series of "focal" or key areas should be identified for each taxa, where populations and/or other conditions are most likely to yield successful conservation results. It is important to initially select only one or two "focal areas" so that they may be easily and effectively controlled. Furthermore, it is important to recognise that all protection measures may have to be concentrated in the last strongholds, at least initially. In some cases, the number of game watchers will have to be increased temporarily, even at the cost of other protected areas. Specific concepts related to focal areas include:

1) Every national park would represent a focal area for the Caprinae living within it, unless its importance for certain taxa is naturally marginal.
2) Initially, at least two focal areas should be selected for each threatened Caprinae taxon. In the long-term, every District should have at least one focal area for each threatened taxon that are native to them.
3) The selection criteria for focal areas include: a) the area completely encloses the largest population of the taxon in question and has at least locally, a high density; b) it is easy to control; c) it is an advantage (but not necessary) if the area is a traditionally protected area (e.g. a former hunting reserve of a Mehtar or Mir such as Chitral Gol, a hunting reserve of the former Gilgit Scouts such as Kargah Game Sanctuary, or existing Government Game Sanctuaries or Reserves).

Applying these concepts to current conditions, most Caprinae taxa are found in at least one focal area in the form of a national park. Examples of potential focal areas include: ***Western Himalayan goral*** – Margalla Hills NP (Federal Capital Territory); ***flare-horned markhor*** – the Kargah GS (Gilgit District), the area around Bagheecha (Byicha) (Baltistan District), with the possibility of stepwise extension of the focal area along the Indus and its side-valleys, and the Tuski GR (Chitral District); ***straight-horned markhor*** – the areas of Takht-i-Sulaiman and the Torghar hills (Zhob District) as well as in the Takatu hills (Quetta District); ***Punjab urial*** – Kalabagh GR (Mianwali District); ***Ladakh urial*** – Kharpocho, Nar Goroo and Narthang near Skardu (Baltistan District), and possibly the lower Miatsil (Hispar) valley (Gilgit District). Focal areas involving existing government controlled areas will require both a management plan and a prompt implementation program. Where government protected areas do not exist, or are not appropriate as focal areas, establishment of private reserves/protected areas must be encouraged. Such protected areas should be established through the joint efforts of government agencies, NGO's and leading local inhabitants. However, provincial wildlife departments should take the lead in this action, through relevant amendments to existing legislation and wildlife rules. They may seek the co-operation of local NGO's in drafting revised rules and in formulating strategies to handle individual situations. Both government and private efforts can also be developed in other areas, but initially not at the expense of focal areas.

Implementation of adequate conservation-management programs must incorporate information about and input from, people living in and near areas being considered for protection. The relationship between over-grazing, over-exploitation and the resulting ecological and economic problems, should be understood and demonstrated in any program. Only then can enforcement of wildlife conservation laws have a chance of being effective.

A national conservation strategy to address these problems (Kabraji 1986; Rao 1987) was recently approved. But even if this strategy is successful, most current Caprinae populations will face the problem of isolation within the next decade. Over the long term, the present largest populations of flare-horned markhor and Chiltan goat cannot be preserved in the existing national parks (Chitral Gol NP and Hazarganji-Chiltan NP respectively), especially if the areas around these Parks are altered in such a way that natural dispersal or migration of animals are cut off. Small and isolated populations require our attention because we must expect a decrease in the natural, intraspecific genetic variability.

Once small and isolated populations of a taxon have increased to viable numbers, re-introduction of animals into previously occupied areas can be considered if natural immigration is unlikely, and if there is a realistic guarantee for protection and monitoring. Protection and re-introduction have to be combined, and a national park or other type of protected area should encompass the population's core area. Also, it should be located within a larger environmental unit, with moderate restrictions for local people and their agricultural and forestry activities. Habitat corridors for wildlife leading from the core area to neighbouring suitable habitat and/or populations, should be also protected.

When adequate protection and management have been implemented, and the necessary demographic data collected, a sustainable local hunting program could be considered for appropriate populations which are not threatened (see **Appendix 1**). Together with hunting licences, information about the detrimental effects of uncontrolled hunting should be given to hunters to increase the number of local conservationists. For political reasons, there is uncertainty about existing laws and the executive functions of the federal government in many areas with Caprinae (e.g. in the disputed territories in the north, as well as in the Tribal Areas). A group of people who could function as link between the planning sections of governmental or private conservation organisations on the one hand and the people living in areas concerned by restrictions on the other, could be representatives of the local aristocracy or local leaders. Many of these individuals are traditional hunters and are aware of the necessity of wildlife conservation and the establishment of a hunting system based on a management plan. Usually, they possess traditional authority and are able to judge the chances of introducing new ideas, yet they are rarely approached by conservation organisations (Hess, in press). Tareen (1990) described a project of this type which started in the Torghar hills of Zhob District (Baluchistan) (see also Virk 1991), but which was recently sabotaged at various levels. This is particularly unfortunate because such failures reduce the potential for future initiatives. What may be learned from this is that such individually sponsored projects are unlikely to be successful if they operate outside the existing local conservation NGO system, which if involved, can otherwise help maintain regular co-ordination with government departments.

Alternatively, community-oriented projects can be developed in which a community and its representatives enter into a partnership with conservationists. Examples of such programs include IUCN-Pakistan/UNDP project, and WWF-Pakistan's straight-horned markhor project, discussed earlier (**General conservation measures taken**). Similar solutions to conflicts between local inhabitants and conservation organisations are being discussed for Chitral Gol National Park (Malik 1985) and for Khunjerab National Park.

Until the Prime Minister's ban on hunting mammals in 1992, Pakistan was the only country in the world where markhor could still be legally shot by trophy hunters. Trophy hunting has frequently been suggested as one of the best means for improving conservation of caprins (Khan 1984; de Clers 1985; Virk 1991). This approach is probably applicable in Pakistan because it demonstrates a clear economic value of wildlife. For example, the fees gained from three trophy markhor could allow the wildlife authorities in the Chitral District to pay the annual salaries of all 67 game-watchers in their district. If a trophy hunting program is to be successful it should be based on the recommendations outlined in **Appendix 1** of this Action Plan.

Currently, the number of hunting permits issued in game reserves is often made on the basis of influence and not on biological considerations (Green 1990). For successful sustainable programs, hunting fees should be legally allocated to a specific conservation program. Despite suitable populations, hunting must be banned in some areas (e.g. the internationally accepted status of National Parks should be adopted in Pakistan, or the Parks placed into a different protection category). Unless clear and biologically-based guidelines are adhered to, trophy hunting instead of stimulating conservation will only increase undesirable hunting pressure (Hess, in press).

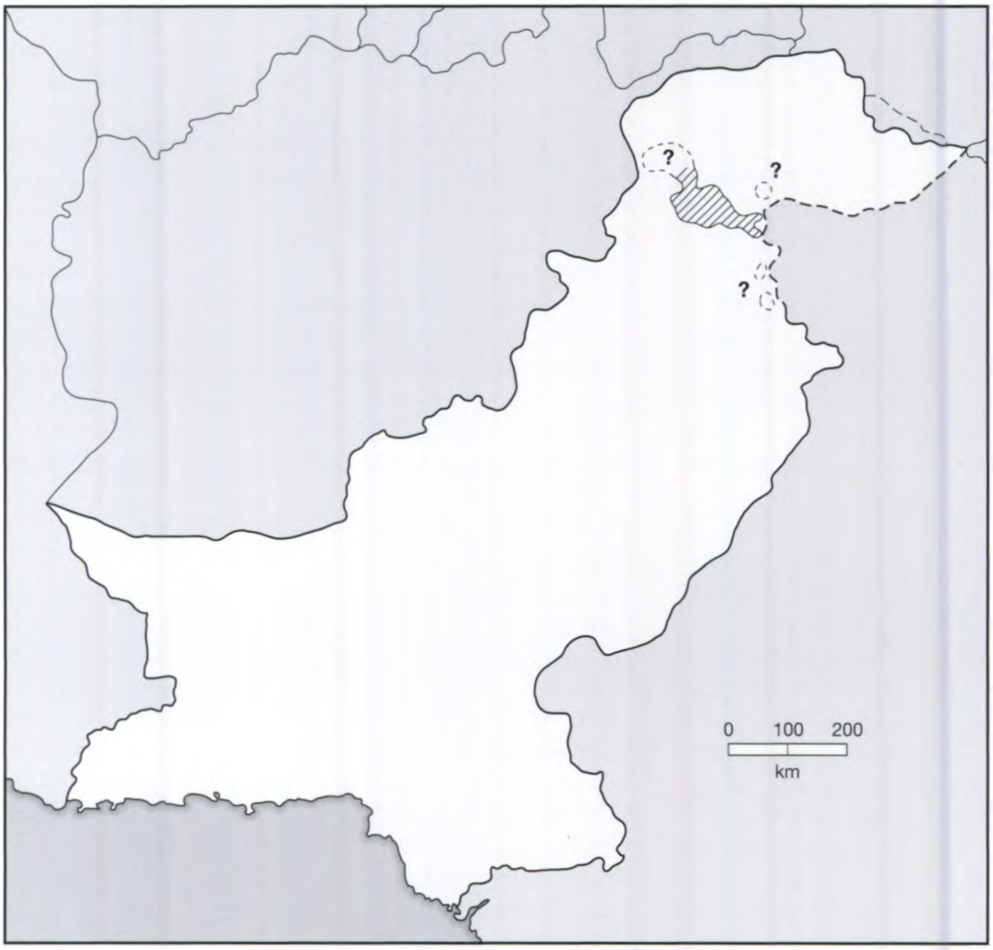
In areas with Caprins, trophy hunting may be the most feasible route for conservation **in the immediate future** for some taxa (Virk 1991). However, we would stress that other possibilities must also be pursued because moneys generated through trophy hunting are, for political or economic reasons, not guaranteed to reach local people, or to be used for wildlife conservation. Also, it must not be forgotten that conservation is not simply a matter of producing trophies. In this context it is important to mention that the development of roads to attract tourists to national parks and other protected areas, or for better control of illegal hunting, should not always be the first priority. Increasing access is almost always accompanied by a variety of impacts potentially detrimental to wildlife (e.g. poaching) and to their habitat (Kermani and Khan 1985; Malik 1985).

Species accounts

The wildlife sanctuaries and game reserves listed under **Conservation measures proposed** in the individual **Species accounts**, are taken from the maps published by, or produced in co-operation with, the Zoological Survey Department. Exceptions are for the Chitral District of North West Frontier Province that are based on Anonymous (1986), the Northern Areas based on Rasool (no date), and the Baluchistan Province based on Virk (1991). Unfortunately these maps vary greatly in quality, but they do represent the only published source on national parks, wildlife sanctuaries and game reserves, together with the main wildlife they contain. The official censuses of the wildlife authorities and the various authors quoted in the **Species accounts**, also vary in quality. Normally the quality of a census is not commented on, but many of the numbers given have to be interpreted carefully. For the system of the administrative districts of Pakistan, and in cases of doubt, the spelling of locality names conforms to the Atlas of Pakistan (Syed 1985). North West Frontier Province is abbreviated as NWFP.

Western Himalayan goral (*Naemorhedus goral bedfordi*)

Distribution: In Pakistan, this goral occurs in the outer Himalayan foothills that form the western extremity of the species' range (Map 8.5.1). Roberts (1977) stated that within the Federal Capital Territory and the Rawalpindi



Map 8.5.1. Distribution of Western Himalayan goral (*Naemorhedus goral bedfordi*) in Pakistan.

District of the Punjab Province, it inhabited the Murree foothills and the Margalla range. However, its present occurrence in Punjab is doubtful (Chaudhry, unpubl. data). Roberts (1977) also mentioned the occurrence of the species in Azad Jammu and Kashmir in parts of the Neelum Valley beyond Ath Muqam (District Muzaffarabad), while Qayyum (1985) and the Zoological Survey Department (1986) describe it in the District of Kotli, at three places in the District of Muzaffarabad, and in the region of Poonch. In the NWFP, its range extends from the Districts of Abbottabad, Mansehra, Mardan, Kohistan and Swat, to the areas of Dir, Malakand and Nowshera which possibly still form the western limit of its range. The main surviving population in Pakistan is probably in the Indus Kohistan region between Swat and the Kunhar Valley catchment (Roberts 1977).

Population: No total estimate. Two hundred animals were counted during a wildlife census by the NWFP Forest Department (NWFP 1987); 18 in the District of Abbottabad, 40 in Mansehra, 35 in Kohistan, and 80 in Swat. In a more recent census, a total of 233 was estimated in the NWFP including the Districts of Mardan (9), Buner (63) and Haripur (25), besides Mansehra (96) and Kohistan (40) (NWFP 1992). During this census, no goral were recorded in Abbottabad or Swat Districts. A total of 893 was estimated in Azad Jammu and Kashmir (Qayyum 1986–87). Margalla Hills National Park contains an estimated 40 to 60 goral, and the population is believed to be slowly increasing (Maqsood 1989).

Threats: The main threats come from habitat destruction, hunting, and possibly from competition with livestock (Maqsood 1989).

Conservation measures taken: Western Himalayan goral is listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Along with all other species of goral, it is in Appendix I of CITES under *N. goral.* The subspecies in Pakistan is legally protected, as are all wild mammals in the country, but enforcement of the laws is not satisfactory. A proposal has been made (Green 1993) that Margalla Hills NP should include a 3,100ha enclosure for captive breeding and re-introductions. In 1988, between 40 to 60 goral were reported in this National Park (Maqsood 1989). Known protected areas with goral (Table 8.5.1) include: ***NWFP*** – Haripur (previously Abbottabad) District: Makhunal GR, Surrana GR (Zool. Survey Dept. 1987); Mansehra District: Manshi WS (Zool. Survey Dept. 1987); Mardan District: Sudham GR; Swat District: Giddar Baik WS, Daggar GR (Zool. Survey Dept. 1987); Boner District: Totalai GR (Zool. Survey Dept. 1987); Nowshera District: Manglot WS or Nizampur GR (Zool. Survey Dept. 1987); ***Azad Jammu and Kashmir*** – Muzaffarabad District: Salkhala WS, Ghamot GR, Machiara GR, Qazi Nag GR (Zool. Survey Dept. 1986). ***Federal Capital Territory*** – Margalla Hills NP (Maqsood 1989).

Status within country: Endangered.

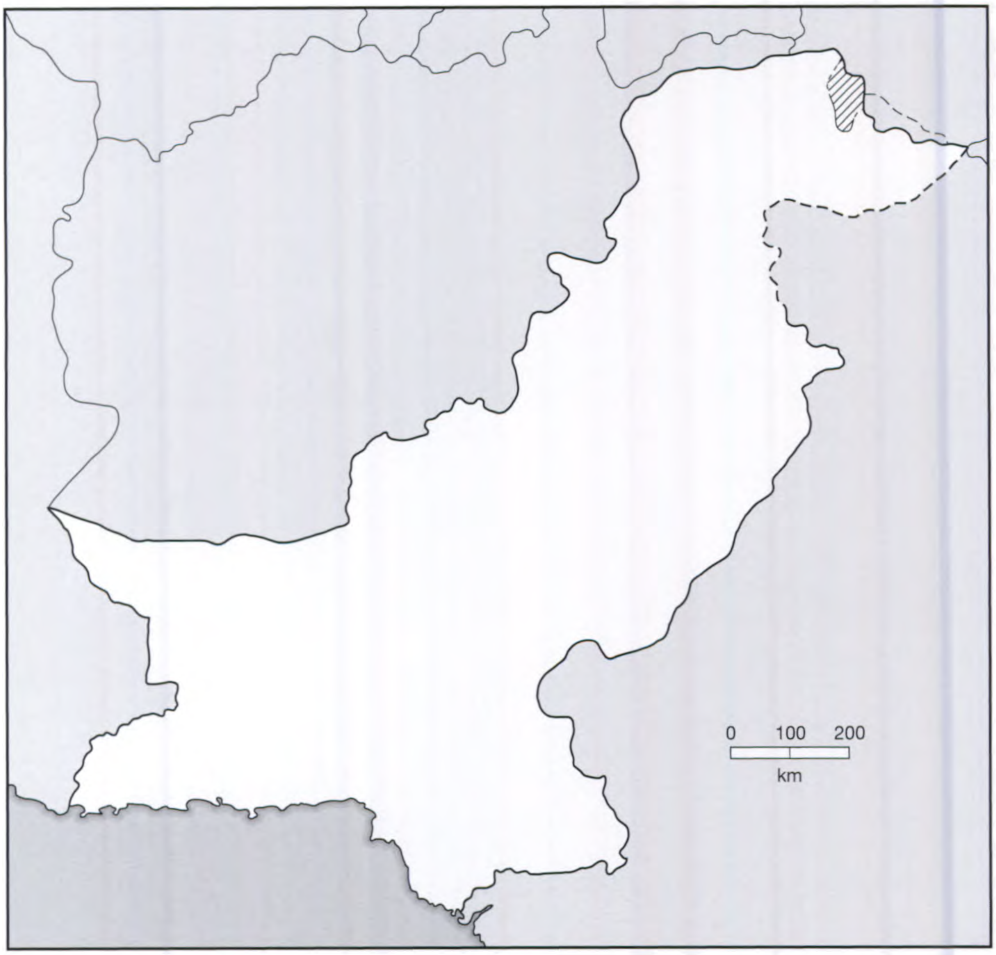
There is very little information about the species in Pakistan. It is classed as endangered because of its small range and the low population numbers that are given for each separate area.

Conservation measures proposed: 1) Secure the protection of the population in the Margalla Hills NP. **2)** Establish several other focal areas (see **General conservation measures proposed** above). **3)** To this end, there is an urgent need to obtain more information about the actual distribution and status of the species. **4)** Identify areas suitable for protection at the same time that censuses are made. **5)** Develop and implement conservation management strategies, including populations on private lands.

Blue sheep (*Pseudois nayaur nayaur*)

Distribution: Like goral, northern Pakistan represents the westernmost part of this species' range. Its main distribution range in Pakistan includes the upper Gujerab valley, the upper Shimshal valley, and the area eastward from Shimshal pass (District Gilgit), including part of Khunjerab NP (Schaller 1976; Roberts 1977; Rasool 1986; Wegge 1988, 1989; G. Tallone, *in litt.* 1993) (Map 8.5.2). Outside this areas there is a single, recent observation of one animal from Khunjerab pass (R. Hess, pers. obs. 1985). Earlier, Roberts (1977) mentioned its occurrence (with proof) around Shigar and the Baltoro glacier (District Baltistan), however, we have no actual information from this area. Roberts' (1977) source for its occurrence in the Passu valley was a quote from Lydekker (1907), who mentioned "Hunza valley, near Passu", but possibly meaning the Shimshal valley. David Mallon (pers. obs., *in. litt.*) was unable to confirm the presence of the species in the Passu valley.

Population: According to written reports (Wegge 1988, Rasool 1990), the species is not as rare as previously thought (Rasool, no date). Earlier population estimates for Khunjerab National Park gave 35 animals in 1976 (no date), none in 1979 and a maximum of two to three for 1980 (Rasool 1981), 170 in 1986 (Rasool 1986), and 600 in 1989 (Rasool 1990). Wegge (1988) estimated densities of two to five blue sheep/km^2 in the southeastern third of Khunjerab National Park, and total numbers between 1,500 and 2,000 in the Shimshal valley and the area eastward of it not currently included in the National Park. The most recent estimates (G. Rasool, unpubl. data) indicated between 2,000 and 2,500 animals in 1992. It



Map 8.5.2. Distribution of blue sheep (*Pseudois nayaur*) in Pakistan.

is not clear whether the population has increased or whether it was previously under-estimated because its main distribution area is far from the Karakoram Highway.

Threats: Limited range and low numbers make it vulnerable to poaching and habitat loss. When access to the Shimshal valley is opened by construction of a jeep road, the species will most probably come under increased hunting pressure.

Conservation measures taken: Listed as Lower Risk (nt) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Khunjerab National Park (Table 8.5.1) contains a large portion of Pakistan's total population of blue sheep. It occurs in no other protected area.

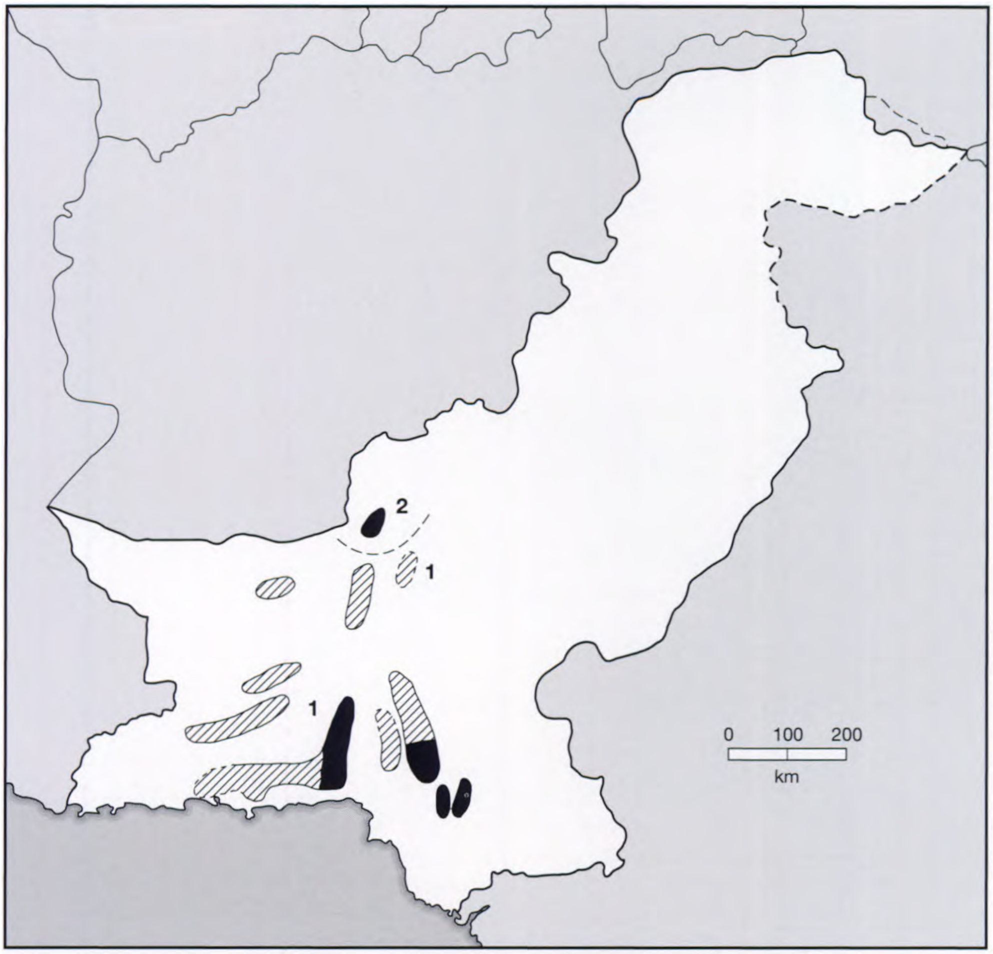
Status within country: Vulnerable.

Despite the fairly good population in the Shimshal valley, the species is classified as Vulnerable according to the IUCN categories of threat (IUCN 1996) because of its limited range in Pakistan and its estimated total numbers.

Conservation measures proposed: 1) Extend the boundaries of Khunjerab NP eastwards to include the area which is supposed to harbour a large population of blue sheep, as well as the only occurrences in Pakistan of the Tibetan wild ass (*Equus hemionus kiang*), and possibly the wild dog (*Cuon alpinus*) (Wegge 1988). **2)** Address problems faced by local people whose livelihoods would be affected by this extension. The management plan originally proposed for Khunjerab NP did not do this, but this is necessary before its conservation recommendations can be implemented. The measures taken in the Bar valley project initiated by WWF-Pakistan and similar projects could serve as useful models. **3)** Determine what detrimental influences the new road to Shimshal will have in the Park's modified management plan.

Wild goat (*Capra aegagrus*)

Distribution: The present range of Sind wild goat (*C. a. blythi*) is the Baluchistan plateau and its foothills in south-western Pakistan (Map 8.5.3). Populations are scattered on arid mountain ranges that are isolated by lowlands of southern Baluchistan and Sind. The distribution range includes the low Mekran coastal range (District Gwadar), areas up to 3,250m asl in the Koh-i-

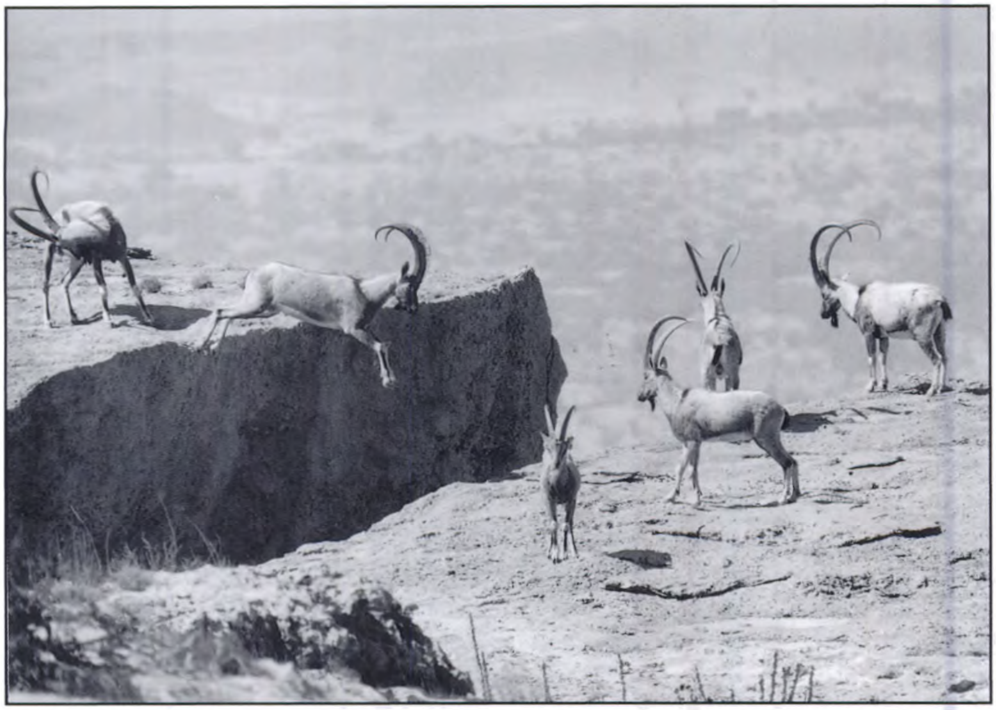


Map 8.5.3. Distribution of wild goat (*Capra aegagrus*) in Pakistan. 1) *C. a. aegagrus*; 2) *C. a. chialtanensis*.

Maran range south of Quetta (District Kalat), and also the Kirthar range (Districts of Dadu and Las Bela) (Roberts 1977, Schaller 1977, Bollmann 1989). A second subspecies, the Chiltan goat (*C. a. chialtanensis*) was restricted in the early 1970s to four or five populations in the accessible mountain ranges (Chiltan, Murdar, Koh-i-Maran and Koh-i-Gishk ranges) south of Quetta (Roberts 1977, Schaller 1977). Today, these have been reduced, principally by uncontrolled hunting, to only one surviving population in the Hazarganji-Chiltan NP (Districts of Quetta and Kalat) (Map 8.5.3).

Population: For *C. a. blythi* there is no overall population estimate. Most survive in small inaccessible areas in isolated populations (Virk 1991). However, reasonable numbers are reported for the Dhrun and Hingol areas (Ahmad and Beg 1989). Kirthar NP probably contains the largest population of Sind wild goat in the country. For the Karchat mountains, a part of Kirthar NP, comparable population numbers have been estimated. Here, since the establishment of the Park in 1973, the population has increased from between 400 and 500 (Schaller and Laurie 1974) to around 950 to 1,050 (Bollmann 1989). For the whole Park, Mirza and Asghar (1980) estimated a total of 1,480 goats, while Kermani and Khan (1985) gave an optimistic number of 4,000 animals. According to Bollmann's (unpubl. data) observations in 1987, the total population inhabiting the Park is between 1,500 and 2,000 goats. The adjacent Surjan-Sumbak-Eri-Hothiano GR contains another 900 to 1,100 (Mirza and Asghar 1980), resulting in a total estimate of 2,400 to 3,100 wild goat for Sind Province. Depending on the study area, densities ranged between 0.5 to 0.65 animals/km^2 (over 3,087 km^2 in Kirthar NP; Bollmann, unpubl. data) and 11.8 to 16.3 animals/km^2 (over 60km^2 in Karchat mountains in Kirthar NP; Edge and Olsen-Edge 1990). The overall density within the species' distribution area is probably well below 0.5 wild goat/km^2. For *C. a. chialtanensis* the single population totalled ca. 168 animals in 1975 (Mirza 1975). Due to rigid protection following establishment of the National Park in 1980, the population had increased to 480 animals by 1990 (Baluchistan Forest Dept. Records, cited in Virk 1991), but this improvement may not have continued.

Threats: Within its distribution range, the species is only locally abundant and under successful protection only in some areas (e.g. Sind Province). Most of the animals



A group of male Pasang or Sind wild goat (*Capra aegagrus blythi*) in Kirthar National Park, Sind, Pakistan.

R. Hess

comprise populations on scattered mountain ranges isolated from each other by lowlands. Consequently, they are vulnerable, especially because local people and nomadic tribes graze their domestic stock on most of the ranges used by wild goats, and because hunting is still widespread. The species requires greater protection.

Conservation measures taken: Sind wild goat is listed as Vulnerable (A2cde), and Chiltan goat as Critical (C2b) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Except for Kirthar and Hazarganji-Chiltan NP's, there are several reserves providing different levels of protection to wild goats, but for many, no management plans have been developed and most lack even supervisory staff (Virk 1991).

Protected areas with Sind wild goat include (Table 8.5.1): ***Baluchistan*** – Las Bela District: Hingol NP, Dureji WS, Khurkhera WS (Baluchistan Forest Dept. 1990); Khuzdar District: Dhrun NP (Baluchistan Forest Dept. 1990); Chorani WS (Zool. Survey Dept., no date); Gwadar District: Buzi Makola WS (Zool. Survey Dept., no date); Kharan District: Ragai Rakshan WS, Ras Koh WS (Baluchistan Forest Dept. 1990); Ras Koh WS (Zool. Survey Dept., no date); Chagae District: Gut WS (Baluchistan Forest Dept. 1990). Kalat District: Koh-E-Gish WS (Zool. Survey Dept., no date); ***Sind*** – Dadu District: Kirthar NP, Sumbak-Surjan-Eri-Hothiano GR (Mirza and Asghar 1980). Between 1,500 and 2,000 Sind goat are protected by Kirthar NP (K. Bollmann, unpubl. data), and a wildlife management plan for the Park (Holloway and Khan 1973) recommended: **1)** no extension of irrigated cultivation, **2)** reduction of livestock grazing by the locals and immigrants, and **3)** prohibition of tree felling, cutting branches for livestock fodder, poaching, stone quarrying and honey collection within the park. This plan is currently being revised.

The world's last remaining population of Chiltan goat is restricted to Hazarganji-Chiltan NP (Quetta District; Zool. Survey Dept., no date) where ca. 480 animals lived in 1990 (Forest Service reports cited in Virk 1991). Previous efforts to protect this Park included more administrative staff, control of livestock grazing, wood cutting, poaching, and construction of ca. 30km boundary fence. This resulted in a marked recovery of the vegetation and an increase in the Chiltan goat population prior to 1990 (Baluchistan Forest Dept. Records, cited in Virk 1991). However, there are reports that conditions have recently deteriorated in this National Park.

Status within country: Sind wild goat – Rare; Chiltan goat – Endangered.

Conservation measures proposed: 1) Enforce the management recommendations for Kirthar NP. **2)** Consider alternative livelihoods for the people who would be displaced by implementation Kirthar NP's management plan. **3)** Develop a range management program for the Park based upon a system of zones of varying use-intensity by humans and livestock. **4)** Implementation of such restrictions on the human population, must be accompanied not only by some form of compensation, but also include responsible involvement of the local community in conservation and agricultural programs. Virk (1991) emphasised the importance of participation of the local communities in the wildlife conservation process and gave a list of objectives for a local participatory approach, as well as a list of management goals. **5)** Determine current distribution and status of this species, and assess the remaining habitat before launching any further wild goat conservation program in the Province of Baluchistan.

6) Consider implementing Virk's (1991) three proposals for Hazarganji-Chiltan NP. **a)** Enlarge the area of Hazarganji-Chiltan NP by including the adjacent Kerkhasa State Forest (Ahmad 1988, cited in Virk 1991) to support any increase in the Chiltan goat population. **b)** Reintroduce and manage at least one herd of Chiltan goat in a formerly inhabited mountain range (e.g. Murdar, Koh-i-Maran). Such re-introductions would provide ways of presenting wildlife conservation to the public, as in the case of the Alpine ibex (*C. ibex ibex*) in the Alps (Nievergelt and Zingg 1986), and involve the local people in the conservation program. Natural dispersal from Hazarganji-Chiltan NP to neighbouring mountain areas can be expected only over the long term and even then only with a high population density within the Park. **c)** Stop allowing hunters to take animals from the last population of Chiltan goat. Only when viable populations have been built up outside the National Park, could a trophy hunting program be considered as a possible means of generating funds for further conservation efforts. If conditions have deteriorated and the Park's effectiveness has declined since 1990, obviously steps should be taken immediately to deal with the problems.

Asiatic ibex (*Capra [ibex] sibirica*)

Distribution: In terms of relative numbers, Asiatic ibex is probably the most abundant Caprinae in Pakistan (Schaller 1977). It is restricted to the relatively dry mountains of the inner Himalaya, Karakoram and Hindu Kush, between about 3,200 to >5,000m asl (Map 8.5.4). Its present range differs little from that described by Schaller (1977). It inhabits most of the higher mountain ranges of the Gilgit, Diamir and Baltistan Districts, and the northern part of the Chitral District. In Dir, Swat, Kohistan and Mansehra Districts, as well as in the northern part of Azad Jammu and Kashmir, it exists in the inner mountain range and inhabits the southern slopes of the main Himalayan chain (Roberts 1977, Schaller 1977, Qayyum 1985). Outside this distribution area there is an unconfirmed report of a totally isolated population in the Safed Koh Mountains (Districts Kurram and Khyber of NWFP). If animals still exist there, it would represent the southernmost limit of the species' global distribution (Roberts 1977). However, a recent Forest Department report (NWFP 1992) makes no mention of such a population.

Population: Asiatic ibex is widely distributed over northern Pakistan, but is only locally abundant in the northern part of its range. Hess (1986) found the highest density in northern Pakistan to be in the area along the Barpu Glacier (Gilgit District) with 1.2 to 1.6 animals/km^2 (n = 194–270 animals, area surveyed = 164km^2). Wegge (1988) estimated that >2,000 ibex lived in the Khunjerab NP, at a slightly

U. Steger

A large group of male Asiatic ibex (*Capra [ibex] sibirica*) on the skyline near the Bapu glacier, Gilgit District, Northern Areas, Pakistan.

lower density of ca. 1.0 ibex/km². In many areas the species has densities of >0.1 to >0.3/km² as in the Shinghai Valley, Gilgit District (n = 15–50 animals, area surveyed = 176km², Hess 1986). Within the Gilgit District, Asiatic ibex is clearly rarer in the southern than in the northern part. The reasons for this may be that compared to northern areas, elevations in the south are generally lower, there are higher densities of humans using alpine pastures, and there are smaller distances between villages. The census of the NWFP Forest Department (NWFP 1992) gives 2,545 animals for the whole province, and in Azad Jammu and Kashmir, a total of 375 were estimated (Qayyum 1986–87). For the Northern Areas (Districts Gilgit, Diamir and Baltistan), between 9,000 and 10,000 ibex were estimated in 1993 (unpubl. data, Wildlife Wing, Northern Areas, Gilgit).

Threats: Competition for food with livestock is a growing threat to Asiatic ibex in Pakistan.

Conservation measures taken: There are many protected areas providing differing levels of protection to ibex (Table 8.5.1). These include: ***NWFP*** – Chitral District: Agram-Basti WS, Goleen Gol GR (Anonymous 1986); Swat District: Giddar Baik WS, Mahu Dand GR (Zool. Survey Dept. 1987). ***Northern Areas*** – Gilgit District: Khunjerab NP, Kargah WS, Naltar WS, Kilik-Mintaka GR, Danyore GR, Sherqillah GR, Pakura Nallah GR, Chassi-Bowshdar GR, Nazbar Nallah GR (Rasool, no date); Diamir District: Astor WS (Rasool n. d.); Baltistan District: Baltistan WS, Satpara WS, Nar Nallah GR, Askor Nallah GR (Rasool, no date). ***Azad Jammu and Kashmir*** – Muzaffarabad District: Ghamot GR, Machiara GR (Qayyum 1986–87; Zool. Survey Dept. 1986). Mahu Dand GR was created for ibex in 1992.

WWF-Pakistan began a hunting program in 1990 at the Bar village near Gilgit. In 1991, IUCN-Pakistan, with support from UNDP, in co-operation with local people and the Aga Khan Rural Support Program, initiated a planning process to survey protected areas and to prepare an overall sustainable-use wildlife management plan for ibex populations. The program is to involve hunting by both local and foreign hunters.

Status within country: Not threatened.

Conservation measures proposed: 1) Provide complete legal protection for the species. 2) Establish a proper hunting system involving a management plan for locals,

Map 8.5.4. Distribution of Siberian ibex (*Capra [ibex] sibirica*) in Pakistan.

as well as for foreigners. Hunting could take place in areas with healthy populations but not in National Parks.

Flare-horned markhor (*Capra falconeri falconeri*)

Distribution: Schaller and Khan (1975) considered the former Astor markhor (*C. f. falconeri*) and Kashmir markhor (*C. f. cashmiriensis*) to be one subspecies – the flare-horned markhor. The distribution map given by Schaller and Khan (1975) seems still valid for this markhor, though the populations within the large range along the Indus have probably since decreased (Map 8.5.5). Markhor is mainly confined to the Indus and its tributaries, as well as to the Kunar (Chitral) river and its tributaries. Along the Indus, it inhabits both banks from Jalkot (District Kohistan) upstream to near the Tungas village (District Baltistan), with Gakuch being its western limit up the Gilgit river, Chalt up the Hunza river, and the Parishing valley up the Astor river (Schaller and Khan 1975). The occurrence of this markhor on the right side of the Yasin valley (Gilgit District) in the recent past (Schaller and Kahn 1975), was also reported to R. Hess in 1986, but could not be confirmed. The flare-horned markhor is also found around Chitral and the border areas with Afghanistan where it inhabits a number of valleys along the Kunar river (Chitral District), from Arandu on the west bank and Drosh on the east bank, up to Shoghor along the Lutkho river, and as far as Barenis along the Mastuj river (Schaller and Khan 1975).

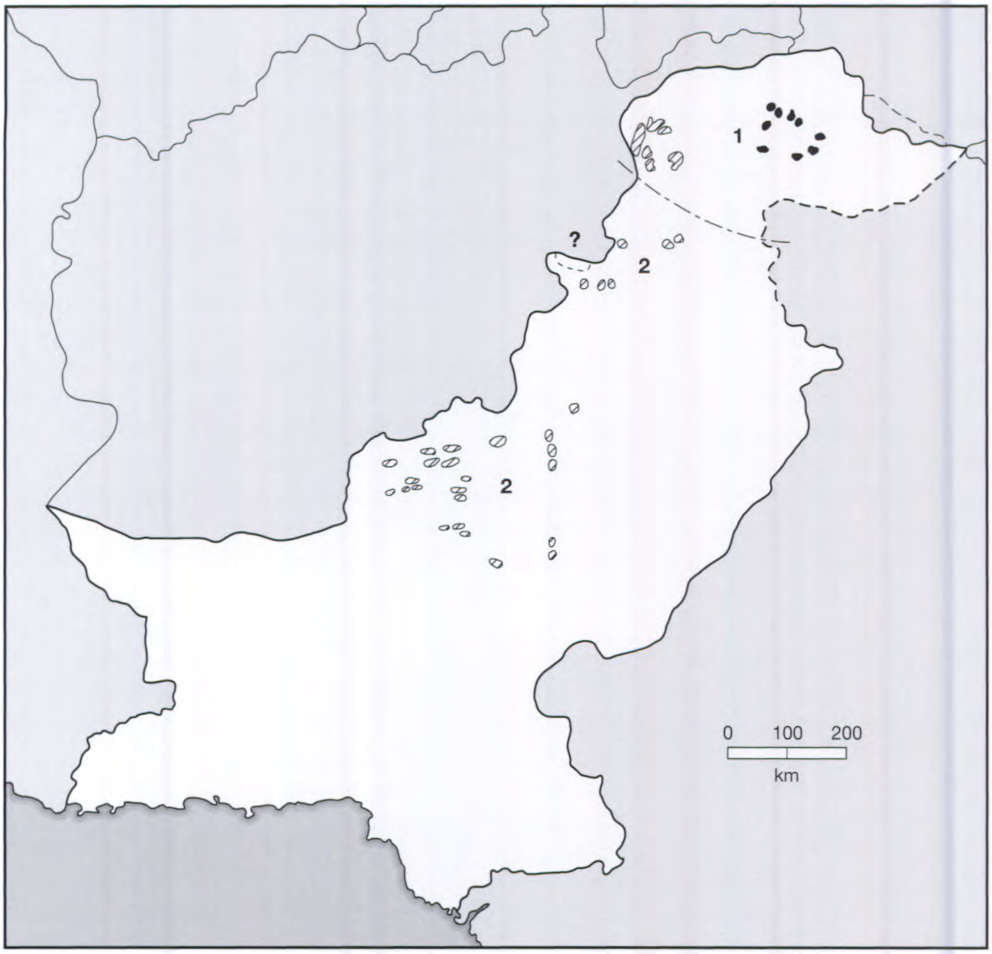
Population: There are comparable population numbers over the last 20 years for three areas. **1)** In 1970, the Chitral Gol, a valley of 77.5km^2 in the Chitral District, and at that time the private hunting reserve of the Mehtar of Chitral, was estimated to harbour 100 to 125 animals (Schaller and Mirza 1971). In 1984, this area was declared a National Park, and by 1985–86, it contained 160 (census) to 300 (estimated) animals. In addition, the proportion of males ≥4.5 years old increased during the same period (Hess 1986). Within this time span, Aleem (1979) registered a maximum of 520 animals in Chitral Gol in 1979. The increase was attributed to better protection from poaching and to other improvement efforts in the Park (Malik 1985). However, according to the latest official census (Ahmad, unpubl. data), the population in Chitral Gol NP was reduced to 195 markhor in 1987. **2)** For the Tushi GR in the Chitral District, Schaller and Khan (1975) estimated 125 animals, a number similar to that estimated in 1985–86 (anonymous 1986, Hess in press). **3)** The population of markhor in the Kargah GS (Gilgit District) was estimated by Roberts (1969) as not less than 500 to 600 animals, by Schaller and Khan (1975) as 50, by Rasool (no date, probably 1976) as 109, by Hess (1986) as 50 to 75, and by Rasool (unpubl. data) in 1991 as 40–50. In 1983, Rasool (unpubl. data) estimated that this area was the best area for markhor within the Gilgit District.

Schaller and Khan (1975) estimated a total of at least 5,250 flare-horned markhor living in Pakistan, in the border areas with Afghanistan, and in India. The official census for Chitral District gave 617 markhor for 1985–86, and the NWFP Forest Department (NWFP 1992) estimated 1,075 for the whole province (619 - Chitral, 109 – Dir, 58 – Swat, 221 – Kohistan, 50 – Mansehra; NWFP 1992). The Wildlife Wing (Northern Areas Forest Dept., unpubl. data) estimated a total of 1,000 to 1,500 markhor in the Northern Areas in 1993 (Districts Gilgit, Diamir and Baltistan), though there may be no more than a maximum of 40 to 50 animals for a single area. Hence the population of this subspecies appears to have decreased since 1975. Today, less than 2,500 to 3,000 flare-horned markhor are estimated to survive in Pakistan.

Threats: Flare-horned markhor generally occur only in small (<100), scattered populations and at low densities

A mixed group of flare-horned markhor (*Capra falconeri falconeri*) in Chitral Gol National Park, Pakistan.

R. Hess



Map 8.5.5. Distribution of markhor (*Capra falconeri*) in Pakistan. 1) *C. f. falconeri*; 2) *C. f. megaceros*.

throughout most of northern Pakistan. Control of poaching in Chitral Gol NP has been successful (Malik 1985; Hess in press), and similar protection should be afforded other populations. Such actions alone may not be sufficient, however. Despite less poaching, markhor numbers have decreased and no more than 200 are believed to remain in Chitral Gol NP (Ahmad, unpubl. data).

Conservation measures taken: Markhor is now listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and is completely protected by federal law (Rao 1986). Nevertheless until 1992, three animals were permitted to be shot annually by foreign trophy hunters in Chitral, two of them even in the Chitral Gol National Park (Sand, in Valdez 1985; Hess, in press). Several protected areas contain flare-horned markhor (Table 8.5.1): ***NWFP*** – Chitral District: Chitral Gol NP, Drosh Gol GR, Gahirat Gol GR, Goleem Gol GR, Goleen Gol GR, Purit Gol-Chinar Gol GR, Tushi GR (NWFP 1992); Swat District: Totalai GR (Zool. Survey Dept. 1987). ***Northern Areas*** – Gilgit District: Kargah WS, Naltar WS, Danyore GR, Sherqillah GR. (Rasool, no date); Diamir District: Astor WS, Tangir GR (Rasool, no date); Baltistan District: Baltistan WS, Askor Nallah GR (Rasool, no date). ***Azad Jammu and Kashmir*** – Muzaffarabad: Mauji GR, Qazi Nag GR, Hillan GR (Zool. Survey Dept. 1986); Poonch District: Phala GR (Qayyum 1986–87). Despite containing <200 animals, Chitral Gol NP may still protect the largest population of flare-horned markhor in the world; an indication of how critical the status of this subspecies is.

Status within country: Endangered.

Conservation measures proposed: 1) Stop allowing foreign hunters to take animals in Chitral Gol National Park. **2)** Treat Kargah GS as a focal area for markhor and enforce protection measures. Kargah is probably the best place for markhor in the Gilgit District, and like the Chitral Gol, should be rather easy to control because it is a traditional wildlife sanctuary and is close to Gilgit. **3)** Adopt a similar procedure for the area around Bagheecha in the Indus valley, which is one of the best places in Baltistan for markhor and also relatively easy to control. **4)** Do not lift the hunting ban, as is currently being considered for the Northern Areas, because no single area contains >50 animals.

Straight-horned markhor (*Capra falconeri megaceros*)

Distribution: The most comprehensive study of the distribution and status of the straight-horned markhor comes from Schaller and Khan (1975). They showed a huge recent past range for this subspecies, but the present range (Map 8.5.5) in Pakistan consists only of small isolated areas in Baluchistan, a small area in NWFP, and one unconfirmed occurrence in Dera Ghazi Khan District (Punjab Province). Virk (1991) summarised the actual information for Baluchistan Province and confirmed the subspecies' presence in the area of the Koh-i-Sulaiman (District Zhob) and the Takatu hills (District Quetta), both according to Ahmad (1989), and in the Torghar hills of the Toba Kakar range (District Zhob) (Tareen (1990). The NWFP Forest Department (NWFP 1987) considered that the areas of Mardan and Sheikh Buddin were still inhabited by the subspecies. There is no actual information about the Safed Koh range (Districts of Kurram and Khyber) where according to Schaller and Khan (1975) probably at least 100 animals lived on the Pakistan side of the border at the time of their survey >20 years ago.

Population: Schaller and Khan (1975) estimated that >2,000 individuals remained throughout the entire range of straight-horned markhor. Roberts (1969) estimated that the total population of the former subspecies *C. f. jerdoni*, restricted mainly to the Province of Baluchistan, may have exceeded 1,000 animals, but that it was severely threatened because it survived in discontinuous and isolated pockets. For this same area, Schaller and Khan (1975) estimated ≤1,000 animals. Roberts (1969) believed that the main concentration of this former subspecies was in the Toba Kakar and Torghar hills and numbers could have been >500. Schaller and Khan (1975) estimated 150 straight-horned markhor living in the Takatu hills in 1971, but later Ahmad (1989) reported that only 50 still existed in these hills, and only 100 in the area of Koh-i-Sulaiman. The NWFP Forest Department (NWFP 1992) gave a total of only 24 animals for the whole province; 12 for the Mardan area, and 12 for the Sheikh Buddin NP. There is no recent estimate for the total number of straight-horned markhor in Pakistan. Considering the general situation of wildlife in these areas we do not expect that the population has increased in recent years, so it is almost certain that there are <1,500 straight-horned markhor remaining today.

Threats: Hunting and livestock competition, as well as significant habitat loss caused by logging in the Suleiman range, which is the most important area of straight-horned markhor's distribution.

Conservation measures taken: Listed as Endangered (C2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix I of CITES. Only one protected area is known to contain straight-horned markhor in Pakistan (Table 8.5.1): Sheikh Buddin NP (previously a Wildlife Sanctuary) in Dera Ismail Khan District of NWFP (Zool. Survey Dept. 1987). The status of the subspecies in protected areas in Baluchistan is uncertain. Its occurrence is not confirmed in Chiltan-Hazarganji NP, and there is no reliable information for either Sasnamana or Ziarat Juniper WS's. There are no reports of any in protected areas in Punjab. Due to recent protective measures in Koh-i-Sulaiman area, the population may be increasing slowly, but poaching still occurs in Takatu.

Status within country: Endangered

Conservation measures proposed: **1)** Immediately develop, a conservation and management plan that includes information on the status and distribution of the subspecies in the areas it still inhabits. **2)** Include participatory management in the tribal areas in this plan. **3)** Besides the Torghar hills, consider the area of Koh-i-Sulaiman and the Takatu hills as a focal area for conservation efforts. **4)** If feasible, establish a captive population to provide animals for re-introduction.

Afghan urial (*Ovis orientalis [vignei] cycloceros*)

Distribution: A distribution map for this urial in the North West Frontier Province is given by Malik (1987). It shows the occurrence of the subspecies in the Districts of Dera Ismail Khan, Bannu, Northern Waziristan, Karak, Kohat, Orakzai, Kurram, Peshawar, Mardan, Abbottabad, and Swat. Malik (1987) described the populations as being extremely scattered and at low densities in the Districts of Dera Ismail Khan, Bannu, Kohat, Abbottabad and lower Swat (Map 8.5.6). Urial densities in the Tribal lands are believed to be slightly higher. It is not certain whether animals inhabiting the hills along the west bank of the Indus (Districts Peshawar, Kohat, Bannu, Dera Ismail Khan) are Afghan or Punjab urial (Schaller and Mirza 1974). Data for animals in this area are included in this account.

Urial are widely distributed up to 2,750m on gentler slopes of the major mountain ranges in Baluchistan (Map 8.5.6). According to the most recent report by Roberts (1985), these include the Chiltan hills (Districts of Quetta and Kalat), the Hinglaj ranges (District Khuzdar), the Karhan hills (District Karhan), the Mekran Coast ranges (District Gwadar), the Takatu hills (Districts of Pishin and Quetta) and the Toba Kakar range (Districts of Pishin and Zhob). On a map published by the Zoological Survey Department (no date) additional areas are indicated: Kirthar range (Districts of Dadu and Las Bela), the mountains north of Nok Kundi (District Chagae), Takht-i-Sulaiman

(Districts of Zhob and South Waziristan), the western edge of the Indus at Kalabagh (District Mianwali), the Mahsud mountains (Districts of North and South Warizistan), and the Marri mountains (District Kohlu). The last four areas lie within the distribution area for the subspecies given by Schaller (1977), but were not mentioned in Roberts' (1985) more recent report. Because of the different and partially contradictory information of the above authors, it appears that the actual knowledge on the status and distribution of Afghan urial north of 32°N is inadequate. The most recent distribution map is given in Virk (1991). In Sind, the Afghan urial occurs in the Kirthar mountains, especially in the Mari-Mangthar range (District Karachi) and in Dumbar, Kambuh and Karchat mountains (District Dadu).

Population: No total population census based on surveys is available. In the past, Roberts (1985) estimated that perhaps 2,500 to 3,000 Afghan urial lived in Baluchistan, with 1,000 ($0.2/km^2$) inhabiting the Torghar hills of Toba Kakar range (District Zhob) according to Mitchell (1988). About 150 animals inhabit the Takatu hills near Quetta (A. Ahmad, unpubl. data), and the situation in the Dureji hills (District Zhob) may be a little better (Virk 1991). Malik (1987) estimated a total of 310 to 340 Afghan urial for the whole of NWFP, whereas the NWFP Forest Department (NWFP 1992) reported a more recent total of only 80 urial (68 from Kohat, two from Mardan and 10 from Abbottabad), suggesting a severe decline over five years. For Sind Province, a census carried out by Mirza and Asghar (1980) estimated a population of 430 urial for Kirthar NP. Based on a census in the Mari-Lusar-Manghtar range and in the Karchat mountains in 1987, K. Bollmann (unpubl. data) estimated between 800 and 1,000 urial ($0.26–0.32/km^2$) for the whole of Kirthar NP. About 150 to 200 animals live in the Mari-Lusar-Manghtar range, and 100 to 150 in the Karchat mountains; i.e. 1.7 to 2.5 $urial/km^2$ (Edge and Olson-Edge 1987). The overall density within the subspecies' distribution is probably much lower than this.

Threats: Overhunting, livestock overgrazing, and habitat degradation caused by fuelwood gathering and by agriculture, are the main threats to this urial. Afghan urial may be more susceptible to such threats than are wild goats inhabiting the same areas because of species-specific differences in habitat preferences (Edge and Olson-Edge 1987). Throughout its range in Baluchistan, Afghan urial faces severe hunting pressure and competition from domestic sheep and goat, and lives in extremely scattered and small populations (Virk 1991).

Conservation measures taken: Afghan urial is listed as Vulnerable (C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix I of CITES under *Ovis vignei*. Protected areas reported to contain mostly very small numbers of Afghan urial include (Table 8.5.1): ***NWFP*** – Dera Ismail Khan District: Sheikh Buddin NP (Malik 1987, Zool. Survey Dept. 1987); Kohat District: Borraka WS (Malik 1987, Zool. Survey Dept. 1987), Rakh Topi GR (Malik 1987); Peshawar District: Nizampur GR (Malik 1987); District Abbottabad: Surrana GR. ***Baluchistan*** – Las Bela District: Hingol NP, Dureji WS, Khurkhera WS (Baluchistan Forest Dept. 1990), Dureji WS (Zool. Survey Dept., no date); Khuzdar District: Dhrun NP, Chorani WS (Zool. Survey Dept., no date); Kharan District: Ras Koh GR, Raghai Rakshan WS (Baluchistan Forest Dept. 1990); Kalat District: Hazarganji-Chiltan NP, and possibly Sashan WS (Baluchistan Forest Dept. 1990); Quetta District: Hazarganji-Chiltan NP (Baluchistan Forest Dept. 1990; though presence in this NP not confirmed by Virk 1991); Sibi District: Ziarat Juniper WS (Baluchistan Forest. Dept. 1990); Pishin District: Masalakh WS (Baluchistan Forest Dept. 1990). ***Sind*** – Dadu District: Kirthar NP (Sind Wildlife Management Board, no date); Karachi District: Kirthar NP (Sind Wildlife Management Board, no date). As a result of the protection given by Kirthar NP, the urial population within its boundaries has increased recently. However, except for Kirthar NP, Hingol NP, Dhrun NP and Dureji WS, the protection measures for the other sanctuaries and reserves may not be effective at the present time.

WWF-Pakistan has recently initiated a participatory management program in the Shirani tribal area, which includes protection for Afghan urial.

Status within country: Endangered.

Unless conservation measures are taken quickly, this urial will be lost throughout an increasing amount of its range in Pakistan. One of the main reasons is that populations are very small and widely scattered in relatively accessible terrain, and thus can easily be wiped out with no chance for areas to be naturally re-populated through dispersal.

Conservation measures proposed: 1) Determine the current distribution and numbers of Afghan urial, as well as its status in all protected areas, as soon as possible. **2)** Immediately, focus intensive protection measures on a few of the already existing, but well controllable sanctuaries, to protect and rebuild viable populations. Apart from the national parks, Takatu hills (District Quetta) and Gharsa Nallah may be good focal areas. The proximity of Takatu hills to Quetta should offer the opportunity for effective protection. **3)** To maximise the efficient use of resources, conservation actions for urial, wild goat, and straight-horned markhor, could be combined where their distributions overlap. **4)** Some areas might ultimately be used for controlled trophy hunting programs once populations have been restored, providing economic incentives to tribal people as part of the management plan (Virk 1991).

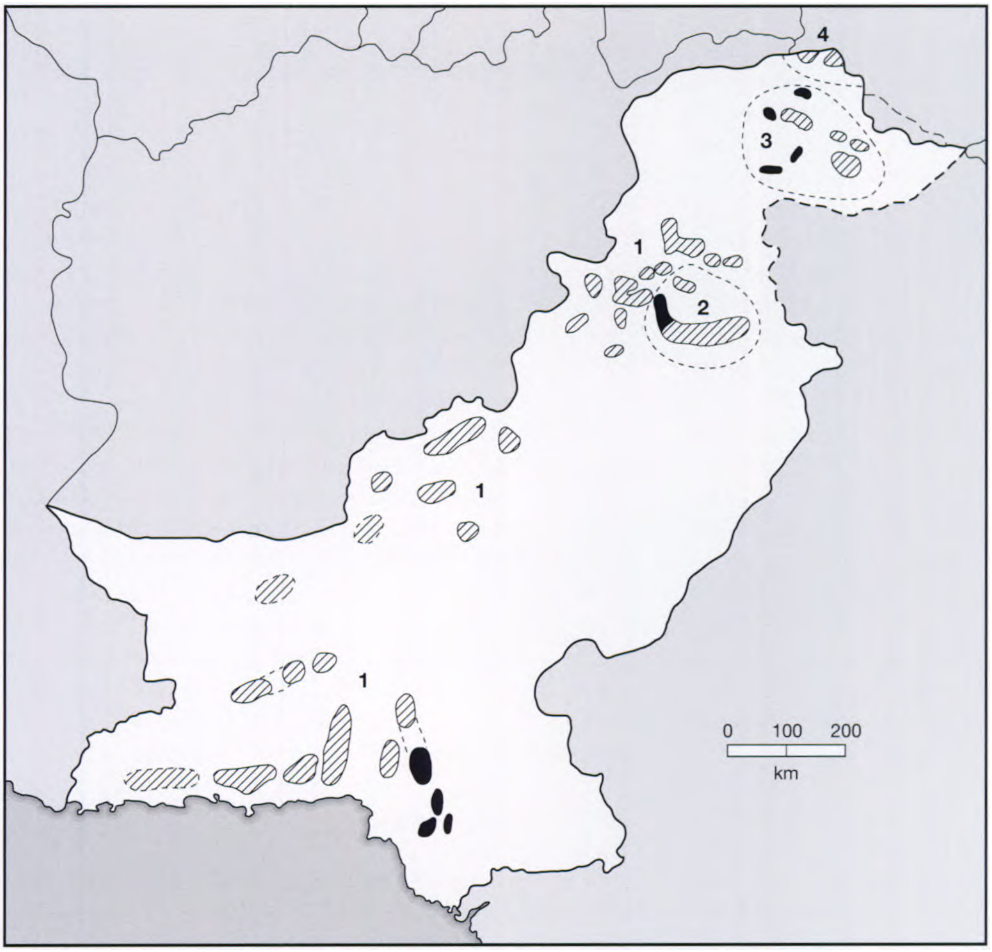
Punjab urial (*Ovis orientalis [vignei] punjabiensis*)

Distribution: The distribution area of this subspecies is enclosed by the Indus and the Jhelum rivers and the forest belt of the Himalayan foothills (Map 8.5.6). The taxonomic status of urial living along the west bank of the Indus, adjacent to the Punjab urial's range, is uncertain (Schaller and Mirza 1974). Punjab urial is found in small scattered populations in the Kala Chitta and in the Salt range up to 1500m asl, and in the Districts of Attock, Chakwal, Jhelum, Mianwali, and Khushab. At present the 2, and perhaps only, major populations of Punjab urial inhabit the Kala Chitta hills (District Attock) and the Kala Bagh Sanctuary of the Jabbah Valley (District Mianwali).

Population: Schaller (1977) estimated a total world population of <2,000 Punjab urial and a complete census made in 1976–77 by Mirza *et al.* (1979) estimated 2,157. Estimates by Chaudhry (unpubl. data) in 1992, give a minimum total population of 1,550 throughout its whole range. For Punjab, Chaudhry *et al.* (1988) reported a significant decline in urial numbers over only one year; from 733 in 1986 to 528 in 1987. A total of only 12 were reported for Chinji NP (Chaudhry and Sarwar 1988), numbers in other protected areas are unknown.

Threats: Apart from the protected population in the Jabbah valley (700 urial), the Punjab urial suffers heavy hunting pressure and has declined drastically in only a short period in some areas (Chaudhry *et al.* 1988). It persists only in small populations and at low densities (Roberts 1985). In addition, competition and transmission of diseases from domestic animals are major threats.

Conservation measures taken: Listed as Endangered (A1cde,C1+2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES under *Ovis vignei*, and like all mammals, it is legally protected in the Punjab. Protected areas reported to contain this urial include (Table 8.5.1): ***Punjab*** – Chakwal (previously Attock) District: Chinji NP (Chaudhry and Sarwar 1988), Kala Chitta GR, Khari Murat GR (Zool. Survey Dept., no date); Chakwal District: Chinji NP, Chhumbi Surla WS; Jhelum District: Jalalpur Sharif WS, Rakh Kundal WS, Diljabba Domeli GR (Zool. Survey Dept., no date), Chhumbi Surla WS (Chaudhry, unpubl. data);



Map 8.5.6. Distribution of urial (*Ovis orientalis*) and Marco Polo sheep *Ovis ammon polii*) in Pakistan.
1) *O. o. cycloceros*;
2) *O. o. punjabiensis*;
3) *O. o. vignei*;
4) *O. a. polii*.

Khushab District: Sodhi WS (Zool. Survey Dept., no date); Mianwali District: Kala Bagh Sanctuary.

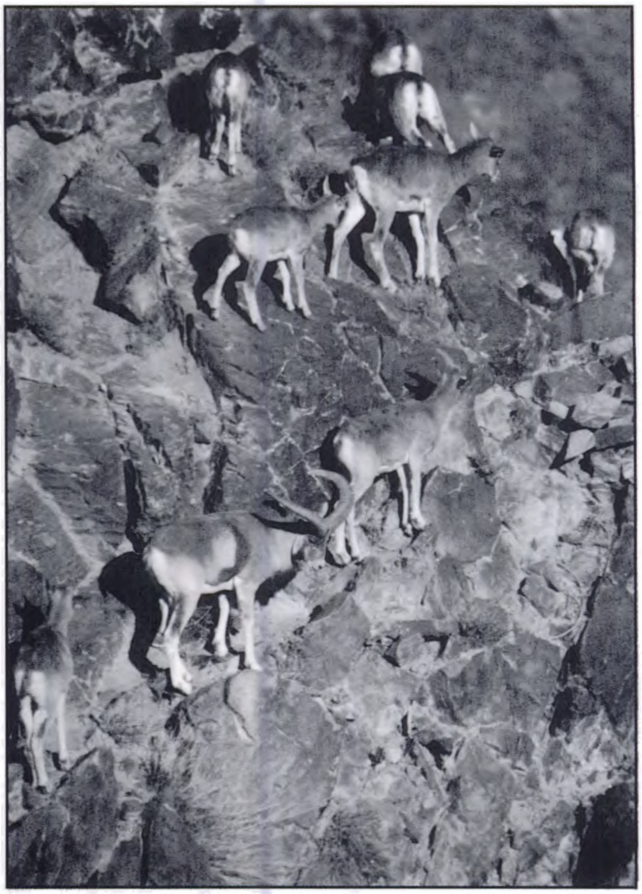
Kala Bagh Sanctuary is a WWF-Pakistan Sanctuary, privately owned and protected by the Maliks of Kala Bagh (Schaller and Mirza 1974; Schaller 1977; Roberts 1967a, 1977, 1985; Mirza *et al.* 1979; Zool. Survey Dept., no date). This population, estimated at 500 in 1966, 1970 and 1974 (Mountfort 1969; Schaller and Mirza 1974; Schaller 1977), increased to over 750, before crashing due to an unknown epidemic transmitted by domestic camel. The population has since recovered and numbers 850 animals at present (Malik A.Y. Khan, 1992, pers. comm. to A. A. Chaudhry).

Status within country: Endangered.

Conservation measures proposed: 1) Enforce protection measures in the relatively accessible protected areas; this is **urgently** required. **2)** Kala Bagh Sanctuary could be selected as a focal area. Animals from this population could be used for a re-introduction program.

Ladakh urial (*Ovis orientalis [vignei] vignei*)

Distribution: Schaller (1977) gave the major river valleys of the Kunar/Chitral river, Indus, Gilgit river and Shyok as the main range of Ladakh urial, and Roberts (1985) presented a similar picture. However, these distribution maps seem no longer valid, indicating instead the recent historical and not the current distribution. Ladakh urial is still widely distributed, but only in very small isolated populations (Map 8.5.6). In Chitral District, it still inhabits the west (right) bank of the Kunar river, from Chitral southwards to Drosh (Anonymous 1986). Localities on the east bank of the Kunar river, as well as from north of Chitral (Anonymous 1986; Zool. Surv. Dept. 1987) are not confirmed. Also, Malik (1987) presents a distribution map showing that it occurs on the east bank of the Kunar river, but does not mention this occurrence in the text. In Gilgit District, Hess (in press) was able to locate only one place where urial survived in 1985–86; reliable informants told him about a population of 27 animals on the right side of the lower Miatsil river (Hispar valley). Also Rasool (unpubl. data) has information about 10 to 15 urial from the main Hunza valley, which may represent animals of the same population described by Hess. There is no evidence of its presence within the whole area along the Gilgit and Indus rivers upstream from Gilgit to downstream from Chilas. Most occurrences of the taxon in northern Pakistan are from Baltistan District. Besides Schaller's (1977) map, additional records exist for the Kharpacho hills close to Skardu, and from a reliable report for the Tormik valley and the area near Rondu (Hess, in press).


R. Hess

A mixed group of Ladakh urial (*Ovis orientalis [vignei] vignei*) in cliffs which they use as security cover. Skardu, Baltistan District, Northern Areas, Pakistan.

Population: According to some reports from around 1900, the Ladakh urial used to be a common animal of northern Pakistan. Schaller (1976) estimated that <1,000 were left in Pakistan and Roberts (1985) gave "intelligent guesses" of 500 to 600 animals for Baltistan and 700 to 800 for Gilgit-Hunza. All these estimates are much greater than present numbers. Hess (in press) estimated the total population of Ladakh urial in Pakistan for 1988–87 to be only 200 to 400 animals. In 1992, a total of 57 urial were estimated (NWFP 1992); 29 in Dir and 28 in Chitral. The total estimated for the Northern Areas for 1993 was 400 to 500 urial (G. Tahir, Wildlife Wing, Northern Areas Forest Dept., *in litt.* to G. Rasool). In 1992, a total of 57 urial was estimated by NWFP Forest Department personnel (NWFP 1992); 29 in Dir and 28 in Chitral. There are probably <600 Ladakh urial in Pakistan.

Threats: Most urial habitat is close to human settlements and also not very steep, therefore easily accessible to hunters and for grazing by livestock.

Conservation measures taken: Listed as Endangered (A2cde,C1+2a) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix I of CITES. Ladakh urial occur in very few protected areas (Table 8.5.1): ***NWFP*** – Chitral District: Chitral Gol NP (Anonymous 1986); ***Northern Areas*** – Gilgit District: Danyore GR (Rasool, no date); Baltistan District: Satpara WS (Rasool, no date). These areas probably protect few urials; for example only two individuals were reported in Chitral Gol NP in 1986.

Status within country: Endangered.

Conservation measures proposed: **1)** Ban all hunting of this urial. **2)** Rigorously protect all areas with populations >20 animals which can be controlled. **3)** Initiate an intensive conservation program in the Kharpacho hills near Skardu, inhabited in 1983 by 14 animals and in 1985 by 18 animals. Its close proximity to Skardu makes it easy to control and offers opportunity to demonstrate wildlife protection to the public (Hess in press).

Marco Polo sheep (*Ovis ammon polii*)

Distribution: Currently, Marco Polo sheep has a very limited spatial and temporal distribution in Pakistan (Map 8.5.6). It is confined to probably at most, three remnant populations in the northwestern part of Hunza district along the Chinese border. Here, between spring and autumn, it occupies two separate valleys in the northwest section of Khunjerab National Park, and also inhabits the Kilik-Mintaka border area, just west of the National Park (Wegge 1988, 1989; Ahmad *et al.* 1989). Schaller *et al.* (1987) found no sign of this argali on the Chinese side of Khunjerab pass, and suggested that the population of the Khunjerab area was isolated.

Population: Rasool (no date) gives a population number of 300 for Khunjerab NP in 1976, and between July 1978 and March 1981, his estimates of monthly population numbers vary between zero and 160 (Rasool 1981). Numbers in Khunjerab NP are reported to have been declining rapidly over the last 10 years (Wegge 1988, 1989, and *in litt.*), with only 20 reported in 1988 (Rasool, in Ahmad *et al.* 1989). However, no animals were observed in the Park after the 1988 sighting until a herd of 45 was seen in July 1991 (G. Rasool, unpubl. data). In 1992, locals reported that between six and 60 argali may use Khunjerab NP in winter (Tallone, 1993). The size of the population in the Kilik-Mintaka area is not known because locals had prohibited wildlife officials from entering the area, but reports in 1991 indicate all animals may have been shot (G. Rasool, unpubl. data). On the Chinese side of Kilik-Mintaka, a population of <150 argali survived at least a few years earlier (Schaller *et al.* 1987).

Threats: Construction and opening of the Karakoram Highway has been a major factor in the rise in poaching for this argali, although local inhabitants in the Kilik-Mintaka area and guards on the Chinese side of the border are also known to hunt it (Wegge 1988, 1989, Ahmad *et al.* 1989; G. Rasool unpubl. data). Competition for forage, created by the presence of an estimated 700 feral yaks (*Poephagus mutus*) and at least 3,000 domestic goats and sheep in the Karchanai Nallah of Khunjerab NP, is an increasing problem that local park officials appear unable to deal with (Ahmad *et al.* 1989). Locals in the Kilik-Mintaka areas are known to have poached nine animals in 1990, which may have eliminated the population in this Game Reserve (G. Rasool, unpubl. data).

Conservation measures taken: Marco Polo sheep is listed as Vulnerable (A2cde,C1) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and along with all argali is in Appendix II of CITES. It is also classed as "Endangered" in the U.S. Endangered Species Act of 1973 (Federal Register of June 23, 1992), and imports of this species are not permitted by the European Union. Hunting Marco Polo sheep is banned under the provisions of the Northern Areas Wildlife Preservation Act 1975, and it is listed as Endangered in Pakistan (NCCW 1978). Most of the known population when in Pakistan is within Khunjerab NP, and if still present, in the Kilik-Mintaka GR (Table 8.5.1). The Park was created for this species in 1975, and theoretically it receives full protection. However, threats from poaching and livestock competition have not been eliminated.

This argali fares no better on the other side of the border in the Taxkorgan Natural Reserve (1,400,000ha) in China, which covers the area used by Marco Polo sheep when not in Pakistan, because protective measures are not enforced there either (Schaller *et al.* 1987). The matter is further complicated by the attitudes and actions of the inhabitants of the Kilik-Mintaka area. They apparently wish to exterminate all important wildlife species, thus eliminating the justification for both the Game Reserve and the National Park, and so leading to the removal of current restrictions. Poaching by locals may have eliminated Marco Polo sheep from Kilik-Mintaka GR, and the Khunjerab Village Organisation (which had grazing concessions in the Park) launched a civil lawsuit against the Park (G. Rasool, unpubl. data). After much discussion, an agreement was reached in January 1992 between the herdsmen of Khunjerab and A. Ahmad for the local administration. The agreement included: **1)** traditional grazing would be allowed under certain conditions; **2)** Khunjerab Village Organisation would be responsible for the protection of all types of wildlife; **3)** employment opportunities from the Park and from tourism would be provided to the Park's herder community, and future direct revenues from the Park would be shared with the community (WWF-Pakistan files, reported by A. A. Chaudhry, 1992). Following a field assessment (Wegge 1988, 1989), management plans for

Khunjerab NP were discussed by representatives of the Government of Pakistan, U.S. National Parks Service and IUCN at a meeting in 1989 (Ahmad *et al.* 1989), and a draft plan has recently been completed. A joint Pakistan-Chinese mission is also scheduled to develop improved conservation measures.

Status within country: Endangered.

Marco Polo sheep is probably the most endangered of Pakistan's Caprinae, and unless action is taken immediately they will probably become extinct. The primary threat is poaching, while the degree of competition from domestic ruminants is not fully known.

Conservation measures proposed: 1) Develop a management plan and action immediately that must include, through international efforts, the halt of poaching of argali on both sides of the border. The management plan must address the following issues: **a**) halt poaching and ensure better protection for the argali throughout its entire range; **b**) regulate grazing and eliminate pressure on crucial argali ranges; **c**) enhance the local economy through eco-tourism programs; **d**) determine methods and suggest policies to involve locals in park management and protection of natural resources. **2)** Staffing and logistical support for Khunjerab National Park need to be significantly upgraded. **3)** Plans for Marco Polo sheep conservation should also consider proposals for other wildlife species in Khunjerab NP and Kilik-Mintaka GR.

Acknowledgements: Several people contributed to the present version of the Caprinae Action Plan for Pakistan. A. L. Rao reviewed the whole text and provided information on legislation. P. Wegge provided information on Marco Polo sheep and other species occurring in the Khunjerab NP, and A. Maqsood provided information on grey goral. B. Nievergelt reviewed the text and H. Kreutzmann supplied references on the geography of Pakistan. Support for studies carried out in Pakistan by the first two authors was provided for a total of four years by the Swiss National Science Foundation (Grant No. 3,641.84) and directed by B. Nievergelt.

8.6 Regional summary

J.L. Fox

Regional picture

The Indo-Himalayan region represents part of the original centre of Caprinae evolution, and as such, encompasses both a high diversity of taxa and a wide array of forms from primitive to advanced. From the eastern Himalaya, through peninsular India to the western Hindu Kush and Pamir mountains, there are a total of 12 species of Caprinae, including at least 18, possibly 19, subspecies. Within this entire Indo-Himalayan region, three full species can be considered as Endangered (argali sheep, markhor, Nilgiri tahr), and three as Vulnerable (Himalayan tahr, takin, serow). Two species (Himalayan tahr, Nilgiri tahr) and six subspecies (Chiltan wild goat, flare-horned markhor, straight-horned markhor, Ladakh urial, Punjab urial, White's takin) have their entire range (or most of it) within the Indo-Himalayan region. Thus, five species or subspecies are considered as Endangered over their entire range (Nilgiri tahr, Chiltan wild goat, flare-horned markhor, straight-horned markhor, Ladakh urial, Punjab urial), and two can be considered as Vulnerable over this range (White's takin, Himalayan tahr). Although five species (wild goat, Tadjik markhor, Afghan urial, Marco Polo sheep, Tibetan argali) are considered Endangered or Rare within the Indo-Himalayan region, the bulk of their range occurs outside this area. Three species (goral, blue sheep, Asiatic ibex) are believed to have relatively large and stable populations within the Indo-Himalayan region, and they also occur over substantial ranges elsewhere.

One of the clearest conclusions that can be made from this review of Caprinae status in the Indo-Himalayan region is that there is a woeful lack in basic population assessment data to be able to confidently state many species' current vulnerability to extinction. Simply note the abundance of Indeterminate (I) and Insufficiently Known (K) status designations for the various species listed in Table 8.6.1; half of all taxa are so designated. Thus, a primary focus in all countries in the region needs to be the upgrading of survey data, directed at determining the degree of threat for "I" taxa and whether or not "K" taxa are threatened. Some of these needs are impossible to fulfil due to the present political unrest, but there are still numerous instances where population data could be quickly improved with proper attention to surveys.

Major conservation problems related to Caprinae conservation in the Indo-Himalayan region can be summarised as follows: a) population fragmentation related to increased human use of Caprinae habitats, primarily for livestock grazing, b) increasing hunting associated with an increased availability of modern weapons and road access to formerly isolated locations, and c) severe harvesting pressure associated with meat hunting during armed conflicts. The Karakorum Highway is an excellent example of the negative impact that increased road access can have if not accompanied by conservation safeguards. Such threats must be expected to increase significantly in the future. The political situation in Afghanistan remains very unstable, conservation of wildlife is not a priority, and significant decreases in Caprinae population are expected to have occurred over the past 20

Table 8.6.1. Summary of conservation status (category of threat[1]) and regional populations estimates of Caprinae within the Indo-Himalayan region.

Taxon	Afghanistan	Bhutan	India	Nepal	Pakistan	Total regional estimate	Population trend[2]	1996 IUCN Red List[3]
Serow *Capricornus sumatraensis*								
Himalayan serow *C. s. tahr*	-	K	R	K	-	?	?,f	VU$_{A2cd}$
Red serow *C. s. rubidus*	-	K	R	K	-	?	?,f	EN$_{A2cd}$
Goral								
Himalayan goral *Naemorhedus goral*	-	K	K	S	E	?	s	LR$_{nt}$
Burmeese red goral *N. baileyi cranbrooki*	-	-	K	-	-	?	?	VU$_{A2cd}$
Nilgiri tahr *Hemitragus hylocrius*	-	-	E	-	-	≤2,500	d,ff	EN$_{C2a}$
Himalayan tahr *Hemitragus jemlahicus*	-	K	I	S	K	?	d,f	VU$_{A2cde}$
Blue sheep *Pseudois nayaur*	-	S	S	S	V	>25,000	s	LR$_{nt}$
Asiatic ibex *Capra ibex ibex*	K	-	S	-	S	>20,000	s	LR$_{lc}$
Markhor *Capra falconeri*								
Flare-horned markhor *C. f. falconeri*	I	-	E	-	E	1,500-2,000	d,ff	EN$_{C2a}$
Straight-horned markhor *C. f. megaceros*	I	-	-	-	E	ca. 1,000	s,ff	EN$_{C2a}$
Tadjik markor *C. f. heptneri*	K	-	-	-	-	-	d	CR$_{C2a}$
Wild goat *Capra aegagrus*								
Sind or Pasang wild goat *C. a. blythi*	I	-	-	-	R	<3,000	?,f	VU$_{A2cde}$
Chiltan wild goat *C. a. chialtenensis*	-	-	-	-	E	<500	d	CR$_{C2b}$
Urial *Ovis orientalis*								
Afgan urial *O. o. cycloceros*[4]	I	-	-	-	E	?		VU$_{C1}$
Punjab urial *O. o. punjabiensis*	-	-	-	-	E	<2,000	d,f	EN$_{A1cde,C1+2a}$
Ladakh urial *O. o. vignei*	-	-	E	-	E	<2,500	s,ff	EN$_{A2cde,C1+2a}$
Argali *Ovis ammon*								
Tibetan argali *O. a. hodgsonii*	-	-	E	I	-	ca. 300	d,ff	VU$_{A2cde}$
Marco Polo argali *O. a. polii*	I	-	-	-	E	?	d,f	VU$_{A2cde,C1}$
White's takin *Budorcas taxicolor whitei*	-	K	I	-	-	?	?,f	VU$_{A2cde}$

1 Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List of Threatened Animals (Groombridge 1993); S = not threatened.
2 s = stable, d = declining, ? = unknown, f = fragmented, ff = highly fragmented.
3 Global category of threat listed in 1996 IUCN Red List of Threatened Animals (IUCN 1996);
4 Includes *Ovis orientalis blanfordi*

years of conflict. Recent border wars between India and its neighbours China and Pakistan, and the continued military concentrations along their joint borders, have led to significantly decimated wildlife populations in both conflict and staging areas. The problems associated with habitat fragmentation and increased human use of Caprinae habitat, are common to all countries, and can only be addressed by recourse to a structured approach to the development of pastoralism and animal husbandry in each specific country. Because the negative relationship between trends in livestock development and a Caprinae population's status often appears to be specific to the taxon, and to the site characteristics, management programs will have to be developed for the local conditions and the taxon in question.

There are still areas, often in the most rugged and sparsely populated locations, where Caprinae species exist in some abundance. The total populations of blue sheep and ibex, that both probably number >25,000 within the Region, attest to this fact. It is clear though, that those species adapted to relatively low elevations or less rugged terrain are most in danger of displacement and extinction. These low elevation areas are also the most heavily populated by humans. Here, the urial, argali and to a lesser extent wild goat, that are characteristicly found in open habitats, are good examples of such species that are clearly subject to increasing threats from human activities. Isolated Caprinae populations, even those occurring in rugged terrain, but are surrounded by concentrated human activity suffer severe conservation problems. The Nilgiri tahr, Himalayan tahr, markhor, and perhaps serow and goral, are all examples of such circumstances.

Past conservation actions have led to the rapid recovery of Caprinae populations, and certainly have the potential for bringing about such recoveries where either hunting or overgrazing by livestock has been the problem for a species. Himalayan tahr in the Sagarmatha National Park of Nepal have increased in number and become much more visible with institution of the Park's protection. Blue sheep populations in the upper part of Nanda Devi National Park in India, which has seen complete protection over the past couple of decades, are probably the densest known anywhere. As these two instances demonstrate, under certain circumstances it may be possible to maintain an array of small areas (e.g. parks and reserves) of complete protection from hunting or pastoral activities, and thus assure a limited number of isolated subpopulations for various taxa. However, great care must be taken because of the significant threat that fragmentation poses to a taxon's continued existence. Such actions will be more difficult with species that naturally occur in areas of relatively high value to human commercial activities (e.g. urial, argali, possibly Himalayan tahr and serow), and will require a strong commitment to biodiversity conservation.

Our ability to maintain viable metapopulations of Caprinae species, which is critically important for their long-term security, will, however, require some accommodation of pastoralism and wildlife conservation over substantial portions of the large areas required for both. We clearly need much better information on the types and degree of conflict (e.g. food competition, habitat displacement) between wild and domestic Caprinae, so that efforts may be developed to maintain a sustainable livestock industry without undue negative effects on pasture resources, and concomitantly, on the distribution and abundance of wild Caprinae. As livestock industries modernise and develop in Central Asia and the Indo-Himalayan region, assessments of the environmental consequences of such activities need to be made mandatory. These assessments need to be better incorporated into both the national and international development aid programs that drive, and will continue to drive, some of the rapid changes in livestock husbandry occurring in the region.

Regional co-operative and joint actions

Within the Region, ranges of many Caprinae populations encompass more than one country. These are often along remote mountainous border regions, and thus may be appropriate for international co-operative conservation initiatives. A few initiatives have already been accomplished within the framework of locating adjacent protected areas along international borders, and there is potential for more international parks like this. This can be both a sound conservation action and a politically acceptable means of reducing tensions between countries. Given the number of taxa currently listed as Indeterminate or Insufficiently Known status due to the uncertain nature of population data, co-operative census-survey projects could also become a focus for international partnerships in conservation action.

Several species of Endangered or Vulnerable Caprinae in the Indo-Himalayan region may be especially appropriate for such cross-border conservation actions and establishment of international reserves. The endangered flare-horned (Kashmir) markhor and Ladakh urial both occur on the India-Pakistan cease-fire line and could become the focus of conservation/peace efforts. Markhor and urial subspecies could also provide a focus for conservation efforts on the Pakistan-Afghanistan border. Within protected areas on the Pakistan-China border Marco Polo sheep (critically endangered in both countries) could be targeted for either strict conservation or possible re-introduction action. The endangered Tibetan argali provides a conservation focus on the India-China border in locations as distant as Ladakh and Sikkim, as well as in several locations along the west Nepal-China border. Goral, serow, and especially takin along the India-

Burma border could certainly be emphasised in cross-border conservation initiatives.

A significant biodiversity-related consideration associated with Caprinae conservation, is the importance of maintaining sufficient numbers of prey species, including Caprinae, to support viable populations of large predators such as snow leopard (*Uncia uncia*), wolf (*Canis lupus*) and wild dog (*Cuon alpinus*). Each of these predator species has endangered or threatened populations within the Indo-Himalayan region, and often occur along border regions. Large protected areas are important for the conservation of these predators, and the ability to co-ordinate conservation efforts in creating large reserves across mountainous borders is highly desirable.

Today, only a few cross-border reserves have been established in the Indo-Himalayan region, although their substantial size is promising with regard to the conservation of both Caprinae and their predators. The Qomolangma Nature Reserve in China in combination with the adjacent Sagarmatha, Makalu-Barun and Langtang National Parks in Nepal, encompasses an area of some 40,000km^2. The adjoining Khunjerab National Park in Pakistan and the Taxkorgan Reserve in China embrace a total area of 16,500km^2. We must remember, however, that such protected areas often include large expanses of unproductive habitats (e.g. rock and ice), so that protected Caprinae habitat is more limited than these figures suggest.

Promising areas for international conservation co-operation lie on the Bhutan-China border, the India-China border in Arunachal Pradesh (proposed Dibang Valley NP), in Uttar Pradesh (Gangotri WS), in Himachal Pradesh (Sutlej gorge), in Jammu and Kashmir (the joint Jammu and Kasmir-Himachal Pradesh-China border), the India-Myanmar border (Namdapha NP), the Nepal-China border adjacent to Shey National Park; and along the borders of Afghanistan with Pakistan (proposed Nuristan NP), Tadjikistan (Pamir-i-Buzurg WS), Uzbekistan and China. Although the highest profile conservation initiatives will probably concern efforts for protecting isolated pockets of endangered species along border regions, conserving substantial areas of Caprinae habitat may actually be the most productive accomplishment of cross-border reserves. In the past, this has been most successful when one country already has a protected area along or near an international border.

Many protected areas in the Indo-Himalaya have quite limited management agencies and infrastructure, so that in reality, much of the conservation is on paper only. Caprinae status surveys, general biodiversity conservation assessments, and appropriate management plans need to be better formulated. They also need to be carried out with sufficient and appropriately trained personnel (see **Chapter 12**). Only then will governmental co-operation and NGO participation be able to provide important avenues in developing the infrastructures for conservation.

Chapter 9

Far East

9.1 Bangladesh

A.W. Akonda

Introduction

Bangladesh, surrounded by India on its western, northern and northeastern borders, and by Myanmar to the east, covers an area of approximately 144,000km². The country is mostly (80%) lowland alluvial plain occupying much of the lower floodplains of Brahmaputra-Jamuna, the Ganges-Padma and Meghna river systems, all of which flow south into the Bay of Bengal. Mountainous topography is restricted to the steeply-dissected hill country of the Chittagong and Chittagong Hill Tracts Districts in eastern and southeastern Bangladesh, and to the Sylhet District of the northeast.

The climate is typically monsoon with both high temperatures and humidity for more than half the year, and heavy rainfall in the summer. Most of the natural vegetation has been eliminated due to demands from the growing human population, and what remains occurs in the hill regions. Tropical evergreen and semi-evergreen forests are found in eastern Sylhet, Chittagong and Chittagong Hill Tracts, while sal (*Shorea robusta*), moist-dry, deciduous forests are found in the Bhawal-Madhupur Tract of Sylhet. Bangladesh falls into a region of zoogeographic overlap between the Indian, Himalayan and South-East Asian faunas; unfortunately, like its natural vegetation, the formerly diverse and abundant fauna is today greatly diminished (Green 1989; IUCN 1992b).

Current status of Caprinae

Caprinae in Bangladesh are represented only by the red serow (*Capricornis sumatraensis rubidus*) that is restricted to the forested hills of the eastern and southeastern edge of the country. Here, serow inhabits steep hillsides cloaked in tropical evergreen and semi-evergreen forests, relatively free from human disturbance. It is found also in degraded sal forest and grasslands (e.g. dense stands of *Imperata arundinacea*) in the northern forest belt of Sherpur and Mymensingh along the international border with India.

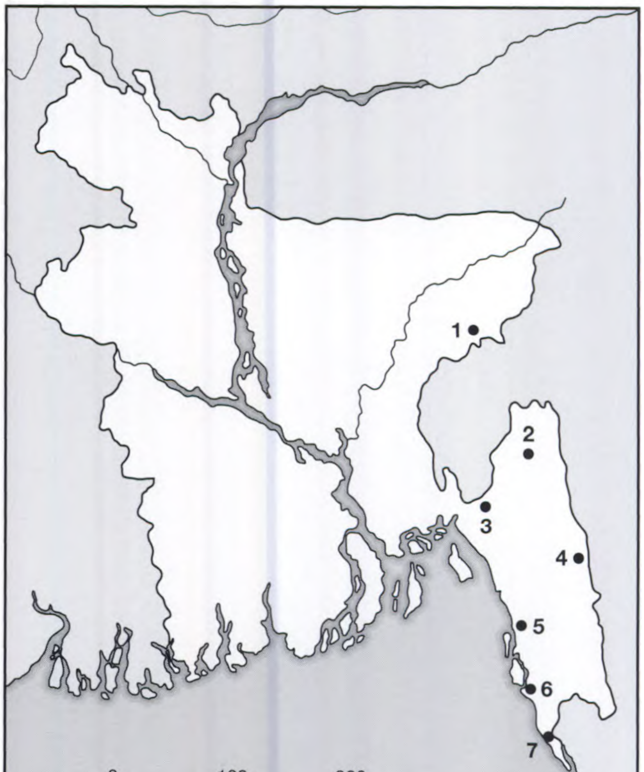
Serow is protected (Schedule III) under the Bangladesh Wildlife (Preservation) Act (1974). However, forest management policies, together with a lack of funds and strong commitment to wildlife conservation, mean that few concrete steps are taken to ensure survival of serow, which is clearly endangered in Bangladesh.

General conservation measures taken

Steps to conserve wildlife were first taken in 1966, prior to independence, when the Pakistan Government requested the World Wildlife Fund assess wildlife conditions and make recommendations primarily related to the widespread problem of deforestation. The Bangladesh Wildlife (Preservation) Order, 1973, promulgated under Presidential Order No. 23, was eventually enacted and amended as the

Map 9.1.1. Protected areas in Bangladesh which may still contain red serow (*Capricornis sumatraensis rubidus*).

1) Rema-Kalenga Wildlife Sanctuary (1,095ha; est. 1981); **2)** Pablakhali Wildlife Sanctuary (42,087ha; est. 1983); **3)** Hazarikhil Wildlife Sanctuary (2,903ha; est. 1974); **4)** Rampahar-Sitapahar Wildlife Sanctuary (3,026ha); **5)** Chunati Wildlife Sanctuary (7,761ha; est. 1986); **6)** Himchari National Park (1,729ha; est. 1986); **7)** Teknaf Game Reserve (11,615ha; est. 1983).



Bangladesh Wildlife (Preservation) (Amendment) Act 1974. This act provides for the establishment of three kinds of protected areas: National Parks, Wildlife Sanctuaries, and Game Reserves. Cultivation, damaging vegetation, and killing or capturing wildlife within a radius of 1.6km outside the boundaries of national parks or wildlife sanctuaries are prohibited under Article 23. The introduction of domestic or exotic species, human residence or entry, are banned only in wildlife sanctuaries, and disturbances such as firing guns are prohibited only in national parks. Hunting is allowed under permit only in game reserves (IUCN 1987). Unfortunately today, there is still no national wildlife conservation policy, and because much of the remaining wildlife is restricted to the greatly reduced forest areas, conflicts arise between wildlife concerns and forest management practices with the inevitable result of further loss of serow and their habitat.

The Forest Directorate has responsibility for wildlife conservation and for management of protected areas. Following the enactment of the Wildlife (Preservation) Act, an ambitious wildlife management program was developed initially and a Wildlife Circle formed within the Forest Department (IUCN 1987). This group was abolished in 1983 and there are no separate funds for wildlife in the Forest Directorate's budget (Green 1989; IUCN 1992b). A Wildlife Advisory Board was created in 1976, under the Wildlife (Preservation) (Amendment) Act and chaired by the Minister of Agriculture. Its purpose was to review major wildlife management proposals (IUCN 1987). Now Divisional Foresters are supposed to hold responsibility for wildlife conservation, although a number of national parks and wildlife sanctuaries have their own staff to oversee protection (IUCN 1987). The existing system of protected areas is far from comprehensive, however, and even established areas are often so understaffed and underfunded as they are ineffective (Gittins and Akonda 1982; Khan 1985).

At present, there are seven protected areas which may still contain red serow in Bangladesh (Map 9.1.1). Most are in hilly areas ranging in elevation from 100 to 400m asl. Some protected areas are irregular and steep sloped (Hazarikhil, Himchari, and Teknaf), while others, such as Rema-Kalenga and Pablakhali, have gentle rolling slopes.

The principal non-government organisation involved with conservation in Bangladesh, the Society for Conservation of Nature and Environment (SCONE), is mainly concerned with fighting pollution (IUCN 1987).

Species account

Red serow (*Capricornis sumatraensis rubidus*)

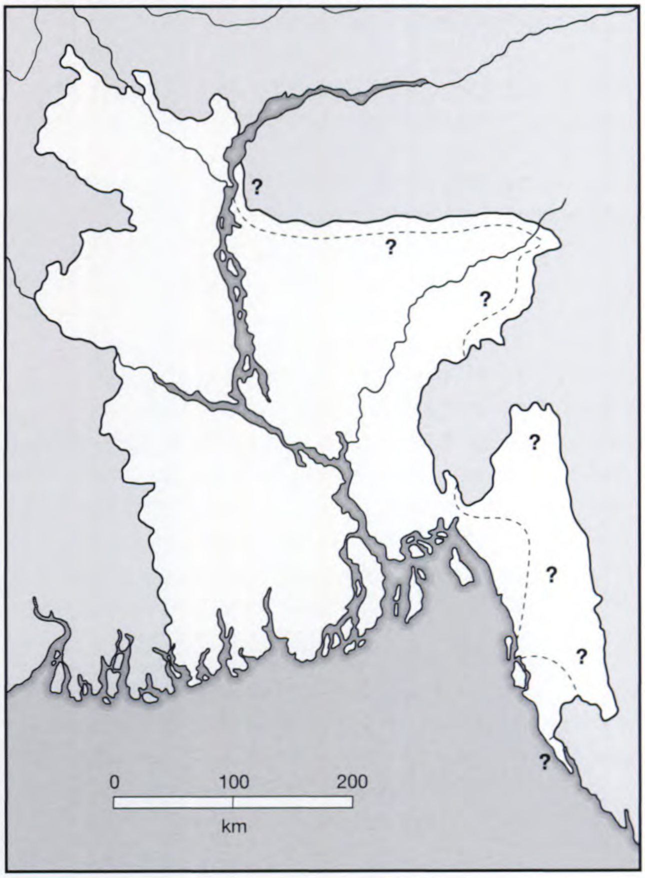
Distribution: Formerly red serow used to occur in the whole region of Bangladesh east of the Jumuna river (90°E). Today, it is very rare and confined to a few scattered, isolated populations in pockets of evergreen and sal forests of northern Mymensingh, northeastern Sylhet, Chittagong, and Chittagong Hill Tracts (Gittins and Akonda 1982; Kahn 1985) (Map 9.1.2). Serow from the neighbouring Indian States of Meghalaya and Tripura are believed to enter the districts of Comilla, Jamalpur and Myemsingh (Green 1987b).

Population: No censuses have been made, but numbers are believed to be very low, as are densities.

Threats: Habitat disturbance and poaching are the greatest threats to its survival in Bangladesh, both related to slash-and-burn (jhoom) cultivation (Khan 1985).

Conservation measures taken: No specific legal protection exists for the red serow in Bangladesh. It is listed as Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix I of CITES. Although seven protected areas are believed to contain the species (Map 9.1.1), no recent sightings or reports of serow have been made in any of them. A Technical Assistance Project Proposal (TAPP) has been submitted to

Map 9.1.2. Suspected general distribution of red serow (*Capricornis sumatraensis rubidus*) in Bangladesh.



the Government for a detailed investigation of all endangered species in Bangladesh. After implementation of this project and following surveys, a conservation management plan will be developed for species including the serow.

Status within country: Endangered.

Conservation measures proposed: 1) Implement detailed investigations of the status of threatened wildlife throughout the country, as outlined in the Technical Assistance Project Proposal prepared by the Forest Department and submitted to the Ministry of Environment and Forest for approval. This was developed following a decision in the 8th meeting of the Bangladesh Wildlife Advisory Board, and could be used for developing a comprehensive conservation management plan. **2)** Execute those conservation measures proposed by Khan (1985) that would impact serow including: replacing clear-felling with selective felling, replanting with mixed species, replacing slash-burn cultivation with terrace gardens, publicising the 1974 Wildlife Preservation Act, enforcement of poaching and control of wildlife trade, and improving management of protected areas. **3)** Increase the number of trained personnel involved in wildlife conservation in Bangladesh; currently, a major limitation in the country (Gittins and Akonda 1982).

9.2 Cambodia

Charun Sarun

Introduction

Cambodia is located on the southwestern part of the Indochinese Peninsula and covers 181,035km^2. Its central region is a low-lying, alluvial plain with the Tonle Sap (Great Lake) at its centre. The Mekong River delta also originates in this region. Along its northern border with Thailand, the Plain ends in a sandstone escarpment rising 180 to 550m asl. This is the southern extent of the Chuor Phnum Dangrek mountain range which stretches more than 320km east-west. Beyond the Mekong river, the plains merge with the densely forested mountains and plateaux of the eastern highlands that run north and east into Laos and Vietnam. Another highland region occurs in the southwest, comprised of the Chuor Phnum Kravanh (Cardomom mountains) and the Chuor Phnum Damrei (Elephant mountains), including the country's highest peak, Phnum Aoral (1,813m asl). These highlands separate the central plain from the narrow heavily forested coastal plain.

The climate, controlled by the monsoons, is divided into two main seasons. Everywhere, maximum temperatures are high (from 27°C to 35°C), whereas annual rainfall varies from 140mm in the central lowlands, to >5,000mm on seaward slopes of the southwest highlands. Almost 75% of the country is forested, but the central lowlands are turned over to rice cultivation and other crops. Tall-grass savannah grasslands dominate the transitional plains between the low and highland regions, with forests on the highlands themselves. On the eastern highlands, high plateaux are covered by deciduous trees and grassland, with broadleaf evergreen forests cloaking the northern mountains. Open pine forests grow at higher elevations of the southwest highlands, and on their southern aspects slopes are covered by virgin rainforest. Coastal vegetation runs from evergreen forests to dense mangrove swamps.

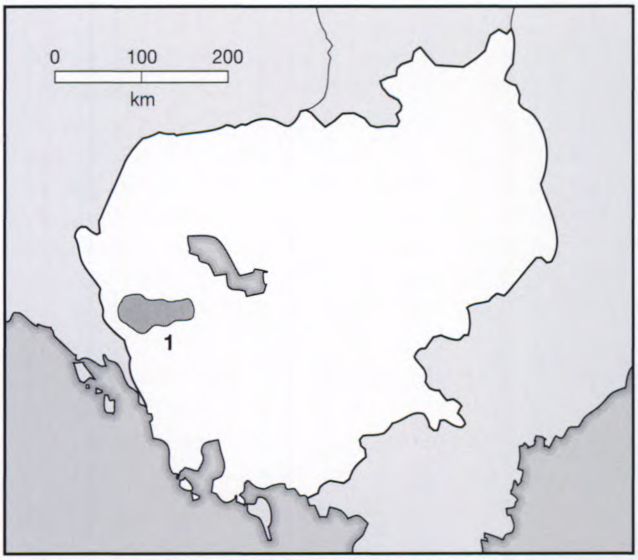
Current status of Caprinae

Cambodia's only caprin is the Indochinese serow (*Capricornis sumatraensis maritimus*), and it is restricted to the forested limestone karst topography of Mondulkiri Province. The main threats to the species in the country come from logging, hunting and from vast numbers of landmines remaining from the violent conflicts the country has recently suffered.

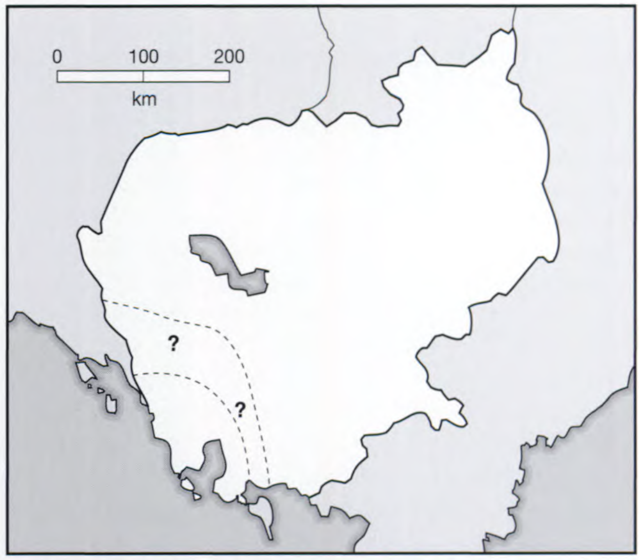
General conservation measures taken

Currently, legislation (State Council No. 35 KR.C, Law Decree on Forestry) governs the use and management of forests and wildlife, and stipulates penalties for contravention. However, this legislation is only interim and is generally unenforceable. It is also only very general in scope and does not specifically include serow. Protection of serow lies within the Forestry Department of the Ministry of Agriculture, and more specifically with the newly-created Wildlife Protection Office. However, Caprinae conservation is not a priority, and until the security situation improves significantly, gathering information to develop conservation plans will be impossible, and measures to protect the species will be ineffectual. Prior to 1975, a system of parks had been established that may have provided protection for some serow populations. However, subsequent, severe internal security problems have prevented enforcement of these protected areas. Serow probably did occur in one of these sites (Map 9.2.1).

At present, only one non-government conservation organisation exists – the Cambodian Society for the Protection of Nature and Cultural Heritage. This society could perhaps support Caprinae conservation. Currently, there are no programs to educate the public on conservation issues related to Caprinae.



Map 9.2.1. Location of Phnom Kravanh (280,6540ha; est. 1971), the only protected area in Cambodia which was known to contain Indochinese serow (*Capricornis sumatraensis maritimus*).



Map 9.2.2 Suspected general distribution of Indochinese serow (*Capricornis sumatraensis maritimus*) in Cambodia.

Species account

Indochinese serow (*Capricornis sumatraensis maritimus*)

Distribution: Virtually nothing is known of the present day distribution or numbers of the species in Cambodia, other than that it is probably restricted to the forested limestone karst topography of Mondulkiri Province (Map 9.2.2).

Population: No estimates.

Threats: The main threats to serow in Cambodia are posed by deforestation due to logging, hunting, and the widespread, and vast number of landmines and other ordnance.

Conservation measures taken: The species is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and is in Appendix I of CITES. No conservation measures or legislation specific to serow exist in Cambodia. The only wildlife laws currently (1993) in existence are interim and virtually impossible to enforce. Serow was known to occur only in Phnom Kravanh protected area (Map 9.2.1), but this is located in a region which has seen military conflict between 1980 and 1982, and possibly more recently.

Status within country: Insufficiently Known.

Conservation measures proposed: 1) Determine the serow's distribution and status in Mondulkiri Province; although this will obviously be difficult until internal security problems cease. The Forestry Department plans to begin these censuses as soon as it becomes safe and feasible. Only when the information is obtained, can an adequate serow conservation program be developed. International support will be required to fund both the census studies and the development of the subsequent conservation plans. **2)** The Cambodian Government must create a broad conservation strategy, including a network of protected areas and supporting infrastructure to protect all the country's natural resources.

9.3 Indonesia

C. Santiapillai

Introduction

The Republic of Indonesia is comprised of a chain of some 13,667 islands that stretch over 5,110km from Sumatra in the west to Irian Jaya in the east, to cover a total land area of around 2,000,000km². Sumatra, the largest of the Greater Sunda islands, is the second largest in Indonesia with an area of 4,726km². It is 1,700km long, 520km wide, and straddles the Equator. The Barisan mountains, a chain of high, volcanic mountains, run along the western edge of Sumatra. These mountains consist of two or more folded ranges running parallel to each other, with an intervening valley along which lie a string of mountain lakes (Loeb 1972). Numerous volcanic peaks exceed 3,650m asl, and the highest mountain, the Gunung Kerinci, is about 3,800m. To the east of this volcanic mountain chain lies a huge tract of flat, alluvial land, criss-crossed by numerous rivers.

The climate of Sumatra resembles that of Java in being hot and extremely moist. In general, the western part of Indonesia is characterised by high rainfall throughout the year, while the eastern archipelago, especially from Lombok eastwards, has a dry climate with low rainfall. Given the location, Sumatra has a rainy equatorial climate characterised by high and extremely constant temperature throughout the year. Rainfall is high and varies from >6,000mm per year in the west, to <1,500mm in some northern parts of the island. In terms of biodiversity, the vegetation of Indonesia is very rich. This is partly due to its geographic position, spanning two major biogeographical regions, the Oriental and the Australasian realms, which result in an area of high floral diversity and endemism. Vegetation types range from coastal mangrove and swamp forests (both peat and non-peat), heath forests, to true tropical rainforests especially in Sumatra, Kalimantan (Indonesian part of Borneo) and Irian Jaya. Indonesia contains more tropical rain forest than does any other nation in the Asia-Pacific region (Collins *et al.* 1991).

Current status of Caprinae

There is only one member of the Caprinae in Indonesia, the Sumatran serow (*Capricornis sumatraensis sumatraensis*), and it is confined to the island of Sumatra. It inhabits steep mountain slopes between 200 and 3,000m asl (van der Zon 1979), covered by both primary and secondary forests. It has also been reported in the pine forests in the northern part of its range (Kurt 1970). Serow is normally considered a generalised herbivore, but in Sumatra its appears to rely more on browsing than on grazing (Santiapillai and Widodo 1989). It is usually solitary in nature, but small groups of up to seven have been observed (Nowak 1991). It may occupy seasonal ranges and use well marked trails, that often run along ridges of steep hills. Serow feeds in the early hours of the morning and in late evenings, sheltering under overhanging cliffs and rocks during the rest of the day. No information on serow reproduction in Sumatra is available.

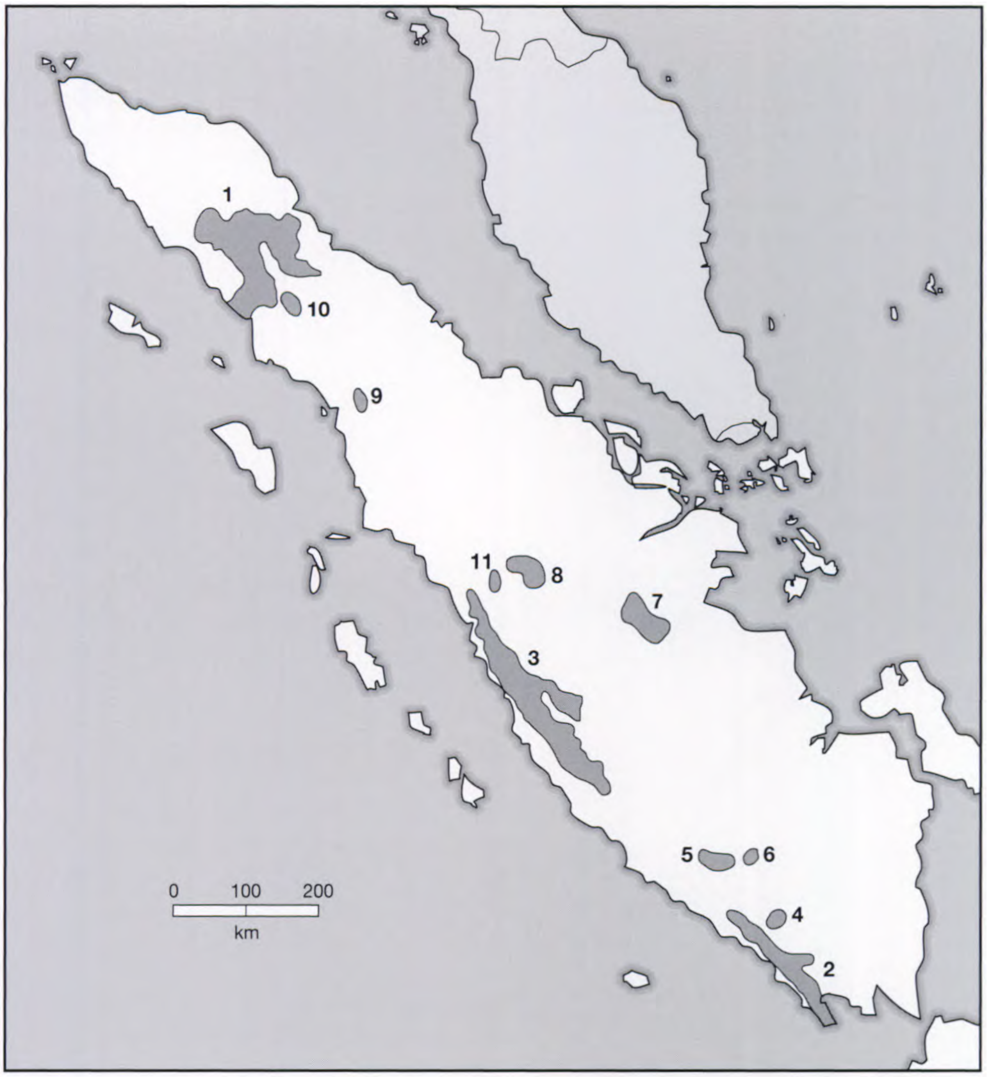
While suitable serow habitat is relatively widespread in Sumatra, the species appears limited to three known major concentrations: **1)** the Aceh highlands in the north, **2)** the Kerinci highlands in the centre, and **3)** the Barisan Seletan highlands in the south. Serow is threatened mainly by habitat destruction and poaching. It is often caught accidentally in snares set by people poaching other animals for meat. Serow meat is considered to be of mediocre quality (Nowak 1991). Forest conversion also creates serious conservation problems in Sumatra. Already it is estimated that between 60% and 80% of the lowland forests on Sumatra have been lost. So far, the mountain areas have been less seriously affected, but the disruption of continuous forest cover is already substantial in some areas. Perhaps 15% of the total area of the mountain regions has been deforested (Santiapillai 1989). Two factors may limit future losses of serow habitat. First, the rugged montane forests it inhabits are less hospitable for humans, and second, many areas it is restricted to today, fall within Protection Forests whose main function is the safekeeping of water catchment areas.

General conservation measures taken

The Sumatran serow has been legally protected in Sumatra since 1932 under the Nature Protection Ordinance No. 1967 of 1932, but no specific action has been taken to ensure its the long-term survival in Indonesia. However, the species has benefited from the system of protected areas established throughout its range. The first protected areas were created by the Dutch under Staatsblad No. 17 in 1932, before Indonesia obtained independence. This was replaced by the Nature Protected Ordinance No. 167 of 1941, and it formed the basis for the Forestry Act of 1967. A new Act of the Republic of Indonesia No. 5 concerning the Conservation of Living Resources and their Ecosystems, was approved by Parliament on 10 August 1990. (IUCN 1992b; WCMC 1991).

In 1983, Conservation of Nature and Natural Resources came under the authority of the Directorate General of Forest Protection and Nature Conservation (PHPA) of the Ministry of Forestry. The Ministry of Forestry in Indonesia recognises seven categories of protected areas. These are: National Parks (Taman Nasional), Game Reserves (Suaka Margasatwa), Nature Reserves (Cagar Alam), Hunting Reserves (Taman Buru), Recreation Parks (Taman Wisata), Protection Forests (Hutan Lindung), and Grand Forest Parks (Taman Hutan Agung). As of 1989, Indonesia has over 33 protected areas covering some 175,000km^2 or 9.1% of the land area (Collins *et al.* 1991). A further 185 areas encompassing almost 30,000km^2 have been recommended by PHPA, and await a decision by the Ministry of Forestry.

Much of the forest along the Barisan mountain chain of Sumatra has been set aside as protection forests to safeguard the water catchment areas of the major rivers. Though these protection forests contain some of the least disturbed areas in Sumatra, they require a higher level of formal protection. Currently, serow occurs in 11 protected areas, which together cover a total area of 3,083,308ha (Map 9.3.1). However, many require much improvement in protection to ensure the survival of serow and other sympatric species. In many reserves, there is no effective mechanism to deal with human encroachment and habitat loss (Santiapillai and Widodo 1989). Surveys have identified main concentration areas of serow, and the information



Map 9.3.1. Locations of protected areas with Sumatran serow (*Capricornis sumatraensis sumatraensis*) in Sumatra, Indonesia.

***National Parks*: 1)** Gunung Leuser (792,675ha; est. 1934); **2)** Barisan Selatan (356,800ha; est. 1982); and **3)** Kerinci-Seblat (1,484,650ha). ***Game Reserves*: 4)** Gunung Raya (39,500ha; est. 1978); **5)** Gumai Pasemah (45,883ha; est. 1976); and **6)** Isau-Isau Pasemah (12,114ha; est. 1978). ***Nature Reserves*: 7)** Seberida (120,000ha); **8)** Bukit Baling (146,000ha); and **9)** Sibolga (20,100ha). ***Protected Forests*: 10)** Dolok Sembilan (33,910ha); and **11)** Lemba Harau (23,476ha).

has been incorporated into a National Conservation Plan for Indonesia (MacKinnon and Artha 1982). A number of these areas now require gazetting (legal establishment) and staffing to prevent further habitat loss and local extinction of the species (Santiapillai and Widodo 1989).

Species account

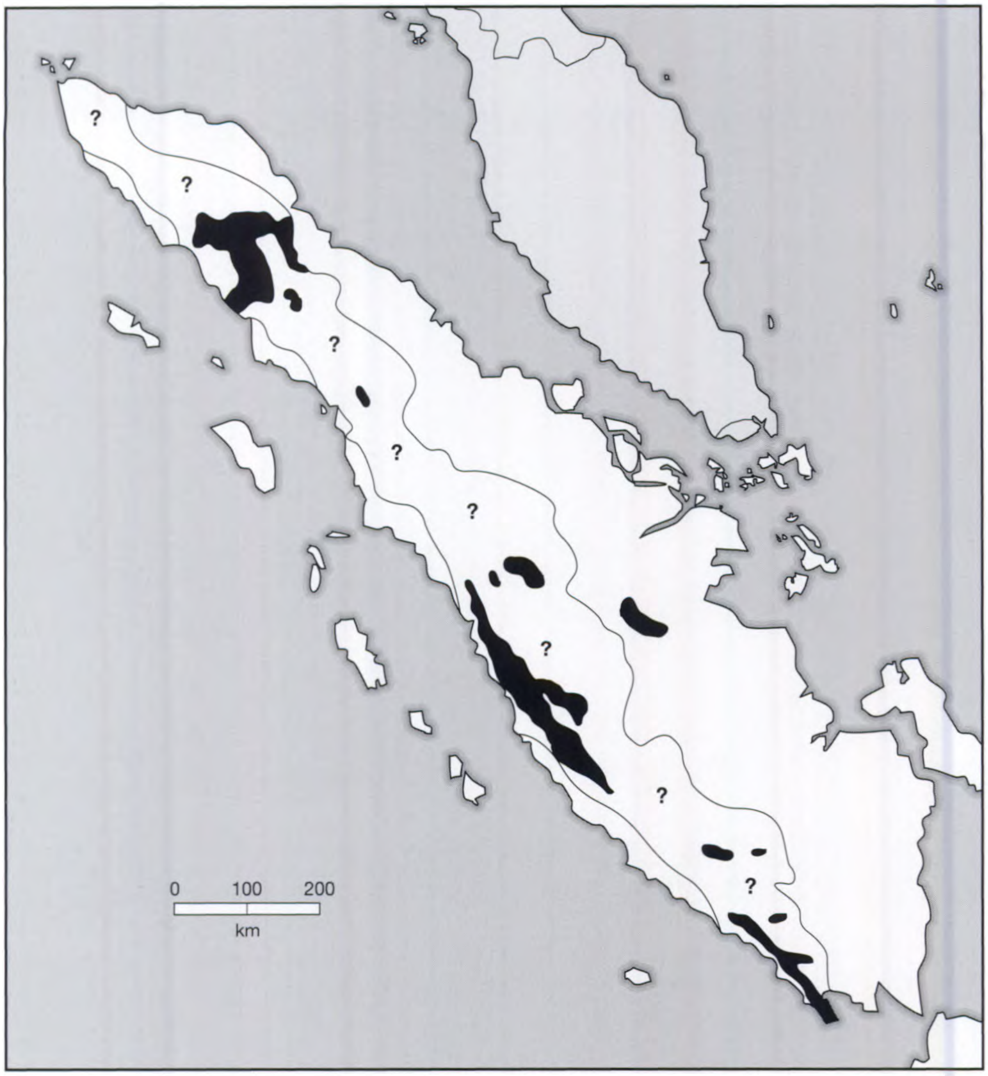
There is only limited published information on the biology and ecology of serow in Sumatra (van der Zon 1979; Kurt 1970; Santiapillai and Widodo 1989).

Sumatran serow (*Capricornis sumatraensis sumatraensis*)

Distribution: Limited almost entirely to the volcanic mountain chain of the Barisan mountains which runs along the western spine of Sumatra from Aceh in the north to Lampung in the south. Although suitable habitat is more extensive within these mountains (Santiapillai and Widodo 1989), there are only three known major concentrations: the Aceh highlands in the north, the Kerinci highlands in the centre and the Barisan Seletan highlands in the south (Map 9.3.2).

Population: No population estimates have been made. Although vulnerable to poaching and habitat destruction, serow appears to thrive well in some of the better protected areas such as Gunung Leuser National Park. Here the serow population may be healthy and increasing (M. Griffiths pers. comm. 1992).

Threats: Habitat destruction threatens the long-term survival of serow in Sumatra. The principal causes being a form of slash-and-burn agriculture practised by highlanders and shifting cultivators, and the indiscriminate extraction of timber for export to the west. Poaching is not uncommon, and serow are caught in snares set for other game species.



Map 9.3.2. Known and suspected distributions of Sumatran serow (*Capricornis sumatraensis sumatraensis*) in Sumatra, Indonesia.

Conservation measures taken: Sumatran serow is listed as Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), is in Appendix I of CITES, and in Sumatra, has been protected by law since 1932. A total of 3,083,308ha of serow habitat are under some form of protection in a system of protected areas that includes three national parks, three game reserves, three nature reserves and two protected forests (Map 9.3.1). However, many of these areas await gazetting and staffing, and in the absence of these actions they are little more than "paper" parks.

Status within country: Endangered.

Conservation measures proposed: 1) Conduct surveys along the Barisan mountain chain to determine current status, and to identify if there are any other viable populations of serow outside the currently known, main concentrations areas. **2)** Maintain natural forest cover along the volcanic spine of Sumatra, free from roads, agriculture, timber extraction and other human encroachment. This offers the best hope for the serow's long-term survival in Indonesia (Santiapillai and Widodo 1989). **3)** Maintain the strict protection of reserves where viable serow populations still exist, this must remain the prime concern. Protected areas where serow now occur must be properly zoned and managed. **4)** Strictly protect the core areas which incorporate the feeding and breeding areas, to avoid interactions with humans. **5)** Design land-use activities in the vicinity of serow reserves so that they are compatible with serow conservation. **6)** Adopt measures to improve the living conditions of people existing along the periphery of serow reserves. **7)** At the same time, publicise the plight of the serow to the people through sensible conservation education programs. Any conservation program, no matter how well rooted in science, can succeed only if it is intelligible to the people concerned.

When assessing the potential impacts on serow and other wildlife, it should be remembered that the 1993 human population of Indonesia was estimated around

185 million, and that this figure is expected to double within the next 50 years. The Government has moved ca. 600,000 people each year from the overcrowded islands of Java and Bali to the less populated outer islands of Sumatra, Kalimantan and Irian Jaya. However, Java alone adds two million people to its population each year.

9.4 Japan

N. Maruyama, H. Ikeda, M. Hanai and K. Tokida

Introduction

The Japanese archipelago consists of many islands that total an area of 377,530km², and that stretch for about 3,000km from subtropical to subarctic regions. Among them are the four main islands of Hokkaido, Honshu, Shikoku and Kyushu. Only 25% of Japan is suitable for human habitation, with the remaining 75% of the country covered by steep mountains, mostly of volcanic origin, and cut by deep valley systems. There are no large plains, and flat areas tend to occur around the coastal regions, or are formed by the alluvial fans of the fast flowing mountain rivers. Volcanoes are common; at least 60 have been active within historic times.

The climate varies seasonally and regionally. Winter snow cover is abundant in northern Japan, especially on the Japanese sea side, but rare or non-existent in southwestern regions. Precipitation ranges between 1,000 and 3,500mm annually, falling primarily in June and July. Approximately 67% of Japan is covered by forests, 43% of which have been converted to artificial plantations where sugi cedar (*Cryptomeria japonica*), hinoki (*Chamaecyparis obtusa*), red pine (*Pinus densiflora*) and Japanese larch (*Larix leptolepis*), predominate. The natural vegetation shows a clear zonal change from south to north, changing from evergreen broad-leaved forests (*Cyclobalanopsis* spp.) to deciduous broad-leaved forests (*Quercus, Fagus* and *Betula* spp.), and finally, evergreen coniferous forests (*Abies, Picea* and *Tsuga* spp.).

Current status of Caprinae

The Japanese serow (*Capricornis crispus*) is endemic to Japan on three of the main islands: Honshu, Shikoku and Kyushu. It is known as "nihon kamoshika", with "kamoshika" meaning both antelope and serow in Japanese. Once severely threatened due to overhunting and habitat loss, it was designated as a natural monument in 1934 but because poaching continued, it was designated as a special natural monument in 1955. As a result, serow

S. Otaka (WWF)

An adult Japanese serow (*Capricornis crispus*), Japan.

increased, especially in northeastern Honshu. By the late 1970s, the total range occupied by serow was estimated at about 34,500km², with total numbers estimated by block counts (Maruyama and Nakama 1983) at between 70,000 to 100,000 animals. The increase in serow was probably influenced by two main factors: the virtual elimination of poachers by the police force, and the creation of favourable habitat in the form of monoculture conifer plantations created after World War II. By the 1980s, these artificial plantations accounted for >40% of Japan's forest cover, while serow range had expanded to cover around 40,000km².

Since 1974, a conflict has developed because serow browse the young shoots of the forest industry's most commercially important tree species – hinoki, sugi cedar, and red pine. Foresters demanded strict control of serow, and hunters were eager to comply. However, opponents favour changing forest practices and there is even disagreement among foresters.

General conservation measures taken

The Japanese serow was designated a "Natural Monument of Japan" in 1934, under the Cultural Properties Protection Act of 1925. Later, in 1955, its status was raised to a "Special Natural Monument" by the Ministry of Education. These designations gave the serow complete protection, and consequently the total population increased gradually to its present levels. However, with this increase in numbers, conflicts arose between serow and forest production.

In 1979, the Agencies of Environment, Cultural Affairs, and the Department of Forestry repealed the serow's protected designation, allowing it to be culled in some areas. Despite strong opposition from naturalists, conservationists, biologists and citizen's organisations such as the Nature Conservation Society of Japan, culling began in 1978, and since then, >9,000 serow had been removed by 1989 from the Gifu and Nagano Prefectures. Culling continues to occur every year. At the same time that the decision to permit culling was made, 15 protection areas were designated for serow and nominated under the Law for Protection of Cultural Affairs. In these areas the species would receive complete protection along with its habitat (Map 9.4.1). The three primary functions of these protected areas were to: **1)** extend serow ranges to ensure conservation of stable serow numbers; **2)** ensure genetic diversity of serow populations; and 3) establish a management system for serow and its habitat where both would receive complete protection. By 1989, 13 of these areas had been established, ranging in size from 143km^2 to 2,180km^2. Together, they cover a total of 11,800km^2, and represent about 20% of current serow range over 23 prefectures. However, the protection areas avoid commercial forests and are generally at such high elevations that they are unsuitable for serow, and thus provide little real protection. Outside the protected areas, serow would be protected from hunting by the Law Concerning Wildlife Protection and Hunting.

The agency of Cultural Affairs initiated a survey system for serow management in 1985, composed of a main and supplemental program. The main program's objective is for 20 teams, each of 10 biologists, to monitor population trends and habitat conditions every year in four or five protection areas, on a 5-year rotation system. The supplemental program involves many more personnel and consists of annual surveys of all other areas to monitor human-caused habitat changes, crop and plantation

Map 9.4.1. Locations of protection areas for Japanese serow (*Capricornis crispus*) in Japan.

***Established protection areas*:** **1)** Shimokita (33,300ha); **2)** Kita-Ohu (104,300ha); **3)** 41,100ha); **4)** Minami-Ohu (57,700ha); **5)** Asahi-Iide (122,800ha); **6)** Echigo-Nikko-Mikuni (218,000ha); **7)** Kanto (76,500ha); **8)** Minami-Arupusa (122,000ha); **9)** Kita-Arupusa (195,600ha); **10)** Hakusan (53,700ha); **11)** Suzuka (14,300ha); **12)** Ibuki-Hira (67,500ha); and **13)** Kii (79,500ha).
***Proposed protection areas*:** **14)** Shikoku; and **15)** Kyushu.

damage. Together, the data are used to develop management plans for each protected area. The annual budget for the surveys is $760,000 (US 1992).

Species account

Information on the biology of Japanese serow is available in a number of publications (e.g. Akasaka and Maruyama 1977; Kishimoto 1987, 1989; Kishimoto and Kawamichi 1996; Maruyama 1985; Maruyama and Nakama 1983; Miura and Maruyama 1986; Miura *et al.* 1987; Sakurai 1981; Suzuki and Takatsuki 1986; Tokida and Miura 1988).

Japanese serow (*Capricornis crispus*)

Distribution: Serow is common in montane regions of northern and central Honshu, but is restricted to small areas on the islands of Shikoku and Kyushu (Map 9.4.2).

Population: In 1985, the total population was estimated by the Environment Agency at ca. 100,000 animals inhabiting a total area of around 39,000km². The population may be slowly increasing.

Conservation measures taken: Listed as Lower Risk (cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). The Japanese serow was originally designated a "Natural Monument of Japan" in 1934, and then in 1955, its status was raised to a "Special Natural Monument" under the Law for Protection of Cultural Properties by the Agency of Cultural Affairs. These designations gave the serow complete protection, but conflicts with agriculture and forestry resulted in its status being repealed in the 1970s. Currently, approximately 11,300 serow receive full protection within 13 designated protection areas throughout 23 prefectures (Map 9.4.1).

Status within country: Not threatened.

Conservation measures proposed: **1)** Follow scientifically-based, altitudinal guidelines for silviculture and methods for damage control, by avoiding plantations in serow habitat. Damage to artificial conifer plantations is caused not only by serow, but also indirectly by unreasonable

Map 9.4.2. Distribution of Japanese serow (*Capricornis crispus*) in Japan in 1983.

silvicultural practices that have ignored scientifically-based guidelines for silviculture and damage control. Following these guidelines will reduce much unnecessary damage. **2)** Change protection area boundaries to encompass lower altitude areas that include the *Fagus* and *Quercus* zone where the main body of the serow distribution occurs. Establish protection areas to avoid forest-serow conflicts. **3)** Young plantations potentially at risk to serow browsing should be enclosed by mesh fences to prevent damage. The Administration should promote the erection of these fences and assist forest owners financially and technically with their construction. **4)** Reintroduce serow into the Chugoku district of Honshu where serow became extinct, probably due to overhunting. **5)** Provide strict protection for serow from poaching in the Kyushu and Shikoku Districts where populations are still restricted to small areas. Serow should not be culled here even though they may cause damage to forest plantations and agricultural crops. **6)** The research institutes established by the Environment Agency and the Agency of Cultural Affairs to study wildlife conservation and natural monuments, must employ enough scientists and specialists to adequately address the problems.

9.5 Laos

R.E. Salter and Bouaphanh Phanthavong

Introduction

The Lao People's Democratic Republic extends approximately 1,000km from northwest to southeast and covers around 236,800km^2. Rugged forest and scrub covered mountains, cut by narrow, deep river valleys, cover the entire northern half of the country, and run along its eastern length. The northern mountains reach as high as 2,820m asl. There are three major high elevation plateaux: the Plain of Jars, located in the mountains of the northeast and covered primarily by grasslands and open pine forests; the Nakai plateau, situated along the western edge of the central Annamites, and also covered by pine forests and grasslands; and the Bolovens plateau, an outlying, broad-leaved forest and grassland-covered massif in the extreme south. Extensive lowlands are found only along the Mekong river and in the southwest.

Laos has a tropical (in the lowlands) to sub-tropical climate. Mean annual rainfall varies from around 4,000mm on the Bolovens Plateau, to <1,500mm in parts of the north. Mean temperatures on the lowland plains are between 25°C and 27°C, but only about 20°C in the mountains and high plateaux where frosts sometimes occur. The original vegetation cover of Laos consisted largely of evergreen and semi-evergreen forests, but also included lowland and montane deciduous forests, tropical pine forests, and scrub forest on limestone areas. Probably <50% of the country remains covered by mature forest, with most of the remainder supporting secondary forest and other vegetation types that are the result of shifting cultivation and repeated fires. Seasonally flooded wetlands were previously a major habitat type all across the Mekong floodplain, but these have been largely converted to permanent rice cultivation, or are influenced by intensive fishing, livestock grazing, forestry, or a combination of these activities.

Current status of Caprinae

The Indochinese serow (*Capricornis sumatraensis maritimus*) is believed to be widely distributed throughout the mountainous regions of Laos. There, it inhabits forest covered hills, including but not limited to, forests on limestone ranges. No specific studies of food habitats or reproduction have been made of this species in Laos. Evans' long-tailed goral (*Naemorhedus caudatus evansi*) may also occur in Laos, but its status and distribution are uncertain (see **Species accounts** below).

General conservation measures taken

Laos is a party to the 1951 International Convention for Plant Protection, the subsequent 1956 Plant Protection Agreement for Southeast Asia and the Pacific, the 1972 World heritage Convention, and the 1982 Law of the Sea Convention. It has been a State Member of IUCN since 1969, and a number of government officials are involved with specialist groups of the Species Survival Commission. The legal system in Laos is only now developing; conservation and land management are currently being regulated by administrative decree. To date, decrees have been promulgated regarding wildlife trade (Decree of the Council of Ministers No. 185/CCM, 21/10/86), import and export taxation (No. 47/CCM, 26/06/89), and hunting and fishing (No. 118/PCM, 5/10/89). Further instructions were issued in 1992, listing protected species and specifying controls on trade and punishments for violations. However, as yet there is little enforcement capacity.

Wildlife conservation and protected areas management are the responsibility of the Wildlife and Fisheries Conservation Division, a directorate created in 1983 within the national Forest Department. The national organisational structure is replicated in the provincial governments, although provincial staff with conservation-related responsibilities generally also have other duties. Currently, only two protected areas are under active management in the country. The 808ha Houei Nhang Forest Reserve and the 200,000ha Phou Khao Khouay area, both near the capital Vientiane.

General conservation measures proposed

A recent review of needs and priorities for conservation legislation (Madar and Salter 1990) recommended development of separate Nature Conservation and Environmental Protection acts. Comprehensive policy and legislation for forest land are now being formulated by the central government, and are expected to include wildlife and protected areas management components. The possibility of joining additional international conventions, specifically CITES and the Ramsar Convention, is being investigated with the assistance of IUCN.

A protected areas system oriented toward ecosystem conservation is currently under development. Field surveys of proposed areas are being conducted, and nine of these (including Phou Khao Khouay indicated above) totalling 6.6% of the land area of the country, have so far been recommended for addition to the protected areas system (Salter *et al.* 1991). The ultimate aim of the protected areas system is to have five to 20% of all forest types and of the total area of Laos under conservation management.

Species accounts

Other than distributions, there is no published information on the biology of either serow or goral in Lao PDR.

Indochinese serow (*Capricornis sumatraensis maritimus*)

Distribution: The historic distribution of serow included virtually all of the uplands of Laos (Deuve 1972; Lekagul and McNeely 1988). Current information (Forest Resources Conservation Project, unpubl.) suggests that the species is still widely distributed (Map 9.5.1).

Population: No data on population size or trend.

Threats: Serow horns, frontal bones, leg bones and other body parts are used in local, traditional medicine and are readily available in shops in Vientiane and elsewhere. The meat is also eaten in rural areas, however, the extent to which hunting affects the population status of this species in Laos is unknown.

Conservation measures taken: Serow is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and is in Appendix I of CITES. In Laos, serow is included in a 1986 central government decree (No. 185/CCM, 21/10/86) that prohibits trade in this and other listed species. However, a decree on the state tax system (No. 47/CCM, 26/06/89) which was intended to control commercial activities in general, lists a resource tax equivalent to US $60 and a special fee of US $140 as payable to the government for individual serow. This resource tax is essentially an extraction tax (i.e. for harvesting animals from wild populations), while the special fee is an export tax. Subsistence hunters are exempt from the resource tax. Also listed for taxation are serow bile (resource tax of US equivalent $0.50/g, special fee $1.00/g) and serow bones (resource tax $15/kg, special fee $35/kg). This taxation schedule is now under revision, and enforcement and tax collection mechanisms are being developed. Recent (1992) instructions for the implementation of Decree No. 118/PCM on the management and protection of wildlife, prohibit the hunting of serow throughout the country, and provide a mechanism for controlling both local and international trade.

The current status of serow in Laos is being evaluated as part of the ongoing field surveys of the Forest Resources Conservation Project. Data obtained since 1988 are now being summarised, and measures required for the serow's conservation are being assessed. Serow has been reported from in and around several of the nine areas so far identified as being suitable for inclusion in Laos' protected areas system.

Status within country: Insufficiently Known.

Conservation measures proposed: Implement the conservation measures identified by the Forest Resources Conservation Project.

Map 9.5.1. General distribution of Indochinese serow (*Capricornis sumatraensis maritimus*) in Laos.

Evans' long-tailed goral (*Naemorhedus caudatus evansi*)

Distribution and Population: Goral has been reported in the west-central region of Laos (Thakhek Province: Deuve 1972), but whether this is based on direct observations or actual specimens collected from the wild is unclear. It may also occur in the extreme northwest (Map 9.5.2) because this is at the edge of the species' range reported by Lekagul and McNeely (1988). Goral has been widely reported elsewhere in Laos during village interviews conducted by the ongoing Forest Resources Conservation Project, but it is likely that in these instances it is being confused with young serow.

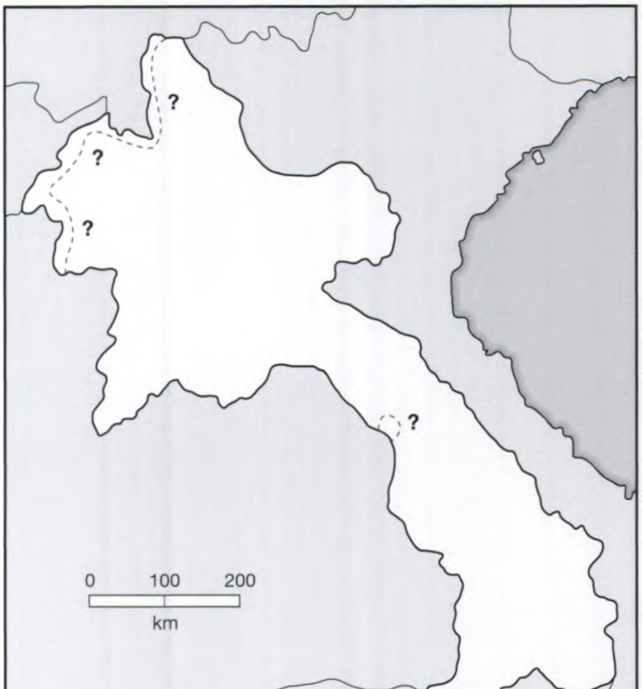
Population: No information available on population size or trends.

Threats: Probably habitat loss and poaching.

Conservation measures taken: Long-tailed goral is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and as a protected species (i.e. no hunting permitted) under existing decrees and instructions in Laos. All goral are in Appendix I of CITES.

Status within country: Insufficiently Known.

Map 9.5.2. Suspected distribution of Evans' long-tailed goral (*Naemorhedus caudatus evansi*) in Laos.



Conservation measures proposed: 1) Create protected areas. Goral has been reported by villagers from in and around all of the nine areas so far identified as being suitable for inclusion in Laos' proposed protected areas system. **2)** Determine the extent to which reports of goral are due to confusion with serow, a species that is believed to be much more widely distributed. **3)** Include the Khammouane Limestone area, which encompasses the goral distribution records reported by Deuve (1972), in the protected areas system.

9.6 Malaysia

M.A. Rahman

Introduction

Malaysia is comprised of West (Peninsular) Malaysia and East Malaysia. West Malaysia consists of 11 states that together cover 131,500km^2 of the southern end of the Malay peninsula. East Malaysia lies 650km to the east, across the South China sea on the northwest part of Borneo. It is comprised of the territories of Sarawak and Sabah and covers 198,160km^2. Peninsular Malaysia is a mountainous land about 800km long and 320km at its widest. More than half the land is over 150m asl, and the mountains are composed either of granite and other igneous material, or by older stratified rocks. The mountains consist of roughly parallel ranges running north-south along the Peninsula. The 480km long Main range is the highest of these mountain systems, and its elevations rise more than 2,140m asl. In central and northern Peninsular Malaysia, the topography typically consists of steep-sided, limestone hills with many caves, with hillsides covered with stunted vegetation. Surrounding the central high regions are coastal lowlands, 16 to 230km wide on the west coast, and narrow and less continuous along the eastern coast of the Peninsula.

West Malaysia has a hot humid equatorial climate which is influenced by maritime conditions and by various monsoons. Mean annual rainfall is around 2,540mm, with the driest area southeast of Kuala Lumpur receiving an annual average of 165mm, and the wettest northwest of Ipoh receiving 500mm. The average diurnal temperature ranges between 21°C to 32°C in the lowlands, but drops as low as 2°C in the mountains. The natural vegetation is dense, evergreen tropical rainforest.

Current status of Caprinae

Sumatran serow (*Capricornis sumatraensis sumatraensis*) is the sole Caprinae species of Peninsular Malaysia. Here it inhabits steep, limestone hills, quartz ridges and dipterocarp forests. The population is threatened, primarily due to the loss of its habitat, and to disturbance from logging in the dipterocarp forests and quarrying in the limestone areas. Poaching is another major problem for the serow because it is hunted for food and medicinal purposes. New logging roads only serve to increase accessibility for poachers.

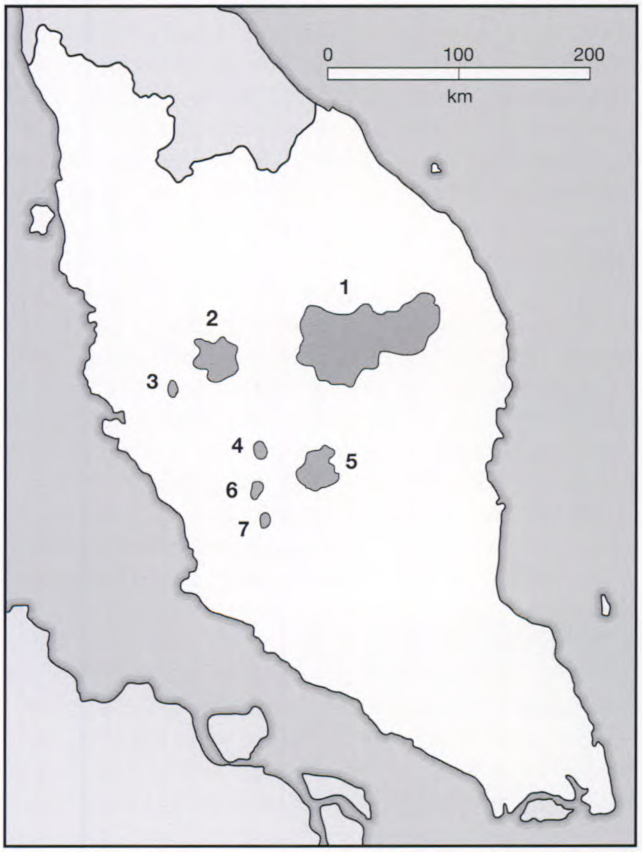
General conservation measures taken

The sole government agency, directly responsible for wildlife conservation and the management of protected areas, is the Department of Wildlife and National Parks, Peninsular Malaysia. Wildlife conservation is not a high priority either for the government or for the public. Serow has been legally protected in Peninsular Malaysia since 1931, but a more recent law dealing with wildlife conservation is the Wild Animals and Birds Protection Ordinance 1955 (Federation of Malaya, No. 2 of 1955). Serow is included in this ordinance in the list of game animals under the title "deer". Under the Malaysian Wildlife Act 76/72 (No. 72 of 1976), serow is included in the list of totally protected species. At least seven protected areas in Peninsular Malaysia contain serow populations (Map 9.6.1), and six more areas have been proposed. Unfortunately, the existing protected areas are not representative of the major habitats or ecosystems used by serow, and are not adequate to ensure the species' survival against the threats that face them in Peninsular Malaysia.

Malaysian non-government organisations which support serow conservation are the Malaysian Nature Society, the Consumer Protection Association, and WWF-Malaysia. There is also a program to educate the public and school children on conservation in general, that is conducted by the Department of Wildlife and National Parks, Peninsular Malaysia.

Map 9.6.1. Locations of Sumatran serow (*Capricornis sumatraensis sumatraensis*) in protected areas within Peninsular (West) Malaysia.

1) Taman Negara National Park (434,351ha; est. 1938). **2)** Cameron Highland Wildlife Sanctuary (70,400ha; est. 1962); **3)** Krau Wildlife Reserve (12,000ha; est. 1923); **4)** Sungkai Wildlife Reserve (2,400ha; est. 1928); **5)** Frazer's Hill (2,944ha; est. 1957); and **6)** Bukit Kutu Wildlife Reserve (1,920ha; est. 1922); **7)** Klang Gates (129ha; est. 1936).



Species account

Published information on serow in the wild and in captivity in Malaysia can be found in Ahmad (1985, 1986), Said (1984) and Vellayan (1989).

Sumatran serow (*Capricornis sumatraensis sumatraensis*)

Distribution: It is found scattered throughout Peninsular (West) Malaysia, but concentrated in the northern states, especially Kelantan, Perlis and Perak (Map 9.6.2). The species has been recorded in 50 areas in Peninsular Malaysia, but in each area, the number of animals is estimated to be only between 10 to 15 individuals.

Population: Mustafa *et al.* (1990) conducted a reconnaissance survey in the Pelangai Forest Reserve, Negeri Sembilan (3,107ha), in an effort to determine the number of serow present before a capture operation started. Thirteen animals were recorded in this area, giving a density of 0.4 serow/km^2. The total number of serow estimated for Peninsular Malaysia is between 500 and 750 animals, scattered through many, very small, isolated populations.

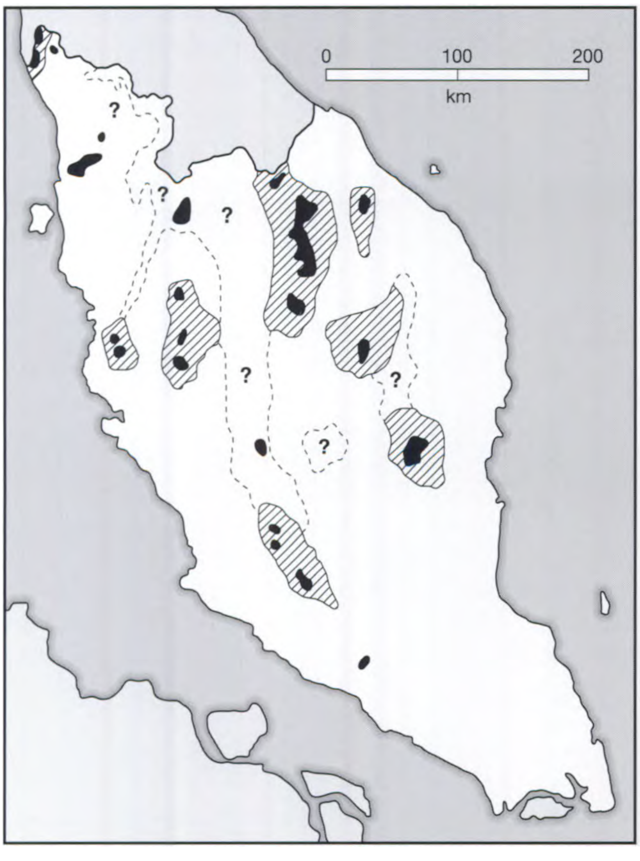
Threats: Mainly from disturbance and from habitat destruction caused by mining activities in the limestone and quartz ridge quarries within their habitat, and by deforestation of the hill dipterocarp forests for logging and agriculture. Serow also suffers from substantial poaching for its meat and body parts that are used for medicinal purposes.

Conservation measures taken: The species is listed as Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and is included in Appendix I of CITES. It is totally protected under the Wildlife Act (76/72) of Peninsular Malaysia. Enforcement is carried out by the Department of Wildlife and National Park's Enforcement Division. Serow occur in seven protected areas (Map 9.6.1), but unfortunately these neither represent typical serow habitat, nor are they adequate to ensure its survival. Serow is also found in six proposed, protected areas. Small captive breeding groups of serow are held at Zoo Negara (Vellayan 1989) and Zoo Melaka.

Status within country: Endangered.

Conservation measures proposed: Implement the serow conservation strategy developed by the Department of Wildlife and National Parks, Peninsular Malaysia. This strategy includes: **1)** Develop management plans and the application of appropriate wildlife management techniques to conserve and enhance serow populations. The management goals are to: **2)** establish and conserve genetically viable populations in protected wildlife reserves, national parks, permanent forest reserves, and other forested areas and limestone hills; **3)** protect areas which contain serow and manage them for an optimum sustainable population; and **4)** establish a captive breeding population for future re-introduction of serow into protected areas.

Map 9.6.2. Known and general distribution of Sumatran serow (*Capricornis sumatraensis sumatraensis*) in Peninsular (West) Malaysia.



Specific management objectives and recommendations identified to meet these goals include: **5)** co-ordinate actions of conservation agencies with those of agencies involved in quarrying and logging operations, to promote wildlife conservation; **6)** develop a public education program; **7)** increase effectiveness of law enforcement; **8)** train personnel; **9)** improve habitat management and conservation by increasing the number of protected areas; and **10)** carry out ecological and biological research.

9.7 Myanmar

R. E. Salter

Introduction

The Union of Myanmar, previously known as Burma, is the largest country in mainland South-East Asia with an area of about 678,030km². The dominant topographic feature is a relatively densely populated central basin of the Irrawaddy-Chindwin river system. This region is surrounded by mountain ranges (Blower 1985b) that form a horseshoe-shaped barrier separating the country from Bangladesh and India to the west, China to the north and east, and Laos and Thailand to the east. Broadly speaking, the country slopes downward from north to south. In the north lie a complex series of north-south running mountain ranges whose highest peak is Hkakabo Rzi (5,881m asl) in the Kumon range. To the northwest and west, the mountain ranges extend south to the tip of the Arakan peninsula. These mountains have an average height of around 1,830m, but some reach >3,050m asl. In the northwest they form the Chin Hills, while further south they become the Arakan Yoma, a series of mountains that separate the central plains from a narrow coastal strip comprised of two separate areas, the Arakan and Tenasserim coastal plains. A series of islands run along the coast. The deeply dissected Shan Plateau forms the northeast part of the country, with an average height of 915m asl, surrounded by mountains over 2,600m asl. The Plateau rises abruptly from the central basin located between the Arakan Yoma and the Plateau. The central region of the central basin contains a line of extinct volcanoes and crater lakes.

The country lies in the monsoon region of southeast Asia, although cold air masses from Central Asia and the modifying effects of its own complex topography, are important factors. Coastal and mountain regions may receive as much as 5,100mm rainfall each year, and the delta regions of the central plains up to 2,500mm annually. Rainfall decreases with increasing latitude. Perhaps about half of the country is still forested, varying in type with rainfall and elevation. Evergreen oak and pine forests grow above the frost line around 915m asl, while rhododendron forests dominate in the northern mountains above 1,830m asl. Evergreen tropical forests grow where annual rainfall exceeds 500mm, and monsoon forests in regions with between 100 to 200mm. Mixed deciduous forests, found throughout the relatively dry central region, produce the commercially valuable species such as teak (*Tectona grandis*) and other hardwoods. In lower rainfall areas, forests give way to scrubland, but true grassland habitats are rare. Not only is floral diversity high in Myanmar, but so also is its fauna. Most belong to the Indochinese zoogeographic Sub-Region of the Oriental Region, while the Arakan and Chin Hills are in the Indian Sub-Region, and the high mountains in the north contain the typically Himalayan fauna of the Palearctic Region (Blower 1985b).

Current status of Caprinae

Four species of Caprinae are believed to occur in Myanmar. Serow (*Capricornis sumatraensis*) is the most widespread. It is found throughout the country with the exception of the central and coastal plains, and the Irrawaddy Delta area. However, there are supposedly two subspecies, the red serow (*C. s. rubidus*) and the Indochinese serow (*C. s. maritimus*), but the distinction between their ranges is unknown, so they are treated together in this report. Both Evans' long-tailed goral (*Naemorhedus caudatus evansi*) and the Burmese red goral (*N. baileyi cranbrooki*) are believed to occupy the forested mountain ranges in the north. Again the division of their distributions is uncertain and could not be separated for this report. Mishmi or Burmese takin (*Budorcas taxicolor taxicolor*), known locally as "Thar min", also occurs in the northern mountain areas where it inhabits dense rhododendron forests, and at higher elevations, small bamboo groves and alpine meadows.

Besides hunting and poaching, habitat degradation and loss from deforestation caused by timber harvesting and agriculture, are major threats to Caprinae in Myanmar, while in some areas fires also destroy much habitat. Unfortunately, very few data are available on either Caprinae or threats to them (Salter 1983).

General conservation measures taken

The first game sanctuary was established in 1911, but the basis of the protection of natural resources lies with two acts. The 1902 Burma Forest Act permits the Ministry of Agriculture and Forests to establish game sanctuaries and reserved forests primarily on government land, which then become the responsibility of the Forest Department. Wildlife is defined by the Act as "forest produce" and local governments are allowed to issue Game Rules. The 1936 Burma Wildlife Act gave further support to the 1902 Act, by making provision for the establishment of wildlife sanctuaries on government-owned lands or on private lands with the owners permission. This second Act prohibits all hunting, fishing and wilful disturbance of animals in wildlife sanctuaries, while such activities in reserved forests require a licence. Further, closed hunting seasons were established nation-wide, while a limited number of species received year-round protection. Although both Acts provide protection for wildlife in sanctuaries and reserved forests (including goral and serow), they do not provide specific protection for habitats (IUCN 1992b; WCMC 1987).

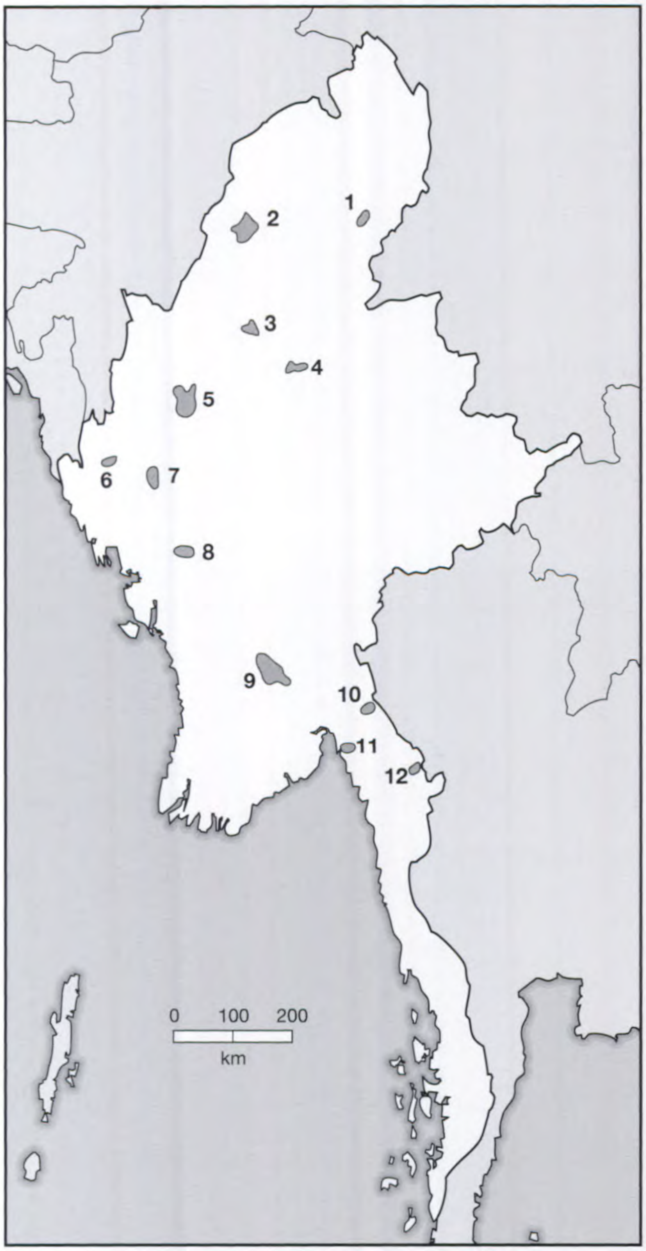
An adult female Mishmi takin (*Budorcas taxicolor taxicolor*) in captivity. San Diego Zoo, California, USA.

D. Shackleton

A total of 14 sanctuaries have been established and are managed along with reserved forests by the Forest Department. This is one of the oldest such departments in Asia, but its effectiveness is strongly influenced by the State Timber Corporation that generates about 25% of the nation's foreign exchange through its monopoly on timber harvest in reserved forests (IUCN 1992b; WCMC 1987).

Map 9.7.1. Location of protected areas reported or suspected of containing Caprinae in Myanmar.

1) Pidaung Wildlife Sanctuary; **2)** Tamanthi Wildlife Sanctuary; **3)** Kyatthin Wildlife Sanctuary; **4)** Shwe-U-Daung Wildlife Sanctuary (32,659ha; est. 1927); **5)** Alaungdaw Kathpa Wildlife Sanctuary (proposed); **6)** Kyaukpandaung National Park (12,960ha; proposed); **7)** Natma Taung National Park (proposed); **8)** Shwesettaw Wildlife Sanctuary; **9)** Pegu Yomas National Park (proposed); **10)** Kahilu Game Sanctuary; **11)** Kelatha Hill Game Sanctuary; **12)** Mulayit Wildlife Sanctuary.



A 3-year FAO/UNDP assisted project, that ended in 1984, was mainly concerned with field surveys, re-evaluating existing wildlife sanctuaries, and identifying areas suitable for national parks or nature reserves (Blower 1985b). Wildlife sanctuaries cover about 0.7% of the total land area, a level considered inadequate to represent the nation's natural resources. Reserved forests, which may provide a similar function to sanctuaries, account for about 14% (FAO 1985). Still, the principal conservation issue throughout the country is deforestation, and this was estimated to be occurring at around 740,000ha per year in 1980 (Blower 1985b). Further, the various forest ecosystems are not uniformly represented in protected areas. For example, protection is urgently needed in the whole upper catchment area of the Irrawaddy, north of Myitkyina, as well as for evergreen forests in general, as well as the dipterocarp-rich forest of south Tenasserim (Blower 1985b).

Several wildlife sanctuaries are known or suspected to contain serow or goral (Map 9.7.1) and the four proposed national parks would also help protect these species. There are no takin in protected areas, however.

General conservation measures proposed

As a result of an FAO/UNDP funded project, new legislation was proposed in 1985 to strengthen conservation efforts and to make provisions for the establishment of national parks and nature reserves (FAO 1981). Unfortunately some of the more promising areas for proposed national parks or reserves occur in Kachin State and in eastern Myanmar, and thus are inaccessible for security reasons (Blower 1985b). The report also called for a greatly strengthened Forest Department, with sufficient numbers of trained staff and funds to carry out their duties. It also called for new legislation that reflected current conservation management approaches, and for programs to educate the population about environmental problems (Blower 1985b).

In addition to increasing the number of protected areas, numbers and distributions of all species of Caprinae in Myanmar need to be estimated before useful conservation strategies can be developed. Work should probably begin in areas within suspected distribution areas where forest extraction is most intense. At the same time, attempts should be made to effectively control poaching until population estimates are available.

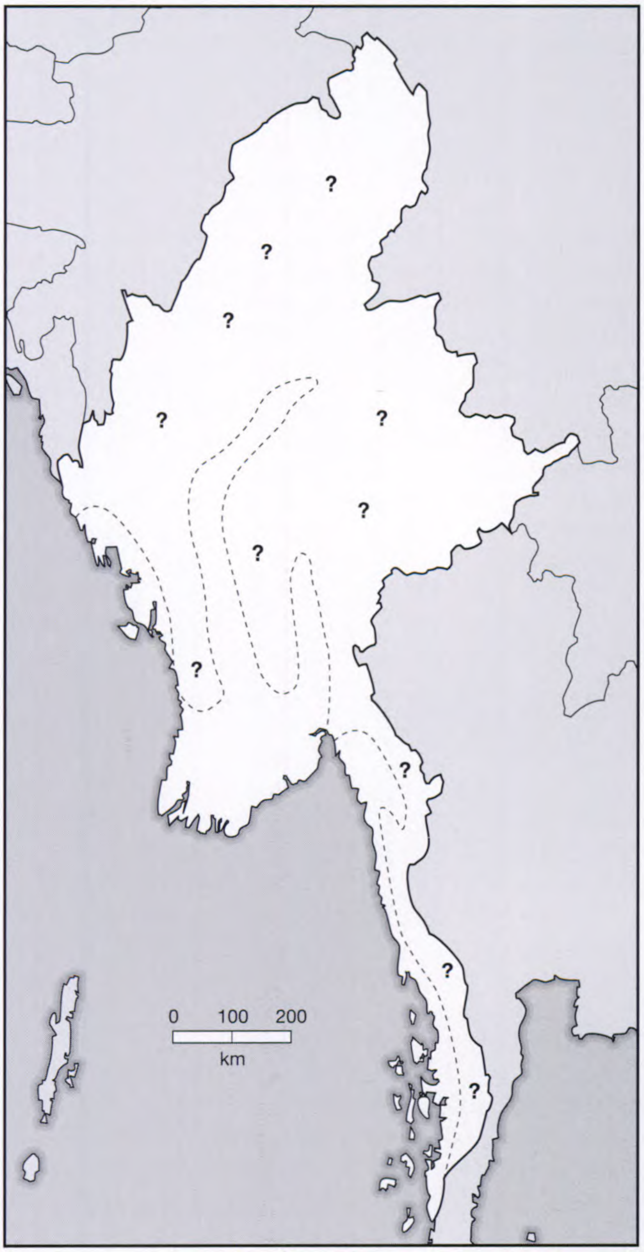
Species accounts

Only general biological data are available for goral (Mead 1989) and for takin (Neas and Hoffmann 1987).

Serow (*Capricornis sumatraensis*)

Distribution: The general distribution appears to follow the forested mountain ranges surrounding the central plains (Map 9.7.2). Its distribution in the northwest is believed to stretch through the Chin Hills from the border with India, probably as far south as 20°N in the Arakan Yoma range. A larger distribution area occurs in the mountains in the north (Kachin state) and in the mountains east of about 96°W, to Myanmar's borders with China, Laos and Thailand. The separate distributions of *C. s. maritimus* and *C. s. rubidus* are not clear.

Map 9.7.2. Suspected distribution of serow (*Capricornis sumatraensis*) in Myanmar.



Population: There are no recent data for either distributions or population numbers.

Threats: Habitat loss due to timber harvesting and slash-burn cultivation, and poaching.

Conservation measures taken: The species is listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and in Appendix I of CITES. Serow occurs in Kahilu (an area of armed civil unrest, which suffers from poaching) and Kelatha Hill Game Sanctuaries, and in Shwesettaw and Shwe-U-Daung Wildlife Sanctuaries (Map 9.7.1). It also probably occurs in Tamanthi, Pidaung, and Mulayit Wildlife Sanctuaries. Serow is also reported in a number of proposed National Parks: Alaungdaw Kathapa, Kyaukpandaung, Natma Taung and Pegu Yomas (Map 9.7.1). Serow was eliminated from Taunggyi Wildlife Sanctuary, probably as the result of poaching and hunting by domestic dogs (IUCN 1992b; WCMC 1987).

Status within country: Insufficiently Known.

Conservation measures proposed: 1) Carry out surveys and censuses to develop conservation programs. **2)** Immediate enforcement of protection against poaching, especially in protected areas.

Gorals (*Naemorhedus* spp.)

Distribution: Both species of goral are found in northern Myanmar, although their separate ranges are uncertain (Map 9.7.3), and no recent distribution data are available. Evans' long-tailed goral (*Naemorhedus caudatus evansi*) is believed to occupy the western forested mountain regions to the borders with China, Laos and Thailand. Burmese red goral (*N. baileyi cranbrooki*) is endemic to northern Kachin State in northern Myanmar, and adjacent Tibet and India (Blower 1985b).

Population: No estimates.

Threats: Habitat loss due to timber harvesting and slash-burn cultivation, and poaching.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and along with all goral, in Appendix I of CITES. Evan's long-tailed goral is reported in the proposed Kyaukpandaung National Park, though poaching is common (Blower 1985b; FAO 1983a), and also in the proposed Natma Taung National Park (Blower 1985b; FAO 1983b). It also probably is found in Tamanthi, or Pidaung Wildlife Sanctuaries and in the proposed Alaungdaw Kathpa Wildlife Sanctuary. Not known whether Red goral occurs in any protected areas in Myanmar.

Status within country: Insufficiently Known (both species).

Conservation measures proposed: 1) Undertake surveys to estimate distributions and numbers. **2)** Develop a conservation strategy, including identification of potential protected areas. **3)** Increase effective protection within existing protected areas, and **4)** establish proposed protected areas.

Mishmi takin (*Budorcas taxicolor taxicolor*)

Distribution: Occupies the high mountain slopes above 2,750m in Kachin State, northern Myanmar, to border with China (Blower 1985b) (Map 9.7.4). No recent distribution data.

Population: No estimate.

Threats: Hunting by local tribesmen occurs, but the extent, and hence the impact on takin, is unknown.

Map 9.7.3. Suspected distribution of goral (*Naemorhedus* spp.) in Myanmar.

Map 9.7.4. Suspected distribution of Mishmi takin (*Budorcas taxicolor taxicolor*) in Myanmar.

Conservation measures taken: This takin is listed as Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix II of CITES. It does not appear to occur in any protected areas in Myanmar.

Status within country: Insufficiently Known.

Conservation measures proposed: Census to estimate numbers and current distribution, and to locate potential protected areas.

9.8 North Korea

D.M. Shackleton

Introduction

The Democratic People's Republic of Korea is a mountainous country occupying about 121,200km^2 of the northern portion of the Korean peninsula. The topography is generally mountainous. The Hamgyong mountains running along the northeastern coast, the Taebaek mountains in the southwest, and Nanghim mountains in the central region, are the principal ranges. Several large rivers originate in the western mountains and form large alluvial plains along the west coast. The Kaema plateau in the north, has an average elevation of 1,000m asl.

The climate is predominantly a cool, continental type. Annual rainfall varies, with the northern inland areas receiving around 610mm of rainfall each year, and most of the country about 1,000mm or more. Coniferous forests occur on the northern Kaema Plateau, and while the western lowlands were originally covered by temperate mixed forests, only a few patches remain in more remote areas. This loss of habitat has had a predictable and negative effect on wildlife.

General conservation measures taken

Nothing could be found on conservation in North Korea.

Species account

Amur or Korean long-tailed goral (*Naemorhedus caudatus raddeanus*)

Distribution and population: Nothing in known of the recent distribution of this species in North Korea outside the country. It is likely that it occurs (or occurred) in the Hamgyong mountains which lie inland from the northeastern coastline, and in the Taebaek mountains in the southwest and which continue into South Korea. A third area where it may occur is the Nanghim mountains in the north-central part of North Korea. These are extensions of the Changhai mountains from Jilin (China).

Population: No estimate.

Threats: Probably habitat loss and hunting.

Conservation measures taken: Two areas proposed as Biosphere Reserves (Poore 1986), Mount Myohyung Nature Reserve (37,500ha) 180km NE of Pyongyang and Mount Paektu (Paekdu) Biosphere Reserve (132,000ha; 41°56'N, 128°10'E), are reported to have goral. These proposed reserves lie across the border from the Changbaishan Biosphere Reserve in Jilin (China).

Status within country: Indeterminate.

Conservation measures proposed: 1) Surveys of population status and distribution, followed by 2) development of conservation actions.

9.9 South Korea

P-O. Won

Introduction

The Republic of South Korea was formed in 1948 by a United Nations resolution. This mainly mountainous country covers 98,993km^2 of the southern part of the Korean peninsula, bounded to the north by North Korea, by the Yellow sea to the west, and by the Sea of Japan to the east. The Taebaek mountains (Taebaek-sanmaek) run north-south along the eastern coastline and reach elevations up to 1,700m asl. From this eastern range, several lesser ranges run southwest, the largest of which are the Sobaek mountains (Sobaek-sanmaek). Relatively large lowland plains lie between the mountain ranges; the main ones being along the Han and Kum rivers in the western part of the country, and along the Naktong river in the southeast.

The climate is characterised by relatively cold winters and hot summers due to continental influences, and has a greater annual temperature variation in the north and interior than in the south and coastal regions. The original vegetation was dominated by extensive subtropical broadleaf, broadleaf, and coniferous forests.

As a result of human population pressures, most of this original forest cover, along with the wildlife, have disappeared.

Current status of Caprinae

There is only one member of the Caprinae found in South Korea, the Amur or Korean long-tailed goral (*Naemorhedus caudatus raddeanus*) (Prynn 1977). The distribution of this species in South Korea is extremely limited, and is now restricted to the steep forested hill regions in the northeastern part of the country. Habitat loss, due to forestry and land clearing for agriculture, is the major threat, but so is poaching because various parts of the goral are used for medicinal purposes, and its meat and hide are prized (Won 1988).

General conservation measures taken

The Korean Commission for Conservation of Nature was founded in 1963, and the country joined IUCN in 1966. In 1974, the Commission was renamed the Korean Association for Conservation, and since 1977, the First Lady of Korea has been its honorary president. Rare and endangered species are the responsibility of the Bureau of Cultural Property Preservation, under the Ministry of Culture, while wildlife conservation and hunting is administered by the Division of Forest Protection in the Office of Forestry Administration. Protected areas, including national parks, come under the Bureau of the Local Development in the Ministry of Home Affairs (Won 1979). The Charter of Conservation, to promote conservation, was enacted in 1978.

The Amur goral has been designated as a Natural Treasure by the Cultural Property Preservation Law in 1968, while hunting of all species was banned throughout the mainland between 1972 and 1981 (Won 1979). Mount Seorak National Park (Map 9.9.1), which contains goral, was approved as a Biosphere Reserve in 1982, and is protected by the National Monument Protection Law (No. 2233) of 1910, the law of Forestry (act 67.68) of 1908, and the National Park Law of 1962.

Map 9.9.1. Protected areas with Amur or Korean goral (*Naemorhedus caudatus radius*) in South Korea.

1) Mount Seorak National Park (37,300ha; est. 1970); **2)** Mount Odae National Park (29,850ha; est. 1975).

Species account

Amur or Korean long-tailed goral (*Naemorhedus caudatus raddeanus*)

Distribution: Restricted to the Seorak mountains at the northern end of the Taebaek range, northeastern South Korea (Map 9.9.2).

Population: Less than 50 animals are estimated to remain on Konbong mountain in Konsong-gun, Kangwon Province, near the demilitarised zone (DMZ) (Won 1988).

Threats: Major threats to its survival include habitat loss due to forestry, agriculture, and poaching.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix I of CITES. Goral is found in two protected areas in South Korea (Map 9.9.1); in Mount Seorak National Park, and rarely in Mount Odae National Park. Goral was designated as Natural Monument No. 217 on 14 November 1968 and theoretically receives full protection.

Status within country: Endangered.

Conservation measures proposed: **1)** Fully re-evaluate the species' status. **2)** Determine the feasibility of providing adequate protection through enforcing current protection measures, creating additional protected areas, or both. **3)** Determine if captive breeding may also be

Map 9.9.2. Distribution of Amur or Korean goral (*Naemorhedus caudatus raddeanus*) in South Korea.

required. However, without adequate habitat protection, this measure would be basically academic.

9.10 Taiwan

K-Y. Lue

Introduction

Taiwan (Republic of China) includes one large and 86 smaller islands, for a total area under its jurisdiction of some 36,960km^2. The main island of Taiwan, approximately 395km long by 145km wide and covering 36,000km^2, lies 161km across the Taiwan Strait from the southeast coast of mainland China. The Tropic of Cancer bisects the main island. The Central range (Chung-yang Shan-mo) forms most of the eastern half of the main island, and many of its peaks reach more than 3,000m asl. There are various outlying hills, but the western half of the country is a lowland region of alluvial plains and terraced tablelands.

The main island falls along the boundary between the tropical and subtropical climate zones. The highest mean monthly temperatures occur between June and September when they may reach 30°C. Although the lowland areas are frost free in winter, the Central Ranges are covered with snow. The average annual precipitation is 2,590mm, although summer levels can exceed 5,000mm in some years, and high elevations receive more than the low areas. More than half the country is covered by forest. Taiwan's topographic diversity creates a wide variety of habitats for plants and animals. Alpine tundra, alpine grassland, coniferous forest, broad-leaved forest and tropical rainforest are the major terrestrial ecosystems. In the lowlands, mixed bamboo stands, palm, and tropical evergreen broad-leaved forests occur, then between 600 and 1,800m asl are subtropical evergreen forests with camphor and laurel. Following these, between 1,800 to 2,500m asl, are broad-leaved evergreen forests with cedars, cypress, junipers, rhododendrons, maples (*Acer* spp.) and Japanese cedar (*Cryptomeria japonica*). Above 2,300m, are sub-alpine coniferous forests, and finally the alpine zone above 3,500m. Wildlife is relatively diverse and there are 62 species of mammals, 13 of which are unique to Taiwan (McHenry and Lin 1984; Steering Committee 1989).

Current status of Caprinae

Formosan serow (*Capricornis* [*crispus*] *swinhoei*) is an endemic caprin to Taiwan and was distributed all over the island before 1945 (Lue, 1983). Even though results of a 3-year survey between 1980 through 1983 showed that Formosan serow occurred in 11 among Taiwan's 16 counties (Lue 1983), since World War II, logging and agriculture have encroached upon the virgin forests inhabited by serow, resulting in significant habitat loss. In addition, poaching over the last two decades has caused the population to decrease dramatically.

Serow occupies elevations from 200m to 3860m asl near the peak of Yu-shan, the highest mountain in the country. Natural habitats used by serow include warm temperate rain-forest, virgin evergreen forests growing on steep mountain slopes, cliffs, disturbed slopes and alpine meadows. Serow is believed to feed mainly on evergreens and ferns in forested areas, and on grasses, forbs and shrubs in early successional forest and on disturbed slopes (McCullough 1974). Virtually nothing is known of its social organisation. Captive animals mark objects with their infra-orbital glands and have localised dung sites; both behaviours are suggestive of territoriality (Pao-Chung 1987). Its reproduction is known almost exclusively from a limited number of captive animals (Ito 1987; Pao-Chung 1987).

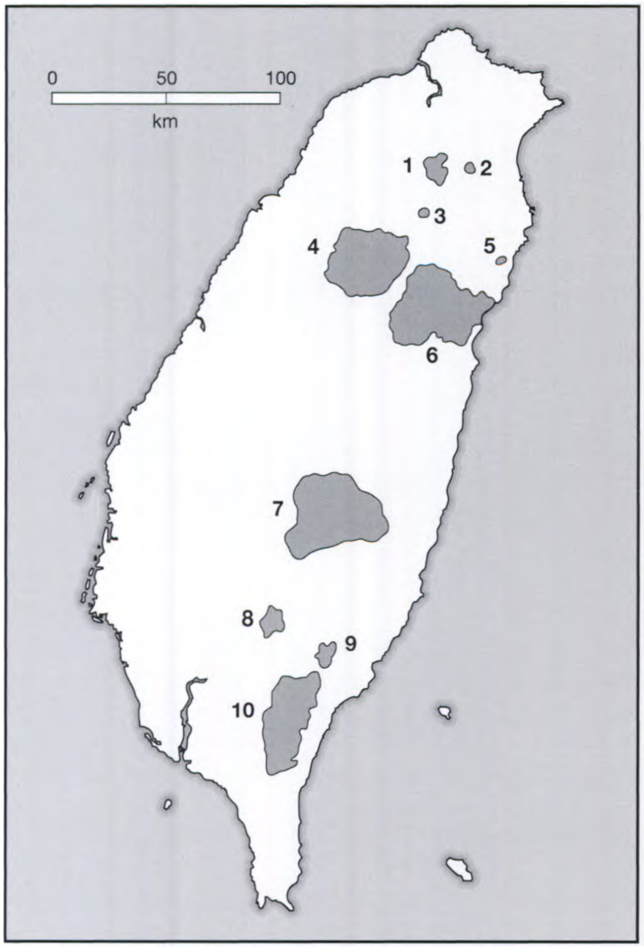
General conservation measures taken

Taiwan is one of the most densely populated countries in the world, with most people distributed along the western coastal plains. Rapidly increasing recreational activities are a major threat to serow and other wildlife.

The legal basis for wildlife conservation is the Wildlife Conservation Act passed in 1989. The Formosan serow is listed in this Act and is included in the "Precious and Rare species" group. The Council of Agriculture (COA) is responsible for administering this Act. Current protected areas legislation is covered by the National Park Law, 13 June 1972, designed to cover natural resources, as well as natural, historical and recreation areas. The Construction and Planning Administration (COA) in the Ministry of the Interior, is responsible for administration of national parks. Also concerned with wildlife conservation affairs, including serow protection, are Yu-shan and Taroko National Parks. The staffs of the COA and the National Park authorities, and park rangers, are appointed to protect wildlife. Unfortunately, outside these protected areas, manpower is insufficient to control illegal hunting activities. Three national parks and several nature preserves protect natural environments with serow populations (Map 9.10.1). More than 330,000ha are included within the Nature Conservation Systems in Taiwan, and ecosystems within national parks are stable with both fauna and flora abundant. Currently, serow in Yu-shan, Taroko and Shei-Pa National Parks are protected by Park authorities. In these three Parks, Formosan serow and other large mammals are used as an important outdoor educational resources for promoting nature conservation in Taiwan.

Map 9.10.1. Locations of protected areas with Formosan serow (*Capricornis* [*crispus*] *swinhoei*) in Taiwan.

1) Chatienshan NPr (7,759ha; est. 1992); **2)** Hahpen NPr (332ha; est. 1986); **3)** Yuanyang Lake NPr (374ha; est. 1986); **4)** Shei-Pa NP (76,850; est. 1992); **5)** Nanao Hardwood Forests NPr (200ha; est. 1992); **6)** Taroko NP (92,000ha; est. 1986); **7)** Yu-Shan NP (105,490ha; est. 1985); **8)** Chuyunshan NPr (6,248ha; est. 1992); **9)** Taitung Honyen Village Taiwan Cycas NPr (290ha; est. 1986); **10)** Tawushan NPr (47,000ha; est. 1988). NP = National Park; NPr = Nature Preserve.



Ecological and other biological research studies of serow were initiated about six years ago by the Department of Biology, of the National Taiwan Normal University. Its distribution, habitat use, age determination, feeding habits and behaviour, are the main subjects being investigated. Most research is supported by COA and National Parks. The main non-government organisation concerned with nature conservation is the Society for Wildlife and Nature Conservation (SWAN), with membership including individuals, bird clubs and government agencies.

Species account

Only a limited number of publications deal with the biology on Formosan serow in Taiwan (Lue 1977; McCullough 1974; Pao-Chung 1987; Steering Committee 1989).

Formosan serow (*Capricornis* [*crispus*] *swinhoei*)

Distribution: Widely distributed from northern to southern Taiwan, it occurrs in the mountainous regions in 11 of Taiwan's 16 Provinces (Map 9.10.2). Here, serow ranges from 200 to >3,800m asl, with most populations occupying regions between 1,000 and 3,000m asl.

Population: No estimate of total population size. An average density of 22 serow/km^2 was estimated in part of Yu-shan National Park. According to casual observations of park rangers, hikers and wildlife researchers, serow populations in National Parks may be increasing. However, this impression is confounded because the number of park visitors is also increasing (see below).

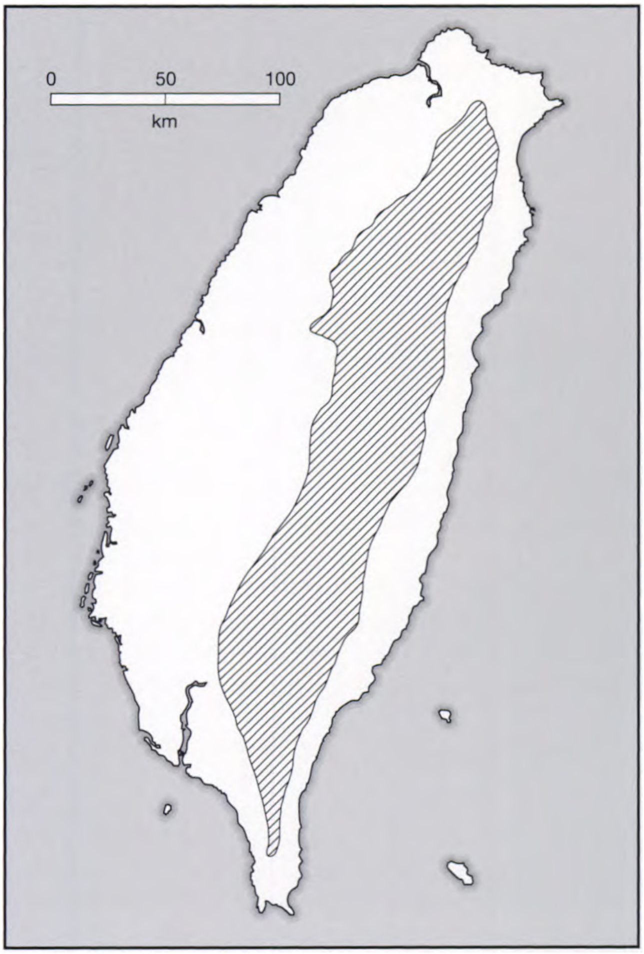
Threats: In the past, wildlife was a major source of protein for the local people, but as a result of highly successful economic development, the general public's living standard is improving. Today, protein from wildlife is becoming less and less important. Unfortunately, hunting still occurs, and so thorough enforcement of conservation laws is necessary. Although hunting serow is illegal throughout

Taiwan, it occurs virtually unchecked outside national parks. In addition, forestry and agricultural activities in mountain regions have encroached on the virgin forests originally inhabited by serow. The latest threat to serow comes from increasing recreational and tourist pressures, and though the impact is unknown, it is believed that it will become a major threat to all wildlife in the very near future.

Conservation measures taken: Formosan serow is classed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Since 1989, it has been listed as a "Precious and Rare species" under Taiwan's Wildlife Protection Act, and hunting the species is prohibited. Serow is protected in three National Parks and in 12 Nature Reserves (Map 9.10.1). Recently, through the development of environmental-protection awareness and enforcement of related wildlife protection laws, conditions for serow have improved. Most importantly, the Council of Agriculture and two National Park agents, are now responsible for the serow's conservation.

Status within country: Vulnerable.

Map 9.10.2. General distribution of Formosan serow (*Capricornis* [*crispus*] *swinhoei*) in Taiwan.



Conservation measures proposed: 1) Academic research institutes or governmental agents should establish a biological data bank on Formosan serow for use in planning a conservation program. This should include information about distribution, population dynamics, habitat requirements, its role in the forest ecosystems, monitoring methods, and determining impacts of land-use practices. Due to the unique montane landscape found throughout the island, field research is often very difficult. Radio-tracking is problematic because of the steep terrain and narrow valley systems. Traffic problems and poor visibility also create problems for researchers in forest ecosystems. **2)** Seek advice from international conservation organisations and academic research institutes. The ecological characteristics of Japanese serow (*Capricornis crispus*) are similar to Formosan serow. Co-operation between Taiwanese wildlife biologists and Japanese serow biologists will improve research efforts on Formosan serow. **3)** Develop a public education program about wildlife in general, and about serow in particular, to reduce the new pressures facing Formosan serow from recreation and tourist activities in National Parks. **4)** Encourage non-government organisations to sponsor Caprinae conservation, and to plan and help educate the public on conservation issues.

9.11 Thailand

S. Lovari

Introduction

The Kingdom of Thailand covers 513,115km^2 of the western side of the Indochinese peninsula of Southeast Asia. Four physiographic divisions can be recognised starting in the mountainous north. Here, the ranges run in a series of parallel ridges as a continuation of the Himalayan system from India, Myanmar, and China. The mountains average 1586m asl and are covered by thick, tropical monsoon forests. The fertile, central plain region is dominated by the Hao Phraya River delta. To the northeast lies the Khorat plateau, a low elevation sandstone area averaging only 200m asl and covered mainly by savannah grass and shrub lands. Southern Thailand covers the northern part of the Malayan peninsula and consists of densely forested, rolling hills.

The subtropical climate is dominated by monsoons and has three distinct seasons, with annual precipitation varying from 900mm in the east to >2,500mm in the Peninsular region. The forests of Thailand vary considerably over the country and can be divided into two main categories: evergreen and deciduous. The evergreen forest can be further subdivided into four forest types:

Tropical Evergreen, Coniferous, Swamp, and Beach. Tropical Evergreen forest itself is again divisible into three sub-types: the Tropical Rain forest in the Southeastern and Peninsular Regions; the Dry or Semi-evergreen forest scattered all over the country; and the Hill or Lower Montane forest confined to areas >1,000m asl and scattered all over the country, but mostly found in the north-western highlands. Coniferous forest is dominated by pines and is scattered in small pockets in the north-western highlands and on the Korat plateau between 200 and 1,300m asl. Swamp forest is a unique type occurring along the depressions in low-lying land, around estuaries, and along the muddy seashores. Beach forest occurs on coastal sand dunes, rocky seashores and elevated seashore coasts. This forest type is most common along the east coast of the country. Deciduous forests are found in the dry belt where rainfall is <1,000mm/year and the climate is more seasonal. This forest type is often subjected to ground fire during the dry season. Deciduous forests can be divided into three main sub-types: Mixed Deciduous forests composed of several deciduous species in a mixed association (but in certain localities a single species such as teak (*Tectona grandis*) may predominate); relatively open, Dry Dipterocarp forest on undulating peneplains and ridges, with the predominant species belonging to the Dipterocarpaceae; and Savannah forest, the most extreme deciduous type that develops following burning, and which is most common in the north-eastern region.

Current status of Caprinae

Two species of Caprinae are native to Thailand: serow (*Capricornis sumatraensis*) and Evans' long-tailed goral (*Naemorhedus caudatus evansi*). Serow is represented by two subspecies: the Indochinese serow (*C. s. maritimus*) in the main part of the country, and by Sumatran serow (*C. s. sumatraensis*) in the south on the Malayan peninsula. Both subspecies inhabit a variety of forest types growing on limestone crags in foothill and hill habitats, including rainforests up to 600m, mixed deciduous up to 1,500m, and evergreen forests up to 2,000m. Evans' long-tailed goral is found usually above 1,500m where it inhabits steep grassland slopes, montane scrub and evergreen hill forests with limestone crags. The species faces extinction in Thailand, and even if steps are taken immediately, it may be already too late to halt its final decline. The slash-and-burn cultivation system, often used to grow opium illegally, greatly endangers the last few populations of goral in the northwest.

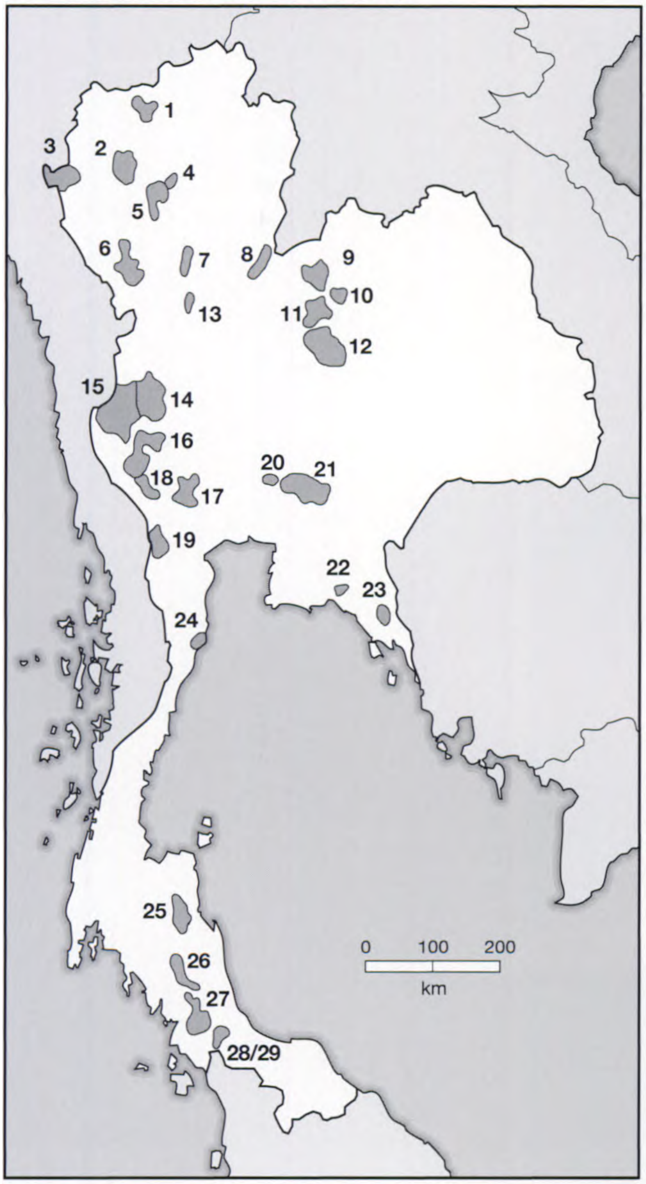
Deforestation, primarily for timber, but also for agriculture, is the main threat to both species, although poaching is also widespread. The recent steps to halt further timber harvesting may be too late. Only legal logging will be affected by the ban, and with about 50% of logging in the country taking place illegally, it is uncertain what effect the ban will have. In addition to habitat loss and poaching, conservation faces problems in border areas where armed conflicts with neighbouring countries are occurring, or where areas are being used by insurgents.

General conservation measures taken

Records of official conservation measures date back to the reign of King Ram Khamkaeng the Great, when the Royal Dong Tan Park was established in the 13th Century. As a consequence of Buddhist beliefs, protected areas have also long been established in the areas surrounding temples and other religious sites. However, little other conservation action occurred until 1896 when the Royal Forest Department was founded. The Department operates under two Forest Acts, B.E. 2484 (1941) and B.E. 2503 (1963). These Acts were later strengthened by the National Forest Reserves Act B.E. 2507 (1967). The first forest parks for recreation and habitat protection were created by the Forest Department in the 1940s and 1950s. Two key Acts deal with protected areas and other nature conservation measures. The first is the Wild Animals Reservation and Protection Act B.E. 2503 (1960) that covers protected areas (wildlife sanctuaries and non-hunting areas), and regulations controlling hunting and wildlife trade, and also ensures total protection for a small number of species. Additional conservation legislation is provided by the Enhancement and Conservation of National Environment Board within the office of the Prime Minister. The Board submits recommendations for environmental policy to the Cabinet, and operates through the Office of the National Environment Board which is divided into sections responsible for environmental information, impact evaluations planning policy, and standards (IUCN 1992b; WCMC 1987). The second, the National Parks Act B.E. 2504 (1961), covers primarily establishment and management of National Parks. These are created by Royal Decree on government land only, and provide complete protection to both living natural resources and landscape. Wildlife Sanctuaries, also known as Wild Animal Preserved Areas in the 1960 Act, are similarly established by Royal Decree on publicly owned lands only. Their function is species conservation, and they provide rigorous protection by forbidding hunting and by protecting habitat. The Ministry of Agriculture and Co-operatives designates non-hunting areas, on either state or private lands, to conserve specific species, though hunting, agriculture, and timber felling is permitted within their boundaries. Two forest types are defined under the National Forest Reserves Act B.E. 2507: Production, and Conservation Forests. National Parks, Wildlife Sanctuaries, and most non-hunting areas, fall into the second category (IUCN 1992b; WCMC 1987). There are many protected areas with serow, and a

Map 9.11.1. Location of protected areas in Thailand known or suspected to contain Caprinae.

1) Doi Chiang Dao WS (52,100ha; est. 1978); **2)** Doi Inthanon NP (48,240ha; est. 1972); **3)** Salawin WS (87,500ha; est. 1978); **4)** Doi Khuntan NP (25,529ha; est. 1975); **5)** Doi Pha Muang WS (58,320ha; est. 1980); **6)** Om-Koi/Mae Tun WS (117,300ha; est. 1978); **7)** Si Satchanalai NP (21,320ha; est. 1981); **8)** Phu Miang-Phu Thong WS(54,500ha; est. 1977); **9)** Phu Luang WS (84,799ha; est. 1974); **10)** Phu Kradung NP (34,812ha; est. 1962); **11)** Nam Nao NP (96,600ha; est. 1972); **12)** Phu Khieo WS (156,000ha; est. 1972); **13)** Rhamkhamhaeng NP (34,100ha; est. 1980); **14)** Huai Kha Khaeng WS (257,464ha; est. 1972); **15)** Thung Yai Naresuan WS (320,000ha; est. 1974); **16)** Si Nakarin NP (153,200ha; est. 1981); **17)** Chaloem Rattankosin NP (Than Than Lot) (5,900ha; est. 1980); **18)** Erawan NP (55,000ha; est. 1975); **19)** Maenam Phachi WS (48,931ha; est. 1978); **20)** Khao Sam Lam NP (4,457ha; est. 1981); **21)** Khao Yai NP (216,863ha; est. 1962); **22)** Khao Chamao-Khao Wong NP (8,368ha; est. 1975); **23)** Namtok Phliu NP (Khao Sabup) (13,450ha; est. 1975); **24)** Khao Sam Roi Yot NP (9,808ha; est. 1966); **25)** Khao Luang NP (57,000ha; est. 1974); **26)** Khao Pu-Khao Ya NP (69,400ha; est. 1982); **27)** Khao Banthat WS (126,699ha; est. 1975); **28)** Tong Nga Chang WS (18,200ha; est. 1974); **29)** Thaleban NP (10,168ha; est. 1980).
NP = National Park; WS = Wildlife Sanctuary.



smaller number suspected to harbour goral (Map 9.11.1), however, poaching is frequent in most of these and illegal logging also occurs in many of them (WCMC files). In January 1989, following extensive floods and mud slides in which 350 people died, the government passed two royal decrees banning all logging in the country, and declared 1989 a year of nature and environmental protection.

At the request of the National Environment Board, IUCN prepared a national conservation plan for Thailand. The plan's guidelines were included in the fifth Five Year National Social and Economic Development Plan (1982–1986). Expansion of the protected areas system was a major recommendation. A 1982 report by UNDP/FAO, commented on the strengths and limitations of the protected areas system in Thailand which, with the assistance of WWF and IUCN, led to the compilation of a protected areas management plan in 1984. These efforts inspired the preparation and implementation of management plans for an additional 23 protected areas as part of the Sixth Five Year Plan (1987–1991), including the creation of a rural development program for conservation by villagers living around Khao Yai National Park. This program, and a similar one based on wildlife farming at Phu Khieo Wildlife Sanctuary, directs benefits from the protected areas to local people and so helps reduce poaching and habitat degradation. Another assessment of protected areas was funded by USAID in 1986, and in addition to compiling data from many sources, the report made a wide range of recommendations (IUCN 1992b; WCMC 1987).

General conservation measures proposed

Slash-and-burning of forest, as well as the use of fire to flush game, should be prohibited not only on paper but in practice. In fact, human-induced and uncontrolled forest fires are common throughout Thailand in the dry season (March–April), even in protected areas. Less tolerance should be shown to illegal wildlife and forest harvesters, even when people from the "hill tribes" or ethnic minorities are involved. If use (not indiscriminate over-exploitation) of wildlife and forest resources is locally unavoidable because of economical and political reasons (e.g. in border areas), it should be planned and executed as much as possible according to scientifically-based conservation management plans. Relevant costs may be shared between the Thai Government and international conservation bodies and foundations. It is essential to recognise that wardens in protected areas must be provided with basic, but essential equipment, such as field glasses and rifles, and most importantly, given appropriate training. Without such support, an effective anti-poaching program is impossible.

Captive breeding of the serow and goral is recommended. The turn-over of captive serow in local zoos is appallingly high. Animals are taken from the wild and all too often die in captivity within a year. Although serow seem to reproduce readily in enclosures, their offspring rarely survive longer than a year. Perhaps some joint captive breeding program could be started between Thai zoos and western zoological gardens that have appropriate funding, facilities, and expertise to breed Caprinae (e.g. San Diego Zoological Society, Bronx Zoo, etc.).

Species accounts

Some information on goral in Thailand has been published by Nabhitabhata (1983), while Lovari and Apollonio (1993) provided a brief account on aspects of the ecology (daily time budget, group size, and density) of goral in the Om-Koi Wildlife Sanctuary, Doi Mon Chong mountain, Tak Province. Nothing has been published on the serow of Thailand except for a short report by Lovari and Locati (1994) on the physical characteristics of sites used by serow for dung-marking in Khao Sam Roi Yot National Park.

Serow (*Capricornis sumatraensis*)

Distribution: Originally widely distributed throughout the country, the species is now restricted to steep, forested limestone hills and cliffs, in areas relatively inaccessible to human encroachment. Lekagul and McNeely (1988) stated that even when the surrounding areas were completely taken over by cultivation, these steep hills remain covered with dense vegetation. Such areas act as miniature sanctuaries for the serow. In 1977, these authors also reported serow in the north and northeast Thailand, but Nakasathien (1986) suggested a much more conservative distribution. The dividing line between the ranges of *C. s. maritimus* and *C. s. sumatraensis* is unclear, but is suspected to fall somewhere in the Chooporn or Suratchathani Provinces on the Malayan peninsula (Map 9.11.2).

Population: No estimates of numbers or population trends for either subspecies.

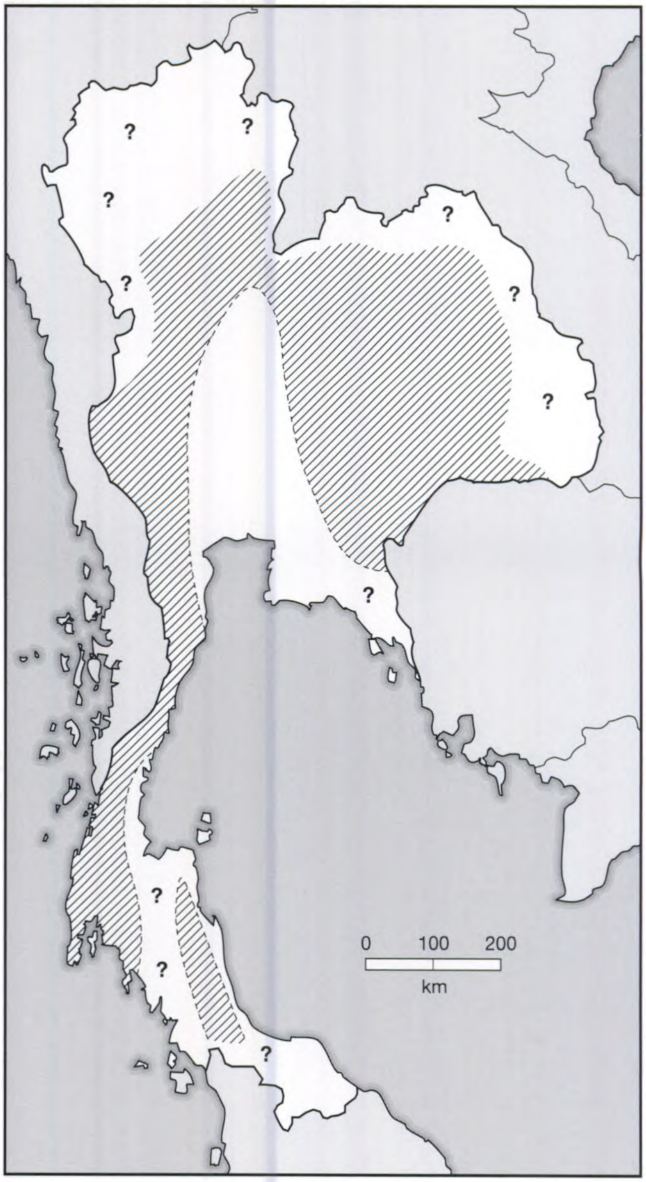
Threats: Loss of habitat caused by logging and land clearing (e.g. slash-and-burn) for agriculture. However, poaching for meat and medicinal purposes is also a major threat.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996) and in Appendix I of CITES, serow is also protected in Thailand. It is known or expected to occur in the following protected areas: ***National Parks*** – Chaloem Rattankosin (Than Than Lot); Doi Inthanon; Doi Khuntan; Erawan; Khao Chamao-Khao Wong; Khao Luang; Khao Pu-Khao Ya; Khao Sam Lam; Khao Sam Roi Yot; Khao Yai; Nam Nao; Namtok Phliu (Khao Sabup); Phu Kradung; Rhamkhamhaeng; Si Nakarin; Si Satchanalai; Thaleban and possibly Ao Phangnga. ***Wildlife Sanctuaries*** – Doi Chiang Dao; Doi Pha Muang; Huai Kha Khaeng; Khao Banthat; Om-Koi/Mae Tun; Maenam Phachi; Phu Khieo; Phu Luang; Phu Miang-Phu Thong; Salawin; Thung Yai Naresuan; Tong Nga Chang (Map 9.11.1).

Status within country: Indeterminate.

Conservation measures proposed: Determine the serow's status to assess the effects that logging and poaching are having on its distribution and numbers. Other proposals for serow conservation are given above in **General conservation measures proposed**.

Map 9.11.2. Suspected and general distribution of serow (*Capricornis sumatraensis*) in Thailand (modified after Nakasathien 1986).



Evans' long-tailed goral (*Naemorhedus caudatus evansi*)

Distribution: Restricted to hills along the Ping river, the most likely area with this goral is on Doi Mon Chong (1,600 to 1,970m asl), Northern Tak Province, to the west of the Bhumibol Dam (Nabhitabhata 1983) (Map 9.11.3).

Population: No estimates of numbers or trends, other than a single local density estimate of ca. 5 goral/km^2 in Om-Koi Wildlife Sanctuary on Doi Mon Chong mountain, Tak Province (Lovari and Apollonio 1993).

Map 9.11.3. Known and suspected general distribution of Evans' long-tailed goral (*Naemorhedus caudatus evansi*) in Thailand (based on data from S. Nakasathien 1987, *in litt.*).

Threats: Loss of habitat caused by logging and land clearing for agriculture, and also poaching for meat and medicinal purposes.

Conservation measures taken: Listed as Vulnerable (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and with all goral, in Appendix I of CITES. Goral is believed to occur in only three protected areas: Doi Chiang Dao, Om-Koi/Mae Tun, and Salawin Wildlife Sanctuaries (Map 9.11.1).

Status within country: Endangered.

Conservation measures proposed: It is critical to determine the status and distribution of goral immediately so that steps can be taken to protect the remaining populations. For other proposals affecting goral see above in **General conservation measures proposed**.

Acknowledgements: S. Nakasathien, and P.D. Round.

9.12 Vietnam

Ha Dinh Duc

Introduction

Vietnam stretches approximately 1,650km along the eastern edge of the Indochinese peninsula, with about 3,260km of coastline and an area of 329,600km^2. A number of archipelagos are also part of Vietnam's territory, including Hoang Sa about 300km from Da Nang, Truong Sa 500km from Cam Ranh, and Tho Chu 200km from Rach Gia. The northern part of the country includes mountain chains and plateaux. There, the main mountain ranges are the limestone Hoang Lien Son which includes the country's highest peak (Phansi Pang, 3,143m asl), and the Song Gam, Ngan Son and Dong Trieu mountain chains. The major plateaux of the north are the Dong Van (Ha Tuyen Province) on the border with China, and the Son La and Moc Chau in the Son La Province. In the central part of Vietnam, the dominant topographic feature is the evergreen-forest covered Truong Son mountain range, running north-south and reaching elevations of over 1,800m asl. The basalt Tay Nguyen plateau covers about 10,000km^2 and is comprised of several sub-units (Lam Vien and Di Linh, Lam Dong Province; and Pleiku, Gia Lai - Kontum Province) which range from 800 to 1,600m asl and are covered mainly with deciduous Dipterocarp forest, as well as coniferous, evergreen and mixed forests. The other major topographic features are two large alluvial river deltas. The North delta covers about 1,500km^2 and belongs to the Song Hong (Red river) system that divides the northern uplands from the lowland region. In the extreme south is the Mekong delta of the Cuu Long River system covering around 6,130km².

Though Vietnam's climate is tropical, it varies significantly between the northern and southern parts of the country. In the north, there are four seasons with mean temperatures between 23°C and 25°C, and a mean annual rainfall of 1,800mm, while in the south there are two main seasons and average temperatures range from 28°C to 30°C and annual precipitation is 2,000mm (Mai Xuan San 1985). The native vegetation can be divided broadly into evergreen and deciduous forests, though in most areas, forests are mixed. In 1943, forest covered ca. 44% of the country, but has since declined so that only ca. 28% was still forested in 1987, including 583,000ha of replanted forest (Nguyen Quangha 1990). The main type in the north and north-central regions is an evergreen forest of *Shorea siamensis, Castanopsis indica*, and *Quercus* spp. In the south-central region are Dipterocarp forests dominated by *Dipterocarpus obtusifolius, D. intracatus, D. tuberculatus*, and *Pentacme siamensis*. Bamboo forest is another major forest type which contain *Bambusa arundinacea, B. beecheyna, B. nutan, B. racemosa,* and *Rattan* spp. There are also coniferous forests of *Pinus mercusii* in the Northeast and other places in the north, and of *P. khasya* in the north and highlands of Lam Dong province.

Current status of Caprinae

Only one species of Caprinae is known to occur with certainty in Vietnam; this is the Indochinese serow (*Capricornis sumatraensis maritimus*). It is found where suitable habitat in the form of forested limestone mountains and cliffs occur, and ranges from northern Vietnam to the south-central areas of Bao Loc and Cat Tien Districts, Lam dong Province (Pham Mong Giao *et al.* 1990). Although Groves and Grubb (1985) recognise only one subspecies, local zoologists claim that the serow inhabiting Cat Ba island is significantly different, being larger and darker than the mainland form (Ha Dinh Duc *et al.* 1990).

General conservation measures taken

The original vegetation was tropical forest, but Vietnam suffered a state of almost continuous war from 1945 to 1975, that in addition to the loss of human life, caused severe damage to her natural resources. The effects continue today, with perhaps the most severe being the effects of defoliants, the extent of which has not been fully assessed. In many areas the natural forests have been replaced by secondary grasslands (IUCN 1985), while the persistence of the herbicide "Agent Orange" has amongst other effects, slowed re-forestation attempts (IUCN 1992b; WCMC 1989).

Establishment of protected areas, together with the flora and fauna they contain, is provided by Article 5 of the Law on the Protection of Forests (1972). Protected areas are separated into Protected Forests administered by the Department of Forest Management and Protection in the Ministry of Forests, and into National Parks, Nature

Map 9.12.1. Locations of protected areas with Indochinese serow (*Capricornis sumatraensis maritimus*) in Vietnam.

***National Parks*: 1)** Cat Ba (27,700ha; est. 1986); **2)** Cuc Phuong (25,000ha; est. 1962. ***Nature Reserves*: 3)** Trung Khanh (3,000ha; est. 1986); **4)** Hoang Lien Son (5,000ha; est. 1986); **5)** Ben En (12,000ha; est. 1986). ***Historical and Cultural Reserves*: 6)** Ba Be (5,000ha; est. 1977); **7)** Bac Son (4,000ha; est. 1977); **8)** Ba Vi (2,144ha; est. 1977); **9)** Yen Tu (2,000ha; est. 1986).

Reserves, and Historic and Cultural Reserves, all managed by the Forestry Officers of the local People's Committee (IUCN 1992b; WCMC 1989). Certain types of resource exploitation are allowed with permission, such as erecting buildings and collecting fuelwood, but others such as logging and agriculture also take place due to lack of adequate support for forest management personnel. All such resource exploitation is occurring at such an extent that forest cover is declining even faster than during the war, especially in the midlands (IUCN 1992b; WCMC 1989). Although serow is found in at least nine protected areas (Map 9.12.1), it receives essentially no real protection in Vietnam.

The Programme for the Rational Utilisation of Natural Resources and Environmental Protection was established in 1981, in an attempt to address the country's severe environmental problems. Following this, a National Conservation Strategy was developed in co-operation with IUCN, that identified the major threats, and recommended several priorities including the establishment of a National Board of Environmental Co-ordination at the ministerial level, together with establishment of more protected areas (IUCN 1992b; WCMC 1989). The strategy was approved by the Council of Ministers in 1991, and has served as a guiding document for biodiversity conservation in Vietnam. Protected area management plans and additional surveys of forest areas are being undertaken by staff of the University of Hanoi, the Forestry Inventory and Planning Institute, the Ministry of Forests, and WWF-International.

Responsible organisations for Wildlife Conservation and Management include the Centre for Resources Management and Environmental Studies (CRES) and the Faculty of Biology (FOB) both of the University of Hanoi, the Institute of Ecology and Biological Resources (IEBR) of the Scientific Academy of Vietnam, and the Forest Inventory and Planning Institute (FIPI) and Department of Protected Forests (DPF) both in the Ministry of Forestry.

Species account

Observations on the behaviour and ecology of serow in Vietnam have been published by Dang Huy Huynh (1986), Do Tuoc (1990) and Le Hien Hao (1973).

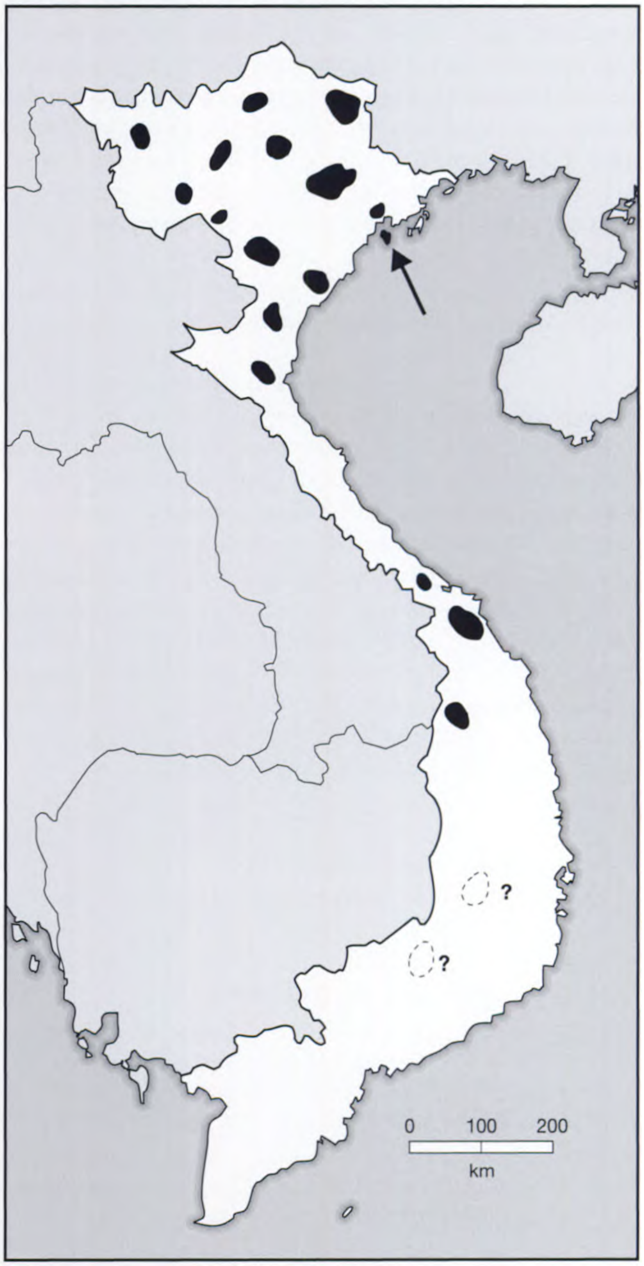
Indochinese serow
(*Capricornis sumatraensis maritimus*)

Distribution: Found on limestone mountains and cliffs throughout Vietnam, except in the south (Map 9.12.2). Population densities are low in Lai Chau, Son La, and Hoang Lien Son, but higher in Ha Tuyen, Cao Bang, Lang Son and Quang Ninh. Serow is distributed along the Truong Son chain across the Hai Van Col to the Ba river (Dang Huy Huynh 1986), and is also known in Pha Son Binh (Dao Van Tien 1985), Cat Ba (Ha Dinh Duc *et al.* 1989; Le Hien Hao 1973), Gia Lai Kontum (Do Tuoc 1990) and Lam Dong (Phan Mong Giao 1990). Populations are widespread but small and scattered.

Population: No estimate of population numbers, trends or densities.

Threats: Serow is frequently hunted for meat and for sale as live individuals in many local markets, while its bones are valued for medicinal purposes (TRAFFIC 1993). The inaccessibility of its range may be the serow's only current

Map 9.12.2. Distribution of Indochinese serow (*Capricornis sumatraensis maritimus*) in Vietnam.



defense against total eradication. Habitat loss is also a serious threat, resulting previously from defoliants used during the war, and now from agricultural expansion and forestry. In addition, the typically small populations are probably genetically isolated by the numerous and extensive rice paddies that form barriers between the forested limestone habitat patches used by the serow. No animals are kept in captivity in Vietnam (Ratajszczak, *in litt.* 1990).

Conservation measures taken: Serow is listed as Endangered (A2cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), in Appendix I of CITES, and is included in Appendix II of the Endangered and Rare Species List of Vietnam. However, it is not included in the list of 38 species covered by Declaration No. 276 of the Ministry of Forestry (2 June 1989) and Decision No. 18 HDBT of the Council of Ministers (17 January 1992), so serow can be hunted or captured. It does occur in nine protected areas, but they are all in the northern part of the country (Map 9.12.2), and they do not provide safety from poaching. It is also reported in Va Quang Nature Reserve. Serow is also threatened by agriculture (grazing), fuelwood gathering, and logging, in Cat Ba National Park.

Status within country: Indeterminate.

Conservation measures proposed: Its scattered range throughout the forested mountainous regions of the country make an effective serow conservation program difficult. Serow is widely hunted by locals who kill it for food, hides, and use its bones for medicinal purposes (e.g. serow bone glue). Conservation measures which should be implemented include: **1)** place serow in Appendix I of the Protected Animals List of Vietnam; **2)** ban all hunting of serow, especially in protected areas; **3)** carry out surveys to determine the current status of serow, distribution and population densities; **4)** establish a breeding population at Cat Ba National Park; and **5)** promote a public education program to encourage local people to protect serow and its habitat.

Acknowledgements: R. Ratajszczak.

9.13 Regional summary

D.M. Shackleton

Status and problems

Very little is known about numbers, or even accurate distributions, of the three species of Caprinae found in the Far East. In fact, there is probably less known about Caprinae in this Region than in other parts of the world. All taxa except the Japanese serow (*C. crispus*) are considered either Insufficiently Known (K), Indeterminate (I) or Endangered (E) within the Region, and these categories differ little from their 1996 world-wide status (Table 9.13.1).

Hunting and habitat loss are the universal threats. Land clearing probably has the largest impact by causing extensive and permanent habitat loss. In Vietnam, the current rate of deforestation is even greater than during the war when chemical defoliants were used extensively. Habitat loss throughout the Region is the result either of unsustainable logging, clearing land for agriculture, or a combination of each. Both activities are the result of the rapidly increasing human populations (food production), and the need for employment and foreign exchange (e.g. timber exports). In addition, serow and goral are also hunted for food and medicinal purposes in most countries. Unfortunately, as in other parts of the world, some countries within the Region have conservation problems arising from ongoing armed conflicts, or from fighting in the recent past that resulted in widespread amounts of unexploded ordnance and other products that create a serious threat to humans as well as to wildlife.

Main conservation actions required

In general, it is clear that surveys are desperately needed not just to estimate numbers or at least densities, but also to establish actual current distributions and the degree of fragmentation. Too many of the maps in this chapter, show only general or suspected distributions. However, this is not unexpected given the relatively solitary nature of goral and serow, and also their visually dense habitats and difficult topography.

International actions

1) Mishmi takin is a clear candidate for international conservation action on the part of the governments of Myanmar, China, and perhaps India. Co-ordination of surveys and establishment of protected areas along their shared border would greatly benefit the conservation of this species that appears restricted to this area.

2) While ideally the level of international trade in serow and goral for medicinal purposes needs to be determined, perhaps it may be more effective and timely for the countries in the Region to re-examine trade laws that relate to export of parts of these species. They may also consider other means for limiting such activity until a better understanding of the status of these species is known. In this area, there is a clear role

for the TRAFFIC network, as well as for the parties and Secretariat of the CITES Convention.

3) There are no other obvious candidates for specific, joint international conservation efforts. However, pooling efforts, expertise and experience of biologists at international workshops, could be invaluable for more efficiently developing techniques for effective population survey techniques for these small, forest-dwelling Rupicaprids, and the takin. Any such development should also include biologists from countries such as Bhutan, China, India, Nepal and Pakistan, all of which have one or more of the Caprinae found in the Far East Region. With regard to workshops and meetings, sponsorship should be sought through international conservation agencies such as WWF and IUCN, in addition to national governments. Fortunately, any techniques that are found useful for one species will probably be applicable to all other forest-dwelling Caprinae in the region. However, it will be necessary to develop techniques that allow differentiating between goral and serow when the animals are sympatric and difficult to observe. Development of survey methodology should be regarded as a top priority for the Region because population and distribution data are essential for developing appropriate conservation actions. Because these data will take time to collect, national conservation efforts must in the meantime also protect more habitat, create more protected areas, and develop public education programs, to ensure the continued survival of these Caprinae.

Table 9.13.1 Summary of conservation status (category of threat[1]) of Caprinae in South-East Asia. Except for Japanese serow (*Capricornis crispus*) of which there are an estimated 100,000 individuals, no other population estimates are available for Caprinae in this region.

Taxon	Bangladesh	Cambodia	Indonesia	Japan	Laos	Malaysia	Myanmar	North Korea	South Korea	Taiwain	Thailand	Vietnam	Red List (CITES)[2]
Serow *Capricornus*													
Japanese serow *C. crispus*	-	-	-	S	-	-	-	-	-	-	-	-	LRcd
Indochinese serow *C. s. maritimus*	-	K	-	-	K	-	K	-	-	-	I	I	VUA2cd
Red serow *C. s. rubidus*	E	-	-	-	-	-	K	-	-	-	-	-	ENA2cd[3]
Sumatran serow *C. s. sumatraensis*	-	-	E	-	-	E	-	-	-	-	-	-	ENA2cd[3] (I)
Formosan serow *C.* [*c.*] *swinhoei*	-	-	-	-	-	-	-	-	-	V	-	-	VUA2cd
Goral													
Burmese red goral *N. b. cranbrooki*	-	-	-	-	-	-	K	-	-	-	-	-	VUA2cd (I)
Evans' long-tailed goral *N. c. evansi*	-	-	-	-	K	-	K	-	-	-	E	-	VUA2cd (I)
Korean or Amur long-tailed goral *N. c. raddeanus*	-	-	-	-	-	-	-	I	E	-	-	-	VUA2cd (I)
Takin													
Mishimi takin *B. t. taxicolor*	-	-	-	-	-	-	K	-	-	-	-	-	ENA2cd (II)

[1] Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List (Groombridge 1993); S = not threatened.
[2] Global category of threat listed in 1996 IUCN Red List of Threatened Animals (IUCN 1996); - not listed. CITES: I = Appendix I; II = Appendix II.
[3] Listed under *Capricornis sumatraensis*.

Chapter 10

North America

10.1 Canada

D.M. Shackleton, N. Barichello, A. Gunn, D.H. Hebert, and F. Harper

Introduction

Covering about 9,922,330km² between longitudes 42° to 83°N and latitudes 53° to 141°W, Canada is the second largest country in the world but also one of the most sparsely populated. Bounded by three oceans, the Arctic, Atlantic and Pacific, and by the United States of America to the south and northwest (Alaska), Canada is not a single land mass but includes numerous islands, especially in its Arctic region. Canada's Arctic islands run along the northern edge of the Canadian Shield from Ellesmere island in the east adjacent to Greenland, west as far as the Queen Elizabeth islands. The largest physiographic region is the vast Canadian Shield centred around Hudson's Bay and accounting for almost half the country. The Great Lakes-St. Lawrence lowlands lie to the southeast of the Canadian Shield, and though relatively small compared to the other regions, is the most densely populated part of the country. Further east still, is Canada's Appalachian region covering an area north-eastwards from the eastern townships of Quebec to the Gaspé peninsula, the Maritimes and Newfoundland on the east coast. South of the Shield, the Interior plains extend as far south as the border with the United States, and stretch westward from the Manitoba lowlands across Saskatchewan to the eastern slopes of the Rocky mountains in Alberta. A vast cordilleran region in western Canada, at times up to 800km wide, stretches from western Alberta across British Columbia (BC) to the Pacific, and from the western edge of the Northwest Territories (NWT), west across Yukon. It contains many, major mountain ranges running predominantly north-south in parallel with the Pacific coastline. In the north, the Mackenzie river flowing north from Great Slave lake to the Arctic ocean is flanked to the east by the Franklin mountains and by the Mackenzie mountains to the west. At the northern end of the Mackenzie range, along the Yukon boundary, are the Richardson mountains that continue north-westward into the British mountains straddling the Yukon-Alaska border. Immediately to the south lie the Ogilvie and Selwyn mountains of north-central Yukon, while in the south-central region are the Pelly mountains, and in the extreme southwest corner, the St. Elias range. This latter range containing Canada's highest peak, Mount Logan (5,951m asl), continues northwest to form Alaska's Wrangell range, and to the south it is continuous with the Coast Ranges of southern Alaska and BC. These coastal ranges in BC include large glaciers and icecaps, with many mountain peaks over 3,000m, including the highest in BC, Mount Waddington at 4,042m asl. Vancouver island, lying off the southwest BC coast, itself the largest island in the Pacific, also has a mountainous spine running almost its entire length. Between the Coast mountains flanking BC's western Pacific shores and the Rocky Mountains along its boundary with Alberta, are several mountain systems including the Selkirks and the Purcells. Mount Robson (3,952m) is the highest peak in the Rocky Mountains, but at least 30 others exceed 3,000m. The western extent of these mountains is bounded by the Rocky Mountain trench, a wide valley up to 24km wide in some parts.

Due to its size and latitudinal range, Canada's climate varies considerably. Except for Pacific coastal regions, the climate is dominated by a continental type, and at least four other climatic divisions can be recognised (sub-Arctic, southeastern regions, southern Ontario, western prairie regions). Annual precipitation on the west coast can exceed 2,450mm, much of which falls as snow in winter. In northern Canada and the Prairies, precipitation is much less, usually <380mm, with as little as 50mm in the northern Arctic islands. Precipitation increases somewhat east of the prairie regions, ranging from 760 to 1,000mm in Ontario and Quebec, and increasing further in the Atlantic provinces where >1,270mm may fall each year.

Current status of Caprinae

Native Caprinae in Canada include the muskoxen (*Ovibos moschatus*) of the Arctic tundra, and the mountain goat (*Oreamnos americanus*) and mountain sheep of the northern and western cordillera. Thinhorn sheep (*Ovis dalli*) and bighorn sheep (*Ovis canadensis*) are each represented by two subspecies in Canada (Cowan 1940), while mountain goat is considered monotypic (Cowan and McCrory 1970). All Caprinae are relatively abundant, but probably significantly less numerous and widespread than before 19th century European settlement. Mountain sheep and goats are confined to mountain ranges, foothills and some steep river canyons, in Alberta, BC, NWT, and Yukon. Mountain sheep are restricted to rugged terrain in relatively snow-free areas that they often share with mountain goats. Goats, however, can cope with deeper snow (Hebert and Turnbull 1977; Smith 1977) and use more browse, both contributing to their broader ecological distribution than mountain sheep, especially in coastal regions of BC where snowfall can exceed 4m (Hebert and Turnbull 1977).

Overharvesting and habitat loss were the primary causes of declines of mountain sheep and goats, while mountain sheep also suffered decreases caused by diseases transmitted by domestic sheep (*Ovis aries*) (Spraker *et al.* 1984). However, populations of these two species in Canada did not decline to the same degree with European settlement as did those in the United States. Periodic epizootics in bighorn populations still occur, especially in low elevation populations in the Rocky Mountains of southern Alberta and BC (Onderka and Wishart 1984). Increased road access, built primarily for the forest and mining industries, and for exploration and development of energy resources, created problems of overharvesting, particularly of mountain goats (Phelps *et al.* 1983; Foster 1977).

Muskox inhabiting the large islands in the Canadian Arctic are sometimes referred to white-faced muskox (*O. m. wardi*), and those on the mainland to Barrenground muskox (*O. m. moschatus*). However, the question of whether the mainland subspecies are distinct is unresolved. Muskoxen declined throughout their range in Canada during the 19th Century, with local populations becoming extinct in many areas. On the mainland, the cause was primarily unregulated commercial harvesting (Barr 1991), while on the Arctic islands, particularly on the two largest islands (Banks and Victoria), it was probably the result of catastrophic ice storms (Gunn *et al.* 1991). In recent decades, muskoxen on the Arctic mainland have re-occupied most historic ranges, and though recolonisation in the northeast has been relatively slow, by 1991 muskox herds were seen on the Boothia peninsula (Gunn, pers. obs.). Muskoxen have been introduced into northern Quebec, an area outside their historical range (Klein 1988; Le Henaff and Crête 1989).

Today, the status of all Caprinae in northern and western Canada is relatively secure and none are threatened. Species-specific biological research and inventory programs have led to more stringent hunting regulations, and land-use practices have come under increasing levels of environmental screening. Transplants have also been used effectively to help restore population levels towards historic levels.

General conservation measures taken

Caprinae receive varying levels of protection from resource development and settlement in numerous protected areas throughout northern and western Canada. At least 11 National Parks (NP) and National Park Reserves (NPR) contain Caprinae [Banff NP (664,076ha; est. 1885), Ellesmere Island NPR (4,000,000ha; est. 1986); Glacier NP (134,900ha; est. 1886); Jasper NP (1,087,800ha; est. 1907); Kluane NPR (2,201,500ha; est. 1974); Kootenay NP (140,600ha; est. 1920); Nahanni NP (479,150ha; est. 1974); Ivvavik NP (1,01,700ha; est. 1984); Revelstoke NP (26,260ha; est. 1914); Waterton Lakes NP (52,577ha; est. 1895); Yoho NP (131,313ha; est. 1886)], and together they protect greater than 9,00,000ha. Six of these, Banff, Jasper, Kootenay, Nahanni and Yoho National Parks, and Kluane National Park Reserve, are World Heritage sites.

In most national parks, Caprinae receive full, permanent protection from licensed hunting and from resource-industrial development. However, aboriginal peoples are permitted to hunt for food in certain parks with few limitations on access, and livestock grazing permits are available in some northern parks. Other parks are heavily used by tourists, whose presence, together with developments to cater to them, often impact significantly on wildlife. Many provincial and territorial wildlife reserves afford similar levels of protection from hunting, but are not secure from resource utilisation.

Outside national parks and reserves, licensed hunting for Caprinae is strictly regulated by government wildlife agencies, with harvest levels adjusted on the basis of census and harvest data. Easily accessible areas, such as road corridors and mine sites, are often closed to licensed hunting. Resident hunting of Caprinae is often further restricted through limited entry permits whereby only a pre-specified number of licences are issued for a given population annually, usually with the animal's sex, age class, or both, pre-defined. Many areas are divided into guiding territories that are not closed to resident hunters, but are areas to which non-resident hunters are restricted, and only when accompanied by a licensed guide-outfitters. Guides are issued annual quotas limiting them to the number of animals clients may shoot within the outfitter's territory. Sales of resident and non-resident hunting licences generate significant revenues, especially for provincial and territorial governments, and though not all are used for wildlife, they do help maintain a high level of wildlife management.

Public land is controlled by federal and provincial regulations. Wildlife agencies are directly involved in a federal environmental review process of lands subject to alienation or development. Government policies or other government agencies that can have significant direct or indirect effects on Caprinae, are primarily those concerned with agriculture, forestry, mining, recreation and transportation. Caprinae are managed under provincial, territorial, and federal (national parks and national park reserves) control, and wildlife agencies of provincial and territorial governments allocate and regulate licensed hunting. In the Territories, the public, through representation on wildlife management boards, is increasing its input into the management of wildlife through liaison with government representatives. Besides hunting controls, Caprinae management includes access planning, habitat protection, and occasionally when judged essential, limited predator control.

General conservation measures proposed

Progress is being made in the environmental screening process, with the development of environmental legislation, and discussions to revise some archaic mining legislation. Ongoing programs are in place to identify key habitats and provide more substance to the environmental review process. The negotiation of land claims with indigenous people is proceeding with ensuing constraints on resource exploitation and the implementation of conservation measures. Inventory continues, with corresponding adjustments to harvest levels and habitat management. Finally, measures are being developed to allow the public to have input into management of wildlife resources, through the creation of advisory boards and committees that work with or advise government bodies on wildlife management matters.

Some national parks do not encompass the entire annual range used by its Caprin populations; either the animals summer outside the protected areas where they can be legally harvested, or they move outside to winter at lower elevations where they can come into competition with livestock. Provincial parks are also open to the development of natural resources, and so such activities are always a potential threat to populations inhabiting them.

Species accounts

Information has been published on various aspects of the biology of muskoxen (e.g. Gray 1979; Lent 1988; Tener 1965), mountain sheep (e.g. Cowan 1940; Geist 1971; Hoefs and Cowan 1979; Seip and Bunnell 1985; Shackleton 1985; Shackleton *et al.* in press) and mountain goats (e.g. Chadwick 1983; Rideout and Hoffmann 1975).

Mountain goat (*Oreamnos americanus*)

Distribution: Mountain goats inhabit all major mountain ranges from the eastern slopes of the Rocky mountains in Alberta, west to the Coastal range of BC, and north into the St. Elias, Coast, Cassiar, Logan and Selwyn ranges of Yukon; and the Mackenzie mountains of the NWT (Map 10.1.1).

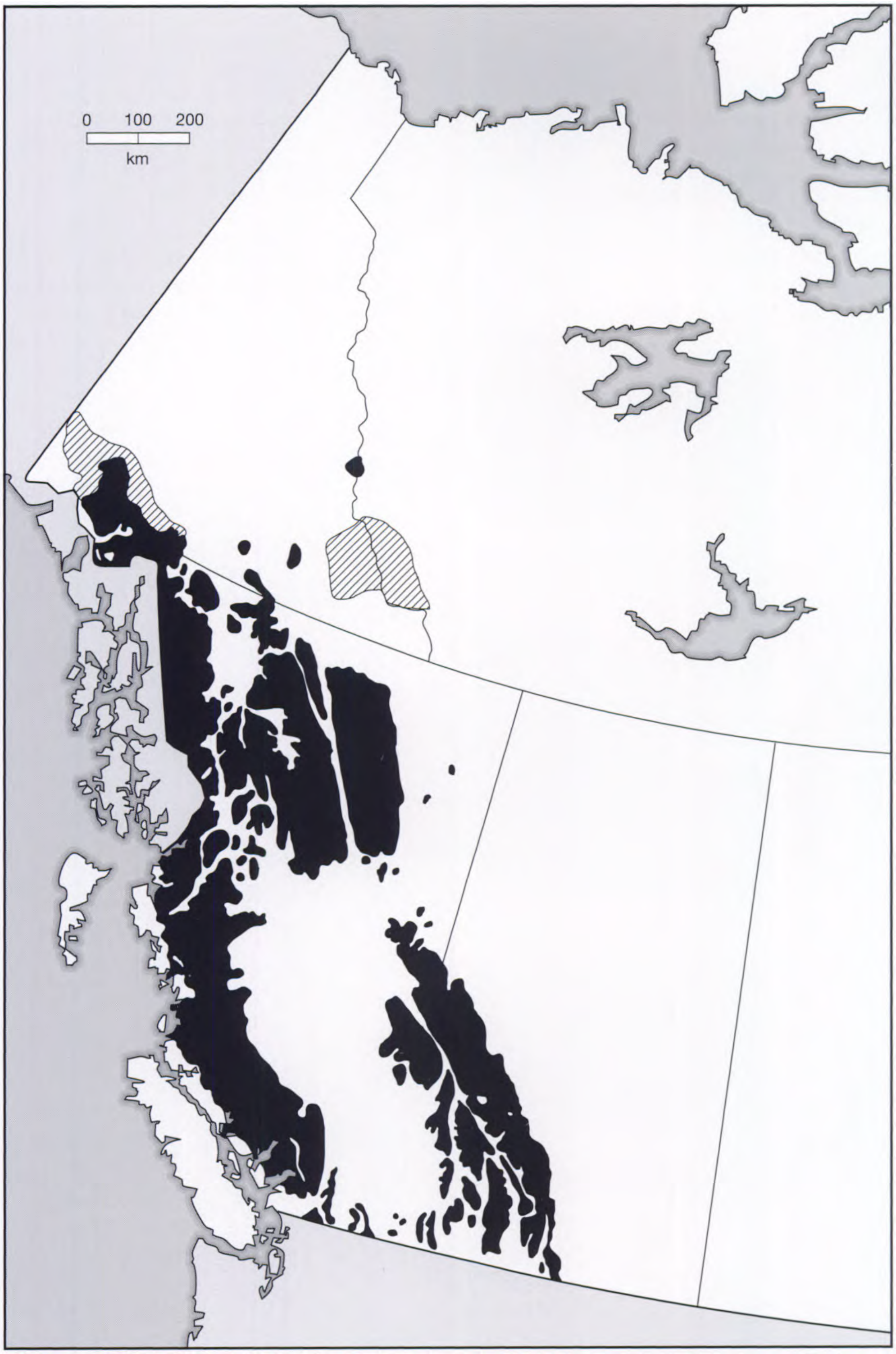
Population: Over 55,000 mountain goats are estimated to occur in Canada distributed as follows: Alberta 3,350; BC 50,000; NWT 100 to 250; and Yukon 2,000.

Conservation measures taken: Mountain goat habitat, along with more than 3,500 goats, are protected in eight National Parks (Banff, Glacier, Jasper, Kootenay, Nahanni, Revelstoke, Waterton and Yoho), Kluane National Park Reserve, and in Kluane Wildlife Sanctuary. Numerous provincial parks and wildlife reserves throughout western and northern Canada provide additional varying levels of protection. Limited hunting by aboriginal people is permitted in some northern national parks and wildlife sanctuaries, and licensed hunting is permitted in many provincial parks.

Outside protected areas, goats are legally hunted under strict controls issued by provincial or territorial government agencies. Harvests are set annually for each population. In BC for example, harvest rates vary between populations and range from 0.4 to 9% (Hebert and Smith 1986), with an average of 1,100 to 1,200 goats shot by resident and non-residents each year in the Province. In Yukon, by contrast, harvests are much lower, varying between three and 15 animals per year, with the aboriginal harvest estimated to be zero. Transplants have been used to reintroduce mountain goats into many areas of its former range. Habitat management continues to play a key role in

Adult female mountain goat (*Oreamnos americanus*) shedding her winter coat in early summer. Kootenay National Park, British Columbia, Canada.

D. Shackleton

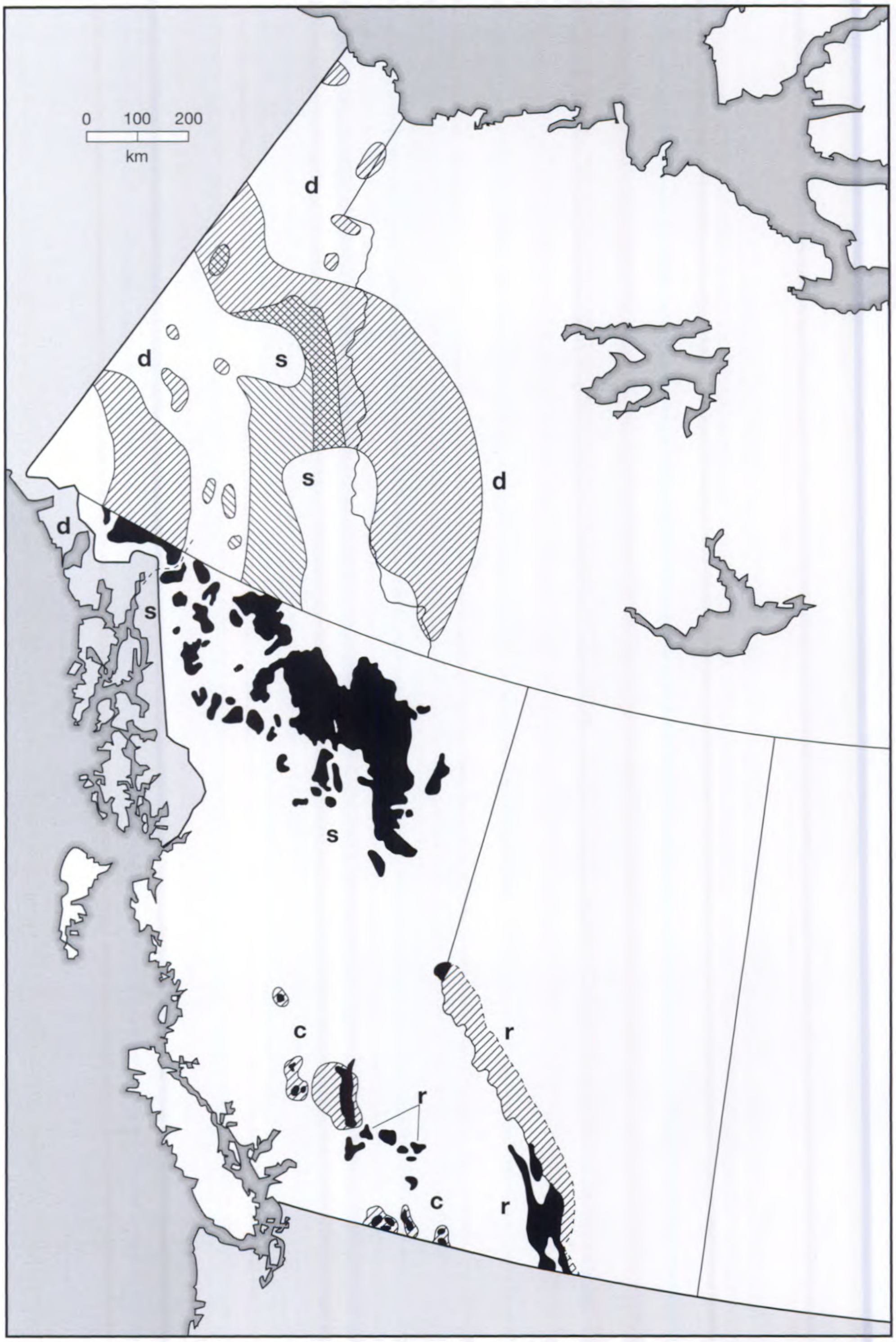


Map 10.1.1. General and specific distribution of mountain goats (*Oreamnos americanus*) in Canada.

its conservation, and developments are subject to environmental screening processes on crown (public) land.

Status within country: Not threatened.

Conservation measures proposed: 1) Determine the species' requirements for mature forests on steep slopes in coastal mountain ranges that are used as winter habitat in BC (Hebert and Turnbull 1977; Fox *et al.* 1989). Several coastal populations will be affected by current and future timber harvest operations. Ideally, much or most of this habitat should be preserved. **2)** Obtain more accurate population inventories in all regions of Canada to allow more detailed management plans to be developed.



Map 10.1.2. General and specific distributions of thinhorn sheep (*Ovis dalli*) and bighorn sheep (*Ovis canadensis*) in Canada. d) Dall's sheep (*O. d. dalli*); s) Stone's sheep (*O. d. stonei*); r) *O. c. canadensis*; c) *O. c. californiana*. Cross-hatched area indicates overlap between Dall's and Stone's sheep.

Thinhorn sheep (*Ovis dalli*)

Distribution: Thinhorn sheep are represented by two subspecies in Canada. Dall's sheep (*O. d. dalli*) occurs west of the Mackenzie river throughout the Richardson and the Mackenzie mountains on the Yukon-NWT border, throughout the mountainous regions in Yukon, and south into the extreme northwest corner of BC (Map 10.1.2). Stone's sheep (*O. d. stonei*) is found only in Canada, and here its range extends from an area of integration with Dall's sheep in south-central Yukon (Cassiar and Pelly mountains, MacArthur ranges, and White mountains), south to the Cassiar range (ca. 560 N) in BC (Map 10.1.2).

Population: The total population of thinhorn sheep in Canada is ca. 41,500 animals. Of this total, 27,000 are Dall's sheep [Yukon 19,000 (Hoefs and Barichello 1985); NWT 7,500 (Poole and Graf 1985; unpubl. data), and BC 500 (J. Elliot, *in litt.* to D. Hebert)] and 14,500 Stone's sheep [Yukon 3,000 (Hoefs and Barichello 1985), and BC 11,500 (J. Elliot, *in litt.* to D. Hebert)].

Conservation measures taken: Three National Parks (Kluane, Nahanni and Ivvavik), covering 36,976km^2, protect ca. 3,200 Dall's sheep (i.e. ca. 12% of the estimated total Canadian population) from industrial development and sport-hunting. Territorial wildlife reserves include no provision for habitat protection, but ca. 2,700 Dall's sheep within these reserves are off-limits to non-aboriginal hunters. Protected areas in BC are strictly managed to allow a limited harvest of thinhorn sheep.

Management of thinhorn sheep populations involves regulating annual licensed harvests, habitat enhancement (usually through burning), limited predator control, and involvement in the environmental screening process with respect to access, mining, forestry and agriculture on crown land. Aboriginal peoples are permitted by Yukon and Northwest Territories Acts (1898) to hunt thinhorn sheep for subsistence purposes within and outside national and territorial parks, and wildlife reserves. Similar treaty rights were granted to aboriginal people in northeastern BC in 1906. A recent federal court ruling in BC has inferred that all Canadian indians have subsistence rights, subject to conservation considerations. Outside national parks, licensed harvest of thinhorn sheep is regulated by territorial or provincial wildlife acts and associated regulations. Status indians are not required to possess a hunting licence. Only in Yukon is the aboriginal sheep harvest systematically estimated, and overall, it is believed to be minimal. Adult males with horns of ¾ curl (NWT) or full curl (Yukon and BC) can be hunted by non-aboriginal hunters under licence, with mandatory reporting of kills. Wildlife regulations can be amended annually with ministerial consent, and are strictly enforced. Typically, trends in the number and age of males killed by licensed hunters provide the basis for more restrictive management. Quotas or limited-entry hunting, that set a ceiling on the harvest or which restrict hunting opportunities, have been implemented in some areas to further control hunting pressure. The licensed annual harvest of thinhorn sheep typically averages 280 in Yukon (Hoefs and Barichello 1985), 200 in the NWT (Poole and Graf 1985), and 500 in BC (J. Elliot, unpubl. data). Guided, non-resident hunters account for about 70% of the total licensed thinhorn sheep harvest.

Status within country: Not threatened.

Bighorn sheep (*Ovis canadensis*)

Distribution: Rocky Mountain bighorn sheep (*O. c. canadensis*) is distributed throughout the Rocky mountains in Alberta and BC, south from the Peace river to the Canada-USA border. Two small populations also have been introduced to central BC outside their normal distribution (Map 10.1.2). Populations of a second subspecies, California bighorn sheep (*O. c. californiana*), are scattered through central BC from north of Anahim lake, south along sections of the Chilcotin, Chilco and other western tributaries of the Fraser river south of William's Lake and west to just north of Lillooet, and also south from around Kamloops along both sides of the Okanagan valley to the border with Washington State (USA) and as far west as Granby, B.C. (Map 10.1.2). Populations around Kamloops and Granby have been introduced.

Population: The total population of all bighorn sheep in Canada is estimated to be ca. 15,500 to 15,700 individuals. Of this total, ca. 11,500 to 11,700 are estimated to Rocky Mountain bighorns [Alberta 10,300 (K. Smith, *in litt.* 1994), and BC 1,500 to 1,700 (Hebert *et al.* 1985)], and ca. 4,000 California bighorn whose individual populations range in size from 15 to 2,400 animals. Populations of both subspecies are either increasing or stable. Several southern populations of Rocky Mountain bighorn are recovering following recent, disease-related die-offs.

Threats: Epizootics have occurred periodically, especially in Rocky Mountain bighorn, and together with overharvesting and competition from livestock at the turn of the century, reduced numbers significantly. Most populations recovered with the aid of provincial wildlife management and conservation efforts, but unpredictable epizootics still occur today. Poaching of large trophy males is a problem in many areas, including within national parks.

As a result of introductions of the Rocky Mountain subspecies in the early 1920s into California bighorn range, some interbreeding between these two subspecies is believed to have occurred where their ranges are contiguous. Unfortunately, there are no practical means to prevent this from occurring.

Conservation measures taken: California bighorn sheep (*O. c. californiana*) is listed as Lower Risk (cd) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). In Canada, more than 4,500 Rocky Mountain bighorns are fully protected within five National Parks (Banff, Jasper, Kootenay, Waterton, Yoho). An even larger number receive some level of protection in provincial parks and other protected areas in Alberta and BC. In an attempt to reduce poaching of large trophy males in

A typical scene in the early rut or mating season – three adult male Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) showing interest in an adult female. Banff National Park, Alberta, Canada.

national parks, a project to genetically identify individual sheep has begun in Jasper National Park. Animals in protected areas are often especially vulnerable to poaching because they are habituated to humans and are also readily accessible.

Outside national parks, both subspecies of bighorn sheep are covered by provincial wildlife acts, and many populations can be hunted under licence. Harvesting both adult males and adult females may be permitted in some populations. Hunting quotas are determined each year, and in general regulations are strictly enforced. Management consists of regulating annual harvests, habitat improvement, annual censuses, translocation of animals, and promoting research. Between 200 to 250 male, and 250 to 300 female, Rocky Mountain bighorns are harvested annually in Alberta. In BC, where only males are hunted, 60 to 65 Rocky Mountain and 40 to 45 California bighorns are shot each year, mainly by resident hunters (Hebert *et al.* 1985).

Status within country: Not threatened.

Although a few small populations may be vulnerable, the status of both subspecies of bighorn is currently satisfactory.

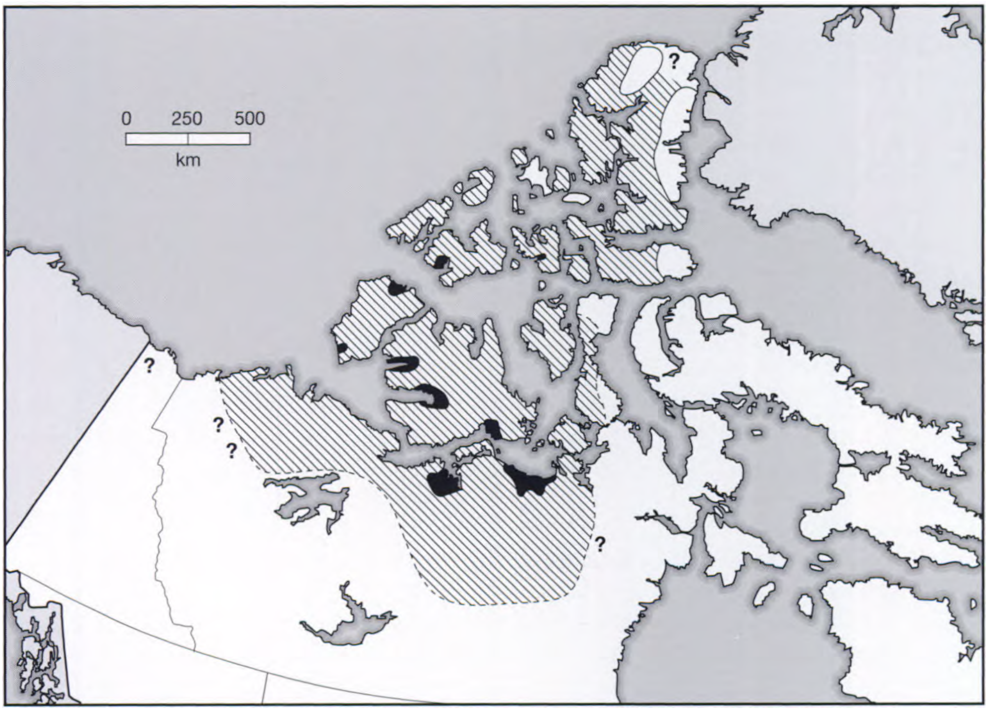
Muskoxen (*Ovibos moschatus*)

Distribution: Except for Baffin island, muskox inhabits most large islands in the Canadian Arctic and in Hudson Bay. It occurs also along the mainland coast of the NWT, as far inland as the treeline in the vicinity of Great Bear lake and the Thelon Game Sanctuary (Map 10.1.3).

Population: The total population in the NWT is estimated to be 106,600 $\pm$10,635 (SD) animals, of which 87,305 6,845 occur on the Arctic islands (Gunn, unpubl. data). Two islands, Banks and Victoria, together account for 92% of the muskoxen on the Arctic islands. A few muskoxen from the transplanted population on the Alaskan North Slope have strayed into Yukon. Outside their natural range, Le Henaff and Crête (1989) counted 290 animals in 1986, after 42 animals had been released from a muskoxen farm in northern Quebec.

Threats: Large tracts of land in the NWT are being transferred from the federal government to the Inuit as part of the settlement of Aboriginal land claims. On those lands, close co-operation between the territorial government and wildlife management boards will develop species management plans, and continue to regulate muskox hunting on the basis of sustainable yields. There is an awareness of the potential momentum created by commercial hunting that is conceivably a risk for populations on islands where climatic catastrophes may have occurred in the past. In some areas, the rapid recovery of muskoxen has led to concerns about the effect of high muskox densities on the vegetation and on caribou (*Rangifer tarandus*) populations.

Conservation measures taken: When the extent of the depredations of unregulated commercial harvesting became apparent, muskoxen were fully protected in 1971 under federal legislation. Populations began to recover, and under the Northwest Territories Wildlife Act, are now subject to aboriginal hunting limited by area-specific quotas



Map 10.1.3. Distribution of muskoxen (*Ovibos moschatus*) in Canada. Solid = high densities (≥0.4/km²); hatched = general distribution.

and seasons. After 1980, the rights to hunt muskoxen could be transferred to non-aboriginal hunters for guided non-resident hunters and for commercial meat harvesting. In 1991, the annual quota for the NWT was set at 6,487 animals. The domestic harvest is relatively stable at ca. 500 animals, and while the commercial harvest varies, it is increasing towards a projected level of 2,500 in 1992; most taking place on Banks and Victoria islands. Muskox harvesting under the Territorial government's tag-control system, has a high degree of hunter compliance, and harvest figures are relatively accurate for the season, location and age-sex of harvested animals. Management activities are mostly systematic aerial strip-transect surveys to track trends in population size, and as a basis for quota adjustments.

No reserves are specifically set aside for muskoxen, but part of the rationale for establishing the Thelon Game Sanctuary was to protect a remnant muskox population from hunting. The species also occurs in Ellesmere Island National Park Reserve and in the proposed national parks on Banks island and Bluenose lake (western Arctic mainland). In these protected areas, land use activities are controlled, but aboriginal hunting is permitted subject to conservation provisions.

Status within country: Not threatened.

Conservation measures proposed: 1) Maintain fully protected populations in favourable "oases", such as northern Banks island, given the potential for climatic catastrophes. The proposed national park will also provide some protection. **2)** Utilise environmental screening of individual developments to protect muskox ranges outside any formally protected areas. This might be particularly important for mining developments. In the longer term, legislation changes may be required to avoid habitat fragmentation caused by roads, and settlement patterns will be necessary, as will steps to limit the effects of such generalised aerial pollution phenomena as the "Arctic Haze".

Acknowledgements: J. Carey, H. Carr, W. Bradford, Susan Jones, R. Kunelius, N. Manners, D. Poll, C.C. Shank, K. Smith, R. Watt, and J. Woods.

10.2 Mexico

R. Valdez

Introduction

The United Mexican States cover ca. 1,972,544km² of land that is greatly influenced by volcanic activity, and which ranges from arid deserts in the north to tropical forests in the south. The central Mexican plateau is bordered on two sides by mountains: the Sierra Madre Occidental range to the west, and the Sierra Madre Oriental range to the east. The northern part of the plateau, the Mesa del Norte, begins at the border with the USA and is generally an arid region with two large deserts: the Sonoran in the northwest, and the Chihuahuan in the north-central section. Limestone peaks in the Sierra Madre Oriental reach >3,660m, while in the volcanic Sierra Madre Occidental, elevations average 2,600m asl and the range is dissected by steep-sided gorges and canyons (barrancas) draining westward into the Sea of Cortez (Gulf of California) and the Pacific ocean. Along the eastern edge of the Sea of Cortez, run the narrow Pacific Coastal lowlands, an arid region of coastal terraces and riverine deltas. Its western edge is the extremely arid desert region of the 1,290km-long Baja California peninsula. Along the centre of this isolated peninsula, run the granite mountains of San Pedro Martir and Sierra de Juarez, which rise >2,750m with steep eastern and gentle western slopes.

Mexico's varied climate is a result of its topographic diversity and latitudinal range, together with the maritime influences of the Pacific ocean, the Gulf of Mexico and the Caribbean sea. The climate of the northern desert regions is dominated by the semi-permanent, Pacific subtropical anticyclone. The hottest temperatures (>43°C) occur in mid-summer in central Baja California and northern deserts. The vegetation is unique to these northern deserts, and is named after them (Sonoran and Chihuahuan). At lower elevations, it is a sparse desert scrub, while higher up is found primarily a short grassland steppe with scattered shrub and cacti. Originally, most of the Sierra Madre Occidental and much of the Mesa Central plateau were covered by evergreen coniferous and deciduous forests. These have been deforested over the centuries for fuel and agricultural purposes. Wild sheep in Mexico occupy the desert scrub and scrub formations of the biotic communities of Southwestern North America. Refer to Brown (1982) and Shreve (1951) for descriptions of the flora of these communities, and to Ramamoorthy *et al.* (1993) for a review of the geology and biodiversity of Mexico.

Current status of Caprinae

Mexico represents the southernmost extension of Caprinae into the New World. They became extinct in the state of Coahuila and Chihuahua due to overhunting, probably also to overgrazing and the introduction of diseases by domestic livestock, especially domestic sheep and goats. At least two subspecies can be readily recognised in Mexico, namely the Mexican bighorn (*Ovis canadensis mexicana*) in Sonora, and the Peninsular bighorn (*O. c. cremnobates*) of Baja California. The taxonomic status of Weems' bighorn (*O. c. weemsi*) is uncertain. The type specimen of (*O. c. weemsi*) came from Cajon de Tecomaja, Sierra de la Giganta, about 78km south of Cerro de la Giganta, southern California. Goldman (1937), who described this subspecies, gave its range as occurring from Sierra de la Giganta, northward spreading towards *O. c. cremnobates* in the Sierra de San Borjas in the central part of the peninsula. Cowan (1940) indicated that Peninsular bighorn sheep was lighter in coloration than Weems' desert bighorn, but that the two were very similar cranially.

Populations have been greatly reduced in Sonora and Baja California principally due to illegal hunting. One future danger facing populations in Mexico is the introduction of exotics, particularly Barbary sheep or aoudad (*Ammotragus lervia*). Although there are no known free-roaming populations of Barbary sheep within the ranges of wild sheep in Mexico, at least two ranches in Sonora and one in Chihuahua have captive herds. If any of these animals escape, they could eventually take over habitats currently occupied by bighorn sheep. The large numbers of free-roaming Barbary sheep currently in Coahuila, preclude the re-establishment of wild sheep in that state (Rangel-Woodyard and Simpson 1980). Large numbers of feral burros (*Equus asinus*) also may be locally detrimental to sheep habitats.

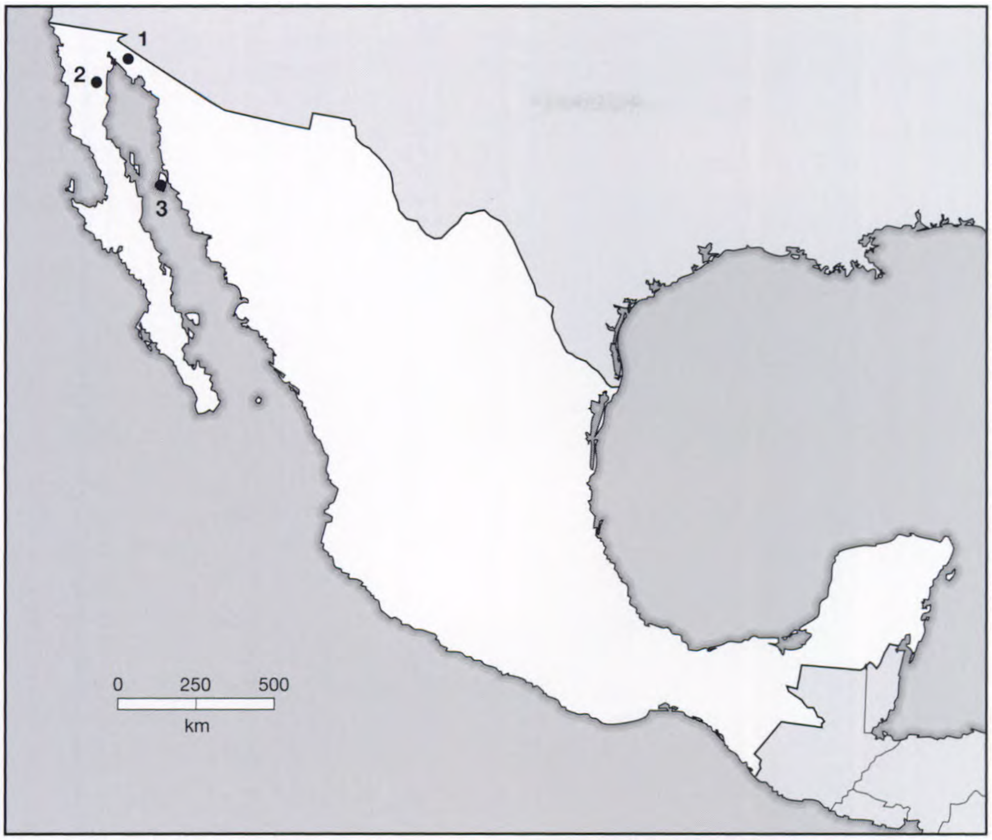
General conservation measures taken

Until 1986, wild sheep hunting and management programs were the responsibility of the Secretariat of Urban Development and Ecology (SEDUE), and specifically of the National Department of Wildlife. In 1986, responsibility was shifted to the National Wildlife Council (Consejo Nacional de la Fauna), a non-governmental organisation recognised officially through federal governmental legislation (Diario Oficial de la Federacion, 24 January 1986).

In 1992, SEDUE was dissolved and jurisdiction over wildlife was divided between the Secretaria de Desarrollo Social (SEDESOL) and the Secretaria de Agricultura y Recursos Hidraulicos (SARH). The Instituto Nacional de Ecologia, an agency within SEDESOL, is responsible for issuing research permits, including the capture and transportation of wildlife. SEDESOL assumed all law enforcement functions, including setting hunting permit numbers and seasons.

There are only three protected areas under federal jurisdiction with bighorn in Mexico (Map 10.2.1). San Pedro Martir National Park (Baja California Norte) and Pinacate Biosphere Reserve (northern Sonora) were established to protect bighorn, but the infrastructure and level of public awareness is insufficient for these to be of much conservation value. In 1978, Mexico declared the islands of Baja California and the adjacent Sonoran Desert on the coast, as wildlife reserves, covering a total of 600,000ha. Two transplants have been made to islands in the Sea of Cortez, both from Sonora; the first in 1975 to Isla Tiburon, and the second in 1979 to Isla Angel de la Guardia. Only the first has been successful. A captive group of desert bighorns was established in 1984, in Hermosillo (Sonora) as an interpretative area of the zoological park.

Bighorn can be legally hunted under licence. A limited portion of the licence fee is returned to land owners and to local communities to encourage them to protect wild sheep



Map 10.2.1. Protected areas with desert bighorn (*Ovis canadensis mexicana* and *O. c. weemsi*) in Mexico.

1) Pinacate Biosphere Reserve (200,000ha; est. 1993); **2)** Sierra de San Pedro Martir National Park (63,000ha; est. 1947); **3)** Isla Tiburon (102,800ha; est. 1963).

and reduce poaching. However, the hunting program has serious problems. As an example, during the 1989 hunting season in Baja California (4 January to 15 March), six males were collected at Arroya Grande (Valdez and Knapp 1989). A biologist accompanied each hunter and recorded the number of sheep seen. Only nine trophy males (= full horn curl) and 11 males with ¾ horn curl, were observed. After the season, it was recommended that hunting in the area be terminated, or at least greatly reduced, due to the low number of males. This recommendation was not followed. The wild sheep management program in Mexico is based on economic gain and not on sound conservation principles. Widespread, illegal hunting of trophy males is a major problem, and law enforcement is practically non-existent. Because of the high prices paid by the foreign hunters, bribes are common. Illegal hunts can be arranged for US $6,000 or less. One Mexican outfitter, who did not have permission to sell sheep hunts, advertised hunts in American hunting magazines. In 1991, a presidential decree closed hunting of wild sheep in Baja California Norte, and this is still in force.

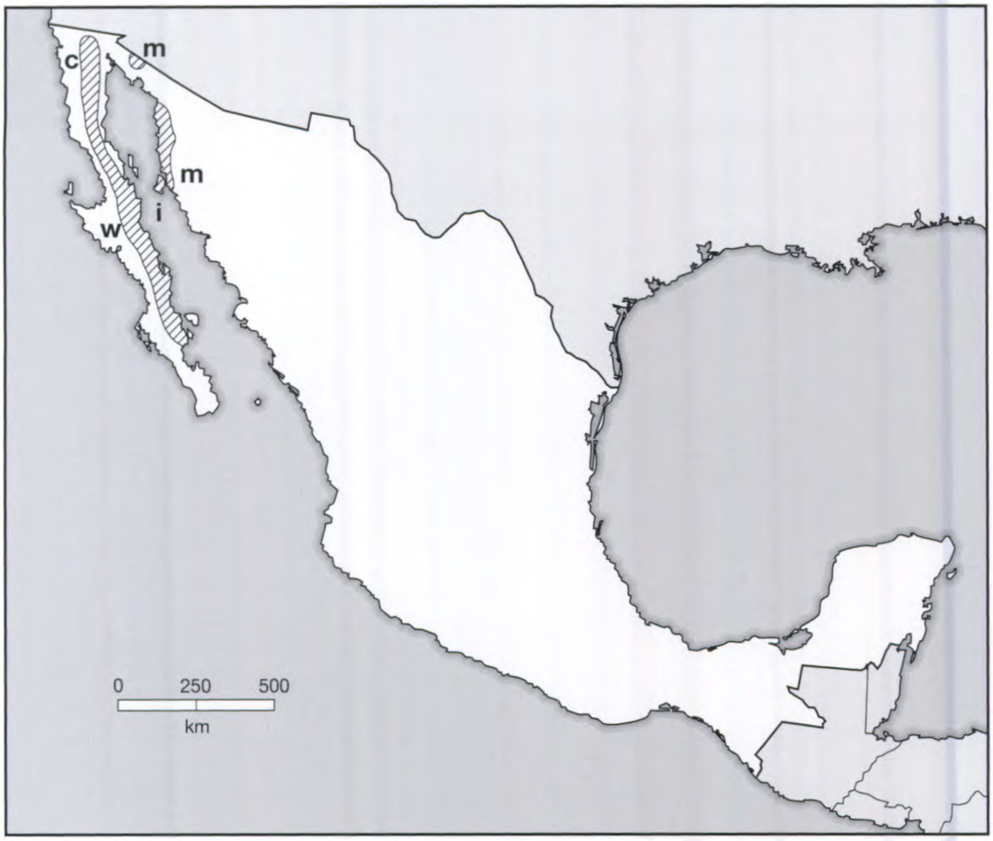
Species account

Published information on the ecology and behaviour of desert bighorns in Mexico can be found in Hernandez and Campoy (1989), and in Valdez *et al.* (1988). General information about the biology and management of desert bighorn is in Monson and Sumner (1980), and in Lee (1989).

Bighorn sheep (*Ovis canadensis*)

Distribution: Originally, bighorn sheep was distributed in the northern Mexico provinces of Nuevo Leon, Coahila, Chihuahua, Sonora, Baja California Norte and Baja California Sur. Desert bighorn in Mexico is now restricted to three provinces: Mexican bighorn (*O. c. mexicana*) in northwestern Sonora and on Tiburon island in the Sea of Cortez; Peninsular bighorn (*O. c. cremnobates*) in the northern two thirds of Baja California Norte; and Weems' bighorn (*O. c. weemsi*) in the southern third of Baja California Sur (Map 10.2.2).

Population: Only rough population estimates are available. Previous estimates of 4,500 in all of Baja California, and perhaps 1,000 on 10 separate ranges in Sonora (Sandoval 1985) were inaccurate. A helicopter survey of the northern two thirds of Baja California in April 1992 by the Bighorn Institute, revealed there were probably >2,500 wild sheep in the entire peninsula (J. Deforge, pers. comm. 1992). Personnel from the Arizona Game and Fish Department and the Centro Ecologico de Sonora, conducted a helicopter survey of the principal mountain ranges of Sonora, Mexico in November 1992. Based on this survey,



Map 10.2.2. Distribution of desert bighorn (*Ovis canadensis*) in Mexico. c) *O. c. cremnobates*; m) *O. c. mexicana*; w) *O. c. weemsi*; i) introduced population of *O. c. mexicana* on Isla Tiburon.

during which 528 sheep were classified by age and sex, R.M. Lee (pers. comm., 1992) estimated ca. 2,000 wild sheep for Sonora. The total estimate of all desert bighorn sheep in Mexico in 1992, is therefore ca. 4,500 animals.

Threats: Poaching, competition from domestic livestock, and habitat degradation (Sandoval 1985).

Conservation measures taken: Mexican bighorn sheep (*O. canadensis mexicana*) is listed as Vulnerable (D), Peninsular bighorn sheep (*O. c. cremnobates*) is listed as Endangered (C1+2a), and Weems' bighorn (*O. c. weemsi*) is listed as Critical (C2a), in the 1996 IUCN Red List of Threatened Animals (IUCN 1996), and the species in Mexico is listed in Appendix II of CITES. Mexican bighorn occur in only two protected areas in Mexico (Map 10.2.1), of which the sheep in Isla Tiburon Wildlife Reserve (Sea of Cortez) are an introduced population. Peninsular bighorn is in only one protected area, Sierra de San Pedro Martir National Park (Map 10.2.1), but Weem's bighorn occur in none. A small group (25 in 1992) of desert bighorn (*O. c. nelsoni*) is held in captivity at Hermosillo.

The high price ($30,000 to >$100,00) that some hunters are willing to pay to hunt wild sheep has recently motivated private and communal landowners in Sonora and Baja California, to begin desert sheep monitoring and management programs. In 1994, ranchers in Sonora started a captive breeding program by capturing 40 sheep and placing them in breeding enclosures. Six hunting permits were issued to private landowners for free-ranging bighorns in 1995, and each sold for $40,000. A private conservation organisation has initiated a transplant of Weem's bighorn from southern Baja California to Carmen island. The excess sheep produced by this island population, once the transplanted sheep increases to a viable size, will be used to re-establish extinct populations on the mainland. The participation of private landowners in wild sheep management programs in Mexico is a positive initiative. Private landowners have the funds to provide for monitoring wild sheep populations and to prevent further poaching.

Status within country: Vulnerable.

Conservation measures proposed: At least five areas must be addressed for conservation of desert bighorn in Mexico (Sandoval 1985):

a) Effective law enforcement is a major problem facing the conservation of bighorn in Mexico. In large part, this is due to the very low financial support generally given to wildlife programs.
b) There is a general lack of technical expertise among wildlife personnel.
c) A public education program, especially targeted towards the rural population, is necessary if conservation programs are to be successful.

d) Habitat management has generally been ignored, despite the fact that agricultural practices and forest use have had, and continue to have, significant negative effects on the bighorn.
e) The further spread of exotic ungulates, such as Barbary sheep, in or adjacent to current and historic bighorn range should be curtailed.

Proposals to deal with these include: **1)** Increase the number of protected areas in Baja California and in Sonora on the mainland. Present protected areas are inadequate to protect sheep populations. Mexico's burgeoning human population requires intensive exploitation of agricultural and natural resources, while coastal tourist development projects in Sonora and Baja California will have further deleterious impacts on wild sheep habitats. **2)** Raise enforcement of anti-poaching efforts to adequate levels. This will require a well-equipped law enforcement division. However, poaching is rampant and there is little hope that resources will be allocated by the government toward law enforcement. **3)** Develop a public conservation education program, especially targeted towards the rural population. This could play an important role for future conservation of wild sheep and all other wildlife and natural resources. **4)** Educate and employ a cadre of professional wildlife biologists.

10.3 United States of America

J.A. Bailey and D.R. Klein

Introduction

The United States of America include the Hawaiian archipelago (which has no native ungulates) in the Pacific ocean, Alaska in the boreal and arctic zones, and the 48 contiguous states in the temperate zone. From Alaska to Florida, the nation extends across 46 degrees of latitude, and covers a total of 9,363,130km^2. Caprinae are restricted to Alaska and to the western mountain and desert regions of the contiguous United States.

Alaska is characterised by diversity in climate and associated major biomes. The temperate rain forest extends up the west coast to Prince William sound and the Kenai peninsula. Central Alaska is dominated by the Yukon River basin that is surrounded by several mountain ranges. To the north, south of the Arctic ocean, lies the Brooks range, with peaks >2,000m asl. To the south, are a complex of major ranges including the Alaska range with the highest peak on the North American continent – Mount McKinley (Denali) (6,166m), the Aleutian range, and the Chugach range. In the lower 48 (contiguous) states, the distribution of Caprinae includes three major mountain ranges: the Cascade and Sierra Nevada mountains to the west, and the Rocky Mountains to the east. Between these ranges are the Columbia plateau, the Great basin and the Colorado plateau. Along the eastern border of the Rocky Mountains, Caprinae have occurred sporadically in badlands and riverbreaks of the shortgrass prairie region of the Great plains. South of the mountains and the Colorado plateau, are three deserts with differing seasonal patterns of precipitation: the Mojave desert to the west, and the Sonoran and the Chihuahuan deserts to the east.

Current status of Caprinae

Caprinae in Alaska include the muskox (*Ovibos moschatus*) endemic in the arctic zone, the mountain goat (*Oreamnos americanus*) also widespread but limited to coastal and island mountain ranges in the southern part of the state, and Dall's sheep (*Ovis dalli dalli*) which is geographically widespread but limited to interior alpine environments. Currently none of these species are threatened.

Mountain goats occupy the rugged mountains of the west coast of Alaska, using alpine habitats in summer and seeking shelter in lower elevation, conifer stands on steep slopes interrupted by cliffs and outcrops in winter. Goats, arriving from southern refugia after ice recession, have also penetrated the southern Wrangell and Talkeetna mountains and the northern Chugach mountains that have somewhat less extreme snow accumulation. Goat populations on Baranof and Kodiak islands are the result of transplants. In the temperate zone of the contiguous United States, the mountain goat naturally occupied interior mountains north of 44°N and west of 112°W, and has been transplanted successfully to many sites.

Dall's sheep was present in the unglaciated interior of Alaska during the late Pleistocene (Wisconsin). Today it occurs in the drier portions of most major mountain ranges in this state. Scattered, possibly relict populations also inhabit the less rugged mountains between the Tanana and Yukon rivers. Bighorn sheep (*Ovis canadensis*) extends north from subtropical environments in Mexico, through the contiguous western United States, to sub-boreal environments in Canada. Five extant and one extinct subspecies of bighorn have been described (Cowan 1940). The extinct subspecies (*O. c. auduboni*) occurred in the badlands of North and South Dakota, Nebraska, and eastern Wyoming. However, the validity of at least three extant subspecies has been questioned by recent genetic research (Ramey 1993), and some subspecies have been transplanted outside their historic ranges. Ecotypic variation of bighorn may now be more clearly defined than is genotypic variation. In the political process of conservation, the public may easily understand and support preservation of ecotypes; whereas the public may be confused by discussions of genetics related to subspecies validities. Preserving the ecotypic variation of bighorn sheep will protect all or most of the genetic and phenotypic variation of the species. In addition, preserving a variety of ecotypes of bighorn sheep will allow continued evolution of the species through natural selection in a variety of environments. This may be necessary for the long-term survival of the species. Consequently, proposed conservation measures emphasise the major ecotypes of bighorn, although the traditional subspecies are cited in some cases.

Muskoxen was widespread in the interior Alaska and Yukon refugium during the Wisconsin glaciation. Until the end of the 19th Century, it occupied tundra of Arctic Alaska, but was extirpated, probably due to over-exploitation by native hunters and whalers. In the 1930s, animals were transplanted from Greenland, and now muskoxen occurs in areas of its historic distribution in both the northeast and northwest of Arctic Alaska. These populations are expanding and dispersing into remaining unoccupied habitats but numbers are still below estimated historic levels. Muskoxen has also been established south of its historic distribution on Nunivak island, on an adjacent mainland area known as Nelson "Island", and on the Seward peninsula.

Neither mountain goats nor Dall's sheep were drastically reduced by early exploitation, and compared to other ungulates, their remote habitats have been less impacted by European development of the continent. By contrast, bighorn sheep populations were drastically reduced in the contiguous United States by the early 1900s. Declines were related to commercial exploitation, habitat loss, and to competition and diseases from domestic livestock (Buechner 1960). Bighorn was extirpated from large portions of its range, and most remaining populations were reduced and isolated. Many once-migratory herds abandoned seasonal ranges and became sedentary (Wakelyn 1987). Conditions improved little until the 1940s and 1950s, when state wildlife management agencies began reintroducing bighorns to their historic range, using animals from the remaining herds and from Canada. Today, all western states have reintroduced populations, and there are more transplanted than indigenous herds (Table 10.3.1).

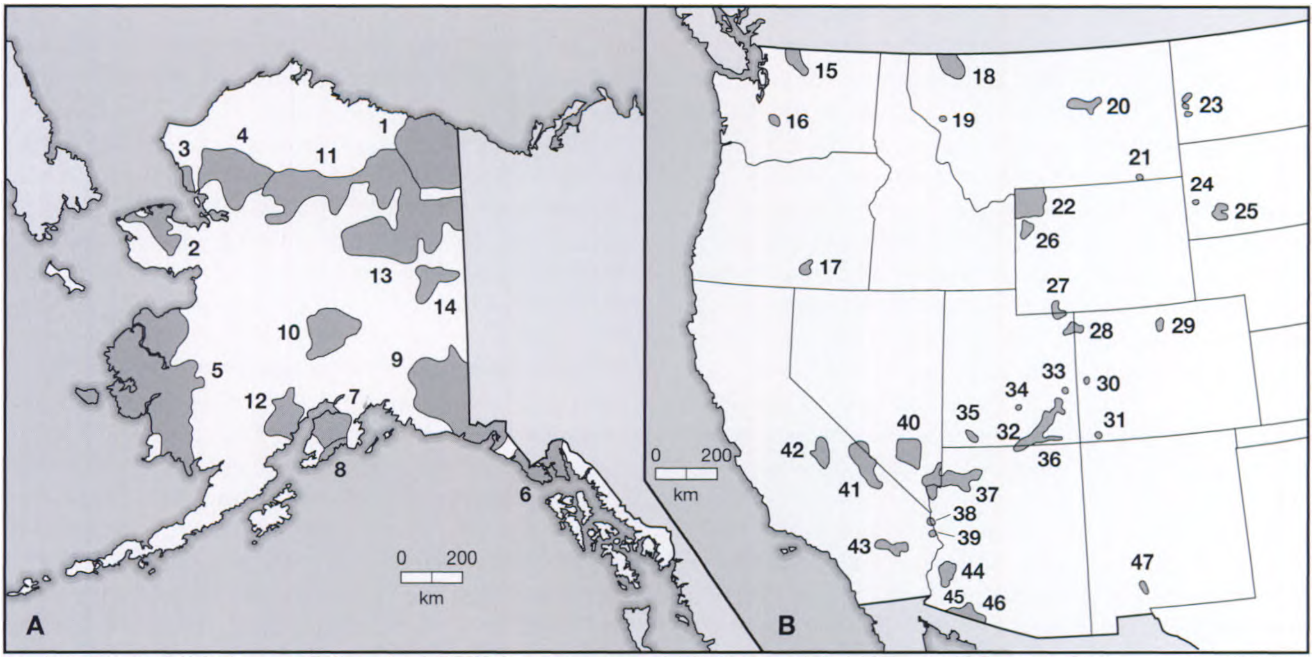
At least 17 species of exotic ungulates have been successfully introduced to the United States (Decker 1978). This total includes six domestic species, at least three of which exist in feral populations. Exotic Caprinae include Barbary sheep or aoudad (*Ammotragus lervia*), wild goat (*Capra aegagrus*), feral goats (*C. hircus*), European mouflon (*Ovis orientalis musimon*), and possibly Himalayan tahr (*Hemitragus jemlahicus*). Competition from these exotic species threatens local populations of native ungulates. Control of these exotics will be necessary wherever the conservation of native ungulates is paramount.

North America is an ecologically diverse continent, but its recent native ungulate fauna is depauperate, consisting of 12 species in 10 genera. Many species originally entered North America from Siberia during the Pleistocene via the Bering Land Bridge above 64°N. Today, the number of native ungulate species increases northward on the continent. Extinction of about 38 species of Rancho LaBrean ungulates ca. 8,000 to 12,000 years B.P. (Kurtén and Anderson 1980) left abundant opportunities for the remaining species to expand. Consequently, all native ungulates in temperate North America had large geographic and ecological ranges when Europeans first described the continent. It appears that a) many species have relatively recently (8,000 to 12,000 years) expanded into some habitats they now occupy, especially in the temperate zone; and b) there has been limited time for these ungulates to co-evolve with physical and biotic components of these habitats. As a result, native ungulates in the temperate zone are apt to sometimes respond poorly to competition or to habitat alteration. This may create problems for conserving bighorn sheep along the southern and eastern borders of its range, and in the more moist, and therefore more densely forested, parts of mountain ranges. Problems in desert habitats will probably be exacerbated by global warming.

General conservation measures taken

Management and conservation of wildlife and wildlife habitat in the United States is governed by both federal and state legislation (IUCN 1987b). Of the many laws affecting Caprinae, one of the most wide-ranging is the Endangered Species Act of 1973. This affects native wildlife within the USA and also limits the importation of living or dead specimens of taxa (including Caprinae) considered threatened in their native countries.

The commitment of the United States towards reserving large parcels of wildlands began at least as early as 1872 with establishment of Yellowstone National Park. Today, most of the reserved wildland is in the western states, including Alaska, and many of these areas are vital for the conservation of Caprinae. Types of federal protected areas include National Parks (NP), National Monuments (NM), National Recreation Areas (NRA), and National Wildlife Refuges (NWR). In Alaska, wild Caprinae habitats are protected in 13 areas administered by the National Park Service or by the United States Fish and Wildlife Service (Map 10.3.1). In the contiguous United States, 33 such areas contain habitats for Caprinae (Map 10.3.1). On all these federal lands, wildlife habitat is a primary management concern. Since 1976, 10 of these National Park Service areas have been designated as Biosphere Reserves and four have been designated as World Heritage Sites. Additional Caprinae habitat is protected on



Map 10.3.1. Locations of major protected areas with Caprinae in the United States of America.

A) *State of Alaska*: 1) Arctic NWR (7,707,965ha; est. 1960); **2)** Bering Land Bridge NPP (1,127,058ha; est. 1978); **3)** Cape Krusenstern NM (267,020ha; est. 1978); **4)** Noatak NPP[B] (2,660,656ha; est. 1978); **5)** Yukon Delta NWR (9,308,972ha; est. 1929); **6)** Glacier Bay NP (1,305,255ha; est. 1925); **7)** Kenai NWR (797,248ha; est. 1941); **8)** Kenai Fjords NP (270,960ha; est. 1978); **9)** Wrangell-St. Elias NP[W] (3,371,754ha; est. 1978); **10)** Denali NP[B] (1,908,833ha; est. 1917); **11)** Gates of the Arctic NP (3,044,876ha; est. 1978); **12)** Lake Clark NP (1,067,114ha; est. 1978); **13)** Yukon Flats NWR (3,492,513ha; est. 1980); **14)** Yukon-Charlie NPP (6,177,600ha; est. 1978).

B) *Contiguous United States*: 15) North Cascades NP (204,282ha; est. 1968); **16)** Mt. Ranier NP (95,267ha; est. 1899); **17)** Hart Mountain NWR (100,866ha; est. 1936); **18)** Glacier NP[B] (410,187ha; est. 1910); **19)** Bison Range NWR (7,503ha; est. 1908); **20)** C.M. Russell NWR (363,063ha; est. 1936); **21)** Bighorn Canyon NRA[b] (48,683ha; est. 1966); **22)** Yellowstone National Park[bBW] (898,337ha; est. 1872); **23)** T. Roosevelt NP (28,497ha; est. 1947); **24)** Mt. Rushmore NM (517ha; est. 1927); **25)** Badlands NP (98,439ha; est. 1939); **26)** Grand Teton NP (125,452ha; est. 1929); **27)** Flaming Gorge NRA (115,338ha; est. 1968); **28)** Dinosaur NM[b] (85,448ha; est. 1915); **29)** Rocky Mountain NP[B] (107,325ha; est. 1915); **30)** Colorado NM (8,278ha; est. 1911); **31)** Mesa Verde NP[W] (21,079ha; est. 1906); **32)** Canyonlands NP (136,613ha; est. 1964); **33)** Arches NP (29,696ha; est. 1929); **34)** Capitol Reef NP (97,897ha; est. 1937); **35)** Zion NP (59,328ha; est. 1909); **36)** Glen Canyon NRA[b] (500,558ha; est. 1972); **37)** Grand Canyon NP[W] (493,070ha; est. 1906); **38)** Lake Mead NRA[b] (605,288ha; est. 1964); **39)** Havasu NWR (18,556ha; est. 1941); **40)** Desert NWR (642,970ha; est. 1936); **41)** Death Valley NM[aB] (836,757ha; est. 1933); **42)** Sequoia - Kings Canyon NP[B] (349,811ha; est. 1890/1940); **43)** Joshua Tree NM[B] (226,611; est. 1936); **44)** Kofa NWR (267,098ha; est. 1939); **45)** Cabeza Prieta NWR (348,037ha; est. 1939); **46)** Organ Pipe Cactus NM[B] (133,828ha; est. 1937); **47)** San Andres NWR (23,155ha; est. 1941). NWR = National Wildlife Reserve; NPP = National Park Preserve; NP = National Park; NM = National Monument; NRA = National Recreation Area; [b] Protected areas extending across state boundaries; [B] Biosphere Reserve; [W] World Heritage Site.

numerous other government lands in Alaska and the contiguous states. These lands include large areas of federal "multiple-use" lands administered by the United States Forest Service and the Bureau of Land Management. On these areas, wildlife habitats are somewhat less secure because they are protected and managed in conjunction with other land uses such as forestry, livestock grazing, mining and recreation. However, some multiple-use lands contain wilderness areas in which human activities are more restricted. Many, usually smaller areas, administered by state governments as parks, forests, wildlife ranges, etc., also contain caprin habitat. Regulation of land uses and degree of habitat protection varies widely among these state areas. Four national wildlife refuges with populations of bighorn sheep in southern deserts (Cabeza Prieta, Kofa, Desert, and San Andres) are adjacent to or within military reservations. On these areas, sheep and their habitats are not always secure from the impacts of military exercises. These federal and state lands include adequate examples of most of the major ecosystems once occupied by native Caprinae in the United States. Exceptions are Chihuahuan desert and badlands ecosystems in which bighorn sheep were reduced or extirpated, especially in New Mexico, Texas, Nebraska, eastern Wyoming, and eastern Montana.

Before the beginning of this century, harvesting of wildlife in North America was largely uncontrolled and many populations, particularly of muskoxen and bighorn sheep, were severely diminished. Today, harvest of wild ungulates is regulated, mostly by state agencies. Caprinae are harvested in limited numbers primarily as trophies. State wildlife agencies have reintroduced mountain goats, bighorn sheep and muskoxen into many native ranges from which the animals had been extirpated, as well as into ranges where the animals did not naturally occur.

All four species of wild Caprinae have been studied abundantly by federal and state agencies responsible for the management and conservation of the species. These agencies include the U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Land Management, National Park Service, each western state's department of wildlife management, and many state universities. Basic elements of the ecology and population dynamics of wild sheep, mountain goats and muskoxen, are fairly well documented (see references in **Species accounts**). This information is widely available in technical and popular literature, providing the knowledge base and the public support for managing both Caprinae populations and their habitats.

Many non-government conservation organisations in the United States benefit Caprinae either directly or indirectly. Some organisations participate in acquisition and management of habitat (e.g. The Nature Conservancy, The National Audubon Society), others in lobbying for protection and conservation of both habitat and wildlife (e.g. The Sierra Club). There are also organisations whose efforts specifically target Caprinae (see **Species accounts**). Wildlife and wildlife conservation are popular topics in many education programs in schools and on television.

Survival of the four species of Caprinae in the United States seems secure because: **1)** a large number of protected areas administered by the National Park Service and the United States Fish and Wildlife Service, and a large number of other federal and state government lands contain populations of these animals; and **2)** each state has a wildlife agency responsible for managing and conserving these animals.

Species accounts

Published information on the ecology, behaviour and management of Caprinae in the United States is numerous (e.g. ***mountain goats*** Bailey 1991, Chadwick 1983, Houston and Stevens 1988, Rideout 1978, Rideout and Hoffmann 1975; ***mountain sheep*** Bunnell 1982, Geist 1971, Monson and Sumner 1980, Nichols 1978, Risenhoover 1988, Shackleton 1985, Thompson and Turner 1982; ***muskoxen*** Flood 1989, Klein *et al.* 1984, Lent 1988).

Mountain goat (*Oreamnos americanus*)

Distribution: In Alaska, mountain goat is generally continuously distributed along the mountains extending up the west coast to Prince William sound and the Kenai peninsula. Its also occurs in the southern Wrangell and Talkeetna mountains and the northern Chugach mountains (Map 10.3.2). Goat populations have been established through transplants on Baranof and Kodiak islands. In the contiguous states, it is found in a relatively continuous distribution across several large mountain ranges in Washington, Idaho and Montana. Mountain goat is also discontinuously distributed to the east and south of this area, where many herds have been established by transplanting animals (Map 10.3.2). In Alaska and Washington, separate herds are not always distinguished.

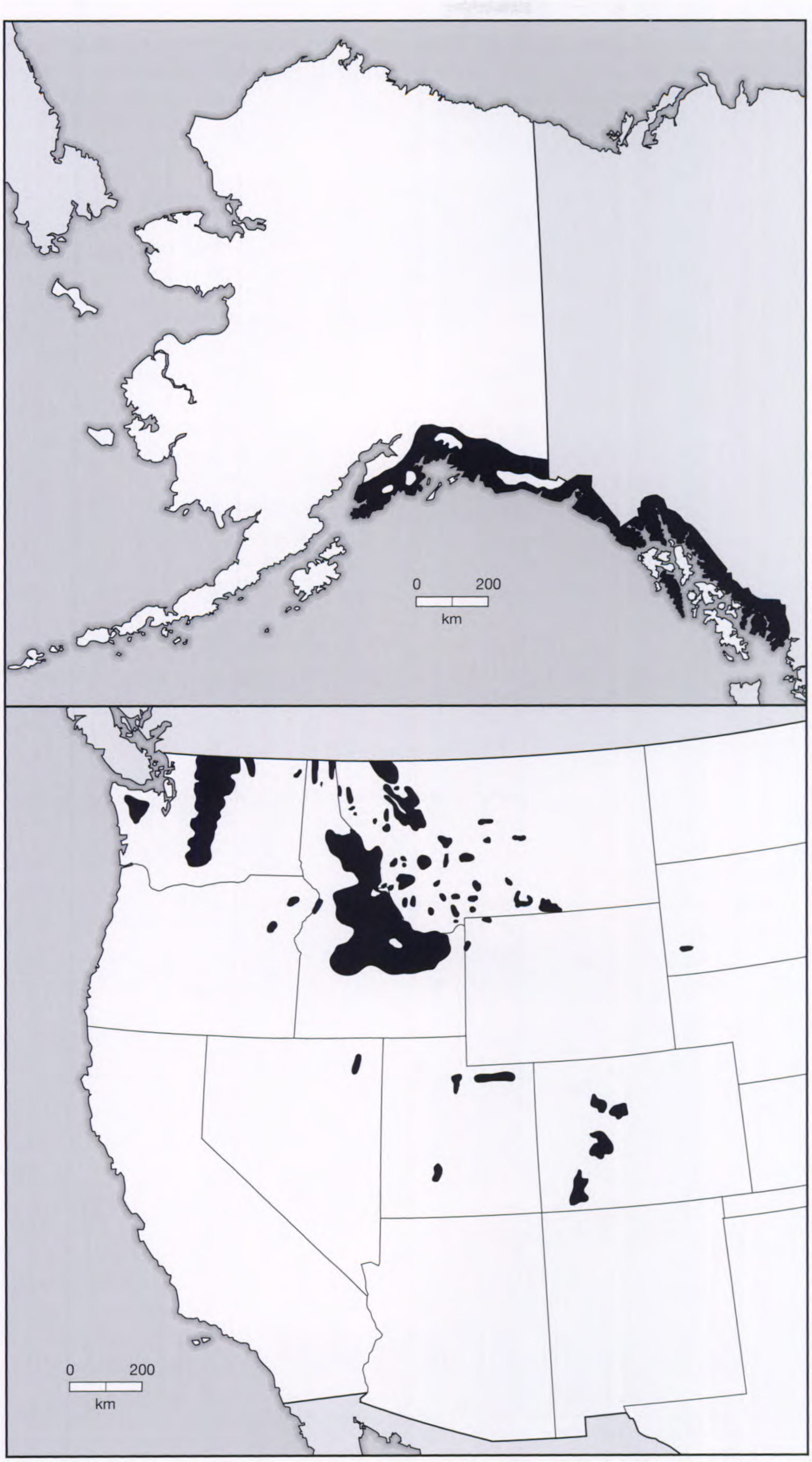
Population: Recent total estimates are for 27,000 to 35,000 goats, with >15,000 animals in 142 herds in the contiguous states, and 12,000 to >20,000 in Alaska (Table 10.3.1).

Conservation measures taken: Primary conservation measures have included habitat protection, introductions

Table 10.3.1. Status of mountain goats (*Oreamnos americanus*) in the United States (1990).

	Total		Transplants				Populations in protected areas[a]		
State	population estimate	number of herds	Indigenous herds	Native range	New range	Hunted herds	NP and NWR	WA	OA
Alaska	12,000–20,000	?	?	2	2	?	5	4	5
Colorado	1,000	10	0	0	10	10	0	4	6
Idaho	3,060	39	39	0	0	21	0	10	29
Montana	5,000	33	12	0	21	?	2	29	2
Nevada	100	1	0	0	1	1	0	1	0
Oregon	60	2	0	0	2	0	0	1	1
S. Dakota	160	1	0	0	1	1	1	0	0
Utah	270	3	0	0	3	1	0	2	1
Washington	5,200	51?	?	0	?	35	2[b]	?	?
Wyoming	160	2	0	0	2	1	0[b]	1	1

[a] NP = National Parks; NWR = National Wildlife Refuges; WA = Wilderness Areas; Other Areas = Federal lands which are U. S. Forest Service multiple-use lands, not duplicating areas having mountain goat herds partly in wilderness areas.
[b] Olympic National Park in Washington, and Yellowstone National Park in Wyoming are not included. The future of non-indigenous mountain goats in these parks is uncertain because park policies emphasise the indigenous biota in these biosphere reserves.
? Population estimates or herd numbers not available or uncertain.



Map 10.3.2. Distribution of mountain goat (*Oreamnos americanus*) in the United States of America.

and re-introductions, and harvest regulation. Eight state wildlife management departments have transplanted mountain goats from native ranges in Canada and the United States. Six of these states did not have indigenous populations (Table 10.3.1). Many transplanted populations were established with only 10 to 15 founder animals. Goats are harvested in nine states under conservative regulations of the wildlife departments which monitor populations. The mountain goat occurs in nine federal protected areas: ***Alaska***: Glacier Bay, Kenai Fjords, and Wrangell - St. Elias NPs; and Kenai NWR; ***Montana***: Bison Range NWR; Glacier NP; ***South Dakota***: Mt. Rushmore NM; ***Washington***: North Cascades, and Mt. Ranier NPs (Map 10.3.1). However, most herds are in national forests including many wilderness areas (Table 10.3.1, Map 10.3.1).

The International Order of Rocky Mountain Goats, a private organisation, raises funds for research and management of the species. One state, Colorado, uses two hunting licences in an auction and a raffle to raise funds for these activities. An organisation of professional management and research biologists, the Northern Wild Sheep and Goat Council, meets biennially to exchange information on mountain goats, bighorn and Dall's sheep in North America. Proceedings of the meeting are published.

Status within country: Not threatened.

Being widely distributed and in many protected areas, especially National Forests, the species is secure.

Dall's sheep (*Ovis dalli dalli*)

Distribution: In Alaska, Dall's sheep occupies drier areas of the Kenai, Chugach, Wrangell, and Talkeeetna mountains, and the Alaska and Brooks ranges. Scattered populations also occur in the low mountains between the Tanana and Yukon rivers (Map 10.3.3A). Separate herds are not usually identified in these large areas.

Population: The total population is estimated at 70,000 to 75,000 animals (Table 10.3.2).

Conservation measures taken: Listed as Lower Risk (lc) in the 1996 IUCN Red List of Threatened Animals (IUCN 1996). Dall's sheep is in eight Federal protected areas in Alaska: Denali, Gates of the Arctic, Lake Clark, Noatak, and Wrangell-St. Elias NPs; Arctic, Kenai, and Yukon Flats NWRs; and Yukon-Charlie NPP (Map 10.3.1). Seven of these areas are among the largest such reserves in the United States. About 70% of all Dall's sheep in Alaska occur in hunted areas. Most harvest is regulated by the state, though federal regulations are being used for some federal lands. Under Alaska Department of Fish and Game regulations, most harvesting of Dall's sheep is conservative, with only mature males being hunted. Dall's sheep are prized as big game trophies. Primarily males are hunted, with around 1,200 to 1,300 mature males taken each year. Native subsistence hunting is allowed in some areas and may threaten local populations. The Department monitors populations, and with other agencies, conducts research on the species.

Status within country: Not threatened.

Dall's sheep is rated secure because it is abundant, widely distributed throughout its native range, and occurs in many areas protected such as national parks, preserves, and wildlife refuges.

Bighorn sheep (*Ovis canadensis*)

Distribution: In the Rocky mountains, bighorn are widely distributed from Montana and Idaho south through

A. Frid

Adult male Dall's sheep (*Ovis dalli dalli*) performing a low stretch behaviour pattern as it approaches a sub-adult male. Kluane National Park, Yukon, Canada.

Table 10.3.2. Status of Dall's sheep (*Ovis dalli dalli*) in Alaska and Bighorn sheep (*O. canadensis*) in the contiguous United States (1990).

State	Total: population estimate	Total: number of herds	Transplants: Indigenous herds	Transplants: Native range	Transplants: New range	Transplants: Hunted herds	Populations in protected areas[a]: NP and NWR	Populations in protected areas[a]: WA	Populations in protected areas[a]: OA
Alaska	72,500	?	?	0	0	70%	8	8	1
Arizona	4,850	?	?	26	0	6	7	?	?
California	4,800	60	49	11	0	2	3	2	55
Colorado	6,720	68	29	43	3?	40	6	8	42
Idaho	5,400	24	15	9	0	16	0	6	18
Montana	3,800	26	12	14	0	23	6	6	12
Nevada	5,850	62	26	36	0	37	6	6	49
New Mexico	795	12	1	11	0	3	1	2	6
N. Dakota	315	11	0	11	0	7	1	0	10
Oregon	2,215	25	0	25	0	11	1	5	19
S. Dakota	350	3	0	3	0	1	1	0	1
Texas	300	5	0	5	0	1	0	0	0
Utah	?	17	4	13	0	5	7	1	9
Washington	890	11	0	11	0	6	0	2	6
Wyoming	6,420	16	10	6	0	13	3	9	5

[a] NP = National Parks; NWR = National Wildlife Refuges; WA = Wilderness Areas; OA = Federal lands which are U.S. Forest Service multiple-use lands, not duplicating areas having mountain sheep herds partly in wilderness areas.
? = Population estimates or herd numbers not available or uncertain.

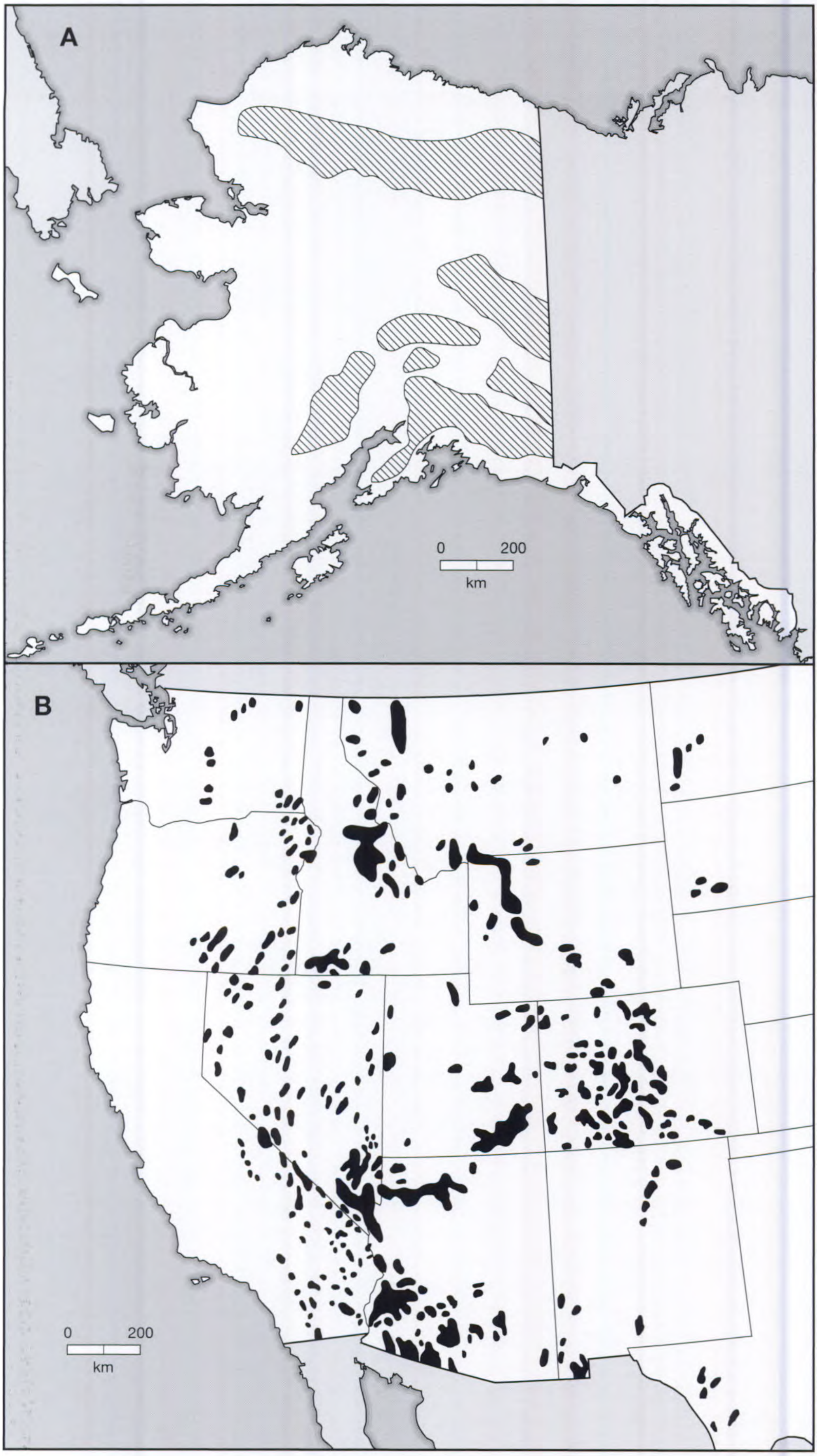
Wyoming and northern Utah, to Colorado and New Mexico (Map 10.3.3B). These bighorn herds comprise most of the traditional *O. c. canadensis*, for which Thorne *et al.* (1985) estimated a population of >19,000. To the south, desert bighorn (traditionally *O. c. nelsoni, O. c. cremnobates,* and *O. c. mexicana*) inhabit southern portions of California, Nevada, Utah and New Mexico, much of Arizona, and west Texas (Map 10.3.3B). Weaver (1985) estimated 16,000 desert bighorn in this area. However, there are few bighorn and few herds (mostly transplants) within the Chihuahuan desert of New Mexico and west Texas. To the west, bighorn occur in scattered populations in the Columbia plateau and Great Basin ranges of Washington, Oregon, southwest Idaho, and northern Nevada (Map 10.3.3B). These herds comprise most of the traditional *O. c. californiana*, for which Thorne *et al.* (1985) estimated >2,800 animals. East of the Rocky mountains, bighorn exist in scattered herds in badlands and riverbreaks in eastern Montana, North and South Dakota, northeast Wyoming, Nebraska, and outside of historic range in southeast Colorado (Map 10.3.3B).

Population: In 1990, there were estimated to be >42,700 bighorn sheep in >340 recognised herds, in 14 states (Table 10.3.2). However, 64% of the herds recently had <100 sheep (Thorne *et al.* 1985; U. S. Bureau of Land Management, n.d.).

Threats: Small (<100) numbers in many herds (see below), and diseases from domestic sheep.

Conservation measures taken: California bighorn (*O. canadensis californiana*) is listed as Lower Risk (cd), Mexican bighorn (*O. c. mexicana*) is listed as Vulnerable (D) and Peninsular (*O. c. cremnobates*) bighorn sheep is listed as Endangered (C1+2a) in the IUCN Red List of Threatened Animals (IUCN 1996). Bighorn sheep occur in the following 30 National Parks, Monuments, Recreation Areas and Wildlife Refuges (Map 10.3.1): ***Arizona***: Grand Canyon NP; Cabeza Prieta, Havasu, and Kofa WRs; Glen Canyon, and Lake Mead NRAs; Organ Pipe Cactus NM; ***California***: Sequoia - Kings Canyon NP; Death Valley, and Joshua Tree NMs; ***Colorado***: Mesa Verde, and Rocky Mountain NPs; Colorado, and Dinosaur NMs; ***Montana***: Glacier, and Yellowstone NPs; Bison Range, and C.M. Russell NWRs; Bighorn Canyon NRA; ***Nevada***: Desert NWR; Death Valley NM; Lake Mead NRA; ***New Mexico***: San Andres NWR; ***North Dakota***: T. Roosevelt NP; ***Oregon***: Hart Mountain NWR; ***South Dakota***: Badlands NP; ***Utah***: Arches, Canyonlands, Capitol Reef, and Zion NPs; Dinosaur NM; Flaming Gorge, and Glen Canyon NRAs; ***Wyoming***: Grand Teton, and Yellowstone NPs; Bighorn Canyon NRA. Also in the large Anza-Borrego State Park (California). Most of these protected areas are in the Mojave and Sonoran deserts, and on the Colorado plateau. Numerous other federal lands administered by the Forest Service and Bureau of Land Management also contain bighorn.

Fourteen state wildlife agencies have transplanted sheep onto >200 historic ranges (Table 10.3.2). This has accounted for much of the recovery of bighorn sheep from historic low numbers in the 1960s. However, numerous other transplants have been failures (Bailey 1990), presumably for lack of careful evaluation of habitat conditions at potential transplant sites. Animals in about



Map 10.3.3. Distribution of A) Dall's sheep (*Ovis dalli dalli*), and B) bighorn sheep (*Ovis canadensis*) in the United States of America.

half the herds are hunted, and all states with bighorn sheep have at least one hunted population (Table 10.3.2). Usually, only adult males are taken as hunting trophies. The number of sheep permitted to be taken each year is conservative and is regulated by each state. All states require that legally taken trophy heads be marked for permanent identification. This practice allows easy identification of illegally taken animals and thus discourages poaching. Improvement of habitat for bighorn sheep has been frequent, especially on federal multiple-use lands. Projects have been funded with combinations of federal, state, and private moneys. Natural water sources have been improved and artificial water sources created, especially in the Mojave and Sonoran deserts of the Southwest. Further north, dense forest or shrub vegetation has been cleared, often by controlled burning, to provide open areas with forage for bighorn sheep. Some populations of bighorn are routinely baited and treated with drugs to control parasites including lungworm (*Protostrongylus* sp.). Such treatments concentrate sheep and may jeopardise wildness.

Management and research biologists exchange information on bighorn sheep in annual meetings of the Desert Bighorn Council and biennial meetings of the Northern Wild Sheep and Goat Council. Proceedings of these meetings are published. Three private organisations, the Foundation for North American Wild Sheep, the Rocky Mountain Bighorn Society and the Society for the Conservation of Bighorn Sheep, raise funds for research and management. At least 10 states auction and/or raffle one or two special bighorn hunting licences to raise funds for these purposes.

Status within country: Not threatened (but see below).

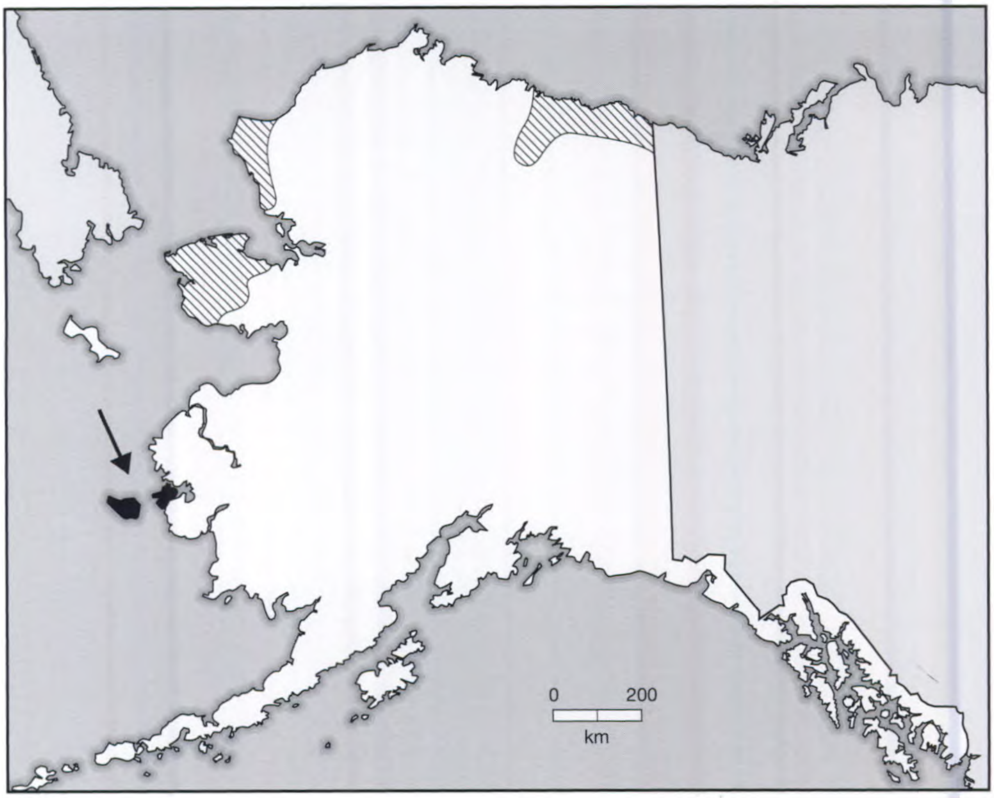
The status of most traditional subspecies and major ecotypes of bighorn sheep is satisfactory because they exist on 30 biological reserves (Map 10.3.1) and on many other protected areas. However, their status is not fully secure because at least 64% of the herds contain <100 animals. Berger (1990) reviewed the history of some small bighorn populations and concluded that those numbering less than 50 animals usually became extirpated (see also Fitzsimmons and Buskirk 1992, and Schwartz *et al.* 1989). Further, the ecotypes of bighorn in the Chihuahuan desert and in shortgrass-badlands and riverbreak environments, are not secure because there are few reserves or other protected lands within these two regions, and very few of these lands contain wild sheep.

Conservation measures proposed: 1) Additional research on bighorn diseases, particularly in relation to domestic livestock, and on developing efficient methods for habitat management is desirable. **2)** State and federal agencies should develop co-ordinated plans to enhance the long-term security of the numerous bighorn herds with <100 sheep. Strategies should include increasing herd size, expanding habitat and reducing herd sedentariness, and enhancing habitat quality and habitat protection in corridors between small herds (Bailey 1992). **3)** Land management agencies, especially the U.S. Forest Service and Bureau of Land Management, should formally recognise bighorn ranges in their management plans, including corridors for movement within and between herds. **4)** Until disease relations are clearer, bighorn should be protected from contact with domestic sheep whenever possible. **5)** Greater recognition of the values and importance of ecotypic variation in bighorn sheep is needed. Federal agencies and state wildlife departments should seek a consensus on classifying the major ecotypes. Each state should furthermore classify its bighorn according to state ecotypes. Conservation of major ecotypes should proceed under the federal Endangered Species Act. Each state should be responsible for conserving another level of ecotypic diversity of bighorn sheep within its boundaries. **6)** Increase the number of bighorn sheep in federally protected habitats in the Chihuahuan Desert and in the shortgrass-badlands and riverbreaks ecosystems. In the Chihuahuan Desert, options include: **a)** expanding protection of habitat and sheep from the San Andres National Wildlife Refuge to a greater portion of the White Sands Missile Range; **b)** formally recognising and enhancing protection of the Big Hatchet Game Range, now on Bureau of Land Management land; **c)** establishing viable bighorn populations in Guadalupe Mountains and Big Bend National Parks; and **d)** establishing bighorn in a new biological reserve, probably in west Texas. **7)** In the shortgrass-badlands and riverbreaks ecosystems, management options include: **a)** expanding bighorn populations and distributions in the Charles M. Russell National Wildlife Refuge, the Bighorn National Recreation Area, and in Theodore Roosevelt and Badlands National Parks; and **b)** establishing bighorn populations in new biological reserves in eastern Wyoming or western Nebraska (or in eastern Colorado, though this area is less desirable because it is not historic bighorn range).

Muskoxen (*Ovibos moschatus*)

Distribution: Formerly found between the coast and the northern slopes of the Brooks range, muskox is now restricted to five isolated areas in Alaska (Map 10.3.4).

Population: A total of 2,170 to 2,250 animals was estimated from aerial and ground counts made by state and federal biologists in 1992 and 1993. Numbers for each of the five populations were: Nunivak island 407; Nelson island 198; Seward peninsula 800 to 850; northwest Alaska 245 to 275; northeast Alaska 520. The re-established herds are increasing in size and range, and in some areas, local



Map 10.3.4. General distribution of muskoxen (*Ovibos moschatus*) in the United States of America.

people are concerned that they will compete with caribou and reindeer.

Conservation measures taken: All five extant populations are the result of re-introductions of the muskox within and outside its historic range. These conservation efforts began in 1935 with the translocation of animals, originally from northeast Greenland, to Nunivak island. From 1967 to the most recent transplants in 1970, the Nunivak island population has been the source for all other Alaskan translocations (Klein 1988). Fully protected by law, muskox occurs in five protected areas: Arctic, and Yukon Delta NWRs; Bering Land Bridge, and Noatak NPPs; and Cape Krusenstern NM (Map 10.3.1). Hunting is allowed under permit, with limited quotas on three of the five herds. Local subsistence hunting is given preference.

Status within country: Not threatened.

Acknowledgements: Information on the status and locations of wild sheep, mountain goats and muskoxen was graciously provided by: W. Heimer, S. Machida, P. Reynolds and C. Smith (Alaska); R. Lee (Arizona); V. Bleich (California); D. Schrupp (Colorado); L. Oldenburg (Idaho); G. Joslin and J. McCarthy (Montana); G. Tsukamoto (Nevada); A. Sandoval (New Mexico); J. McKenzie (North Dakota); W. Van Dyke (Oregon); T. Benzon (South Dakota); J. Kilpatric (Texas); G. Jense (Utah); R. Johnson (Washington); and H. Harju (Wyoming).

10.4 Regional summary

P.R. Krausman

Conservation status

Except for Mexico, Caprinae in North America (i.e. muskoxen (*Ovibos moschatus*), mountain goat (*Oreamnos americanus*), thinhorn sheep (*Ovis dalli*), and bighorn sheep (*O. canadensis*)) have adequate habitats and protection to maintain viable populations (Table 10.4.1). However, most Caprinae taxa were dramatically reduced, at least one subspecies to extinction (*O. c. auduboni*), in the late 19th and early 20th centuries by commercial exploitation, habitat loss, competition and diseases from domestic livestock, or some combination of these. Today, most are safe because of species-specific biological research and inventories, coupled with stringent hunting regulations, transplants, regulated land use practises, and re-introductions to historic habitats. Bighorn sheep, however, are not entirely safe. Many populations in the United States are very small (<100) and hence vulnerable to extinction (see Berger 1990; Fitzsimmons and Buskirk 1992; Schwartz *et al.* 1989). In addition, >17 species of exotic ungulates have been successfully introduced into the United States and competition from them threatens some local bighorn populations. The desert races of bighorn sheep (*O. c. cremnobates*, *O. c. mexicana*, *O. c. nelsoni*, *O. c. weemsi*) in the south-western United States and north-western Mexico are particularly threatened by competition with exotics and livestock, as well as by poaching in Mexico. These sheep are vulnerable (Table 10.4.1) and all bighorn sheep in Mexico are included in Appendix II of CITES. Of special concern for desert sheep in Mexico and parts of the southwestern United States, is the introduced Barbary sheep, a species that could take over bighorn habitat, as it has in Coahuila, thus precluding re-introductions of bighorn sheep. The current uncertain taxonomic status of desert races of bighorn sheep (e.g. see Ramey 1991, 1993; Wehausen and Ramey 1993) must not be allowed to interfere with conservation efforts.

Conservation cautions

Managers need to monitor mountain goat populations in coastal mountain ranges that require mature forests and steep slopes for winter habitat. Several populations will be influenced by timber harvesting. Finally, managers must recognise that the widespread legalisation of game farming results in the commercialisation of wildlife and can be a threat to the survival of all wild ungulates.

Conservation solutions

The numbers of wild sheep in North America (Table 10.4.1) have increased since the 1900s, but management should involve co-ordinated plans to enhance long term viability of small (<100 individuals) populations by increasing herd size, expanding habitat, reducing herd sedentariness, enhancing habitat quality and corridors between herds, and preventing contact with domestic stock, especially domestic sheep.

Immediate action is necessary to effectively manage the sheep remaining in Mexico. This can only be accomplished with effective law enforcement, trained wildlife personnel, public education, habitat management, and the reduction or elimination of exotic ungulates in bighorn sheep habitat.

International conservation actions

Joint action is required only between Mexico and the United States for desert sheep conservation. Desert bighorn sheep is not well represented in the Chihuahuan desert and efforts should be made to expand its habitat and protection in that ecotype. Co-operation among biologists and managers in the two countries would serve to enhance these efforts.

Table 10.4.1. Summary of conservation status (category of threat[1]) and total population estimates of Caprinae in North America.

Taxon	Canada	Mexico	United States	Total numbers estimated	Red List[2]
Mountain goat *Oreamnos americanus*	S	-	S	82,000–>90,000	LRlc
Dall's sheep *Ovis dalli dalli*	S	-	S	97,000–100,000	LRlc
Stone's sheep *Ovis dalli stonei*	S	-	-	14,500	LRlc
Rocky Mountain bighorn sheep *Ovis canadensis canadensis*	S	-	S	>36,700	LRlc
California bighorn sheep *O. c. californiana*	S	-	S	≈8,900	LRcd
Peninsular bighorn sheep *O. c. cremnobates*	-	V	V	<2,500	ENC1+2a
Mexican bighorn sheep *O. c. mexicana*	-	V	V	?(>2,000)	VUD2
Desert bighorn sheep *O. c. nelsoni*	-	-	S	?(15,000)	LRcd
Weems' bighorn sheep *O. c. weemsi*	-	V	-	?(500)	CRC2a
Muskoxen *Ovibos moschatus*	S	-	S	≈108,250	LRlc

[1] Categories of threat from country reports above; status follows categories described in 1994 IUCN Red List (Groombridge 1993); S = not threatened.
[2] Global category of threat listed in 1996 IUCN Red List of Threatened Animals (IUCN 1996).

Chapter 11

Conservation Priorities and Options

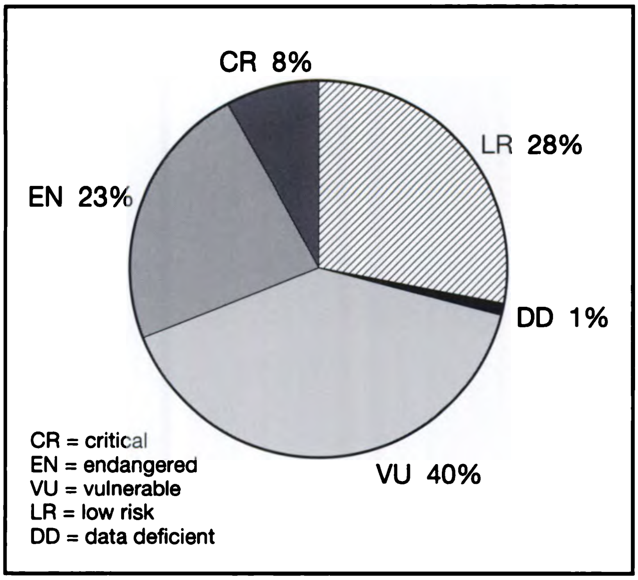
D.M. Shackleton

11.1 Global status of Caprinae

Overall, wild Caprinae are in rather poor shape (Figure 11.1). Around 71% of taxa are threatened (31% classified as Endangered or Critical), with only 28% considered low risk, although five taxa are near threatened (LRnt). Threats are a result of increasing human populations with concomitant demands for food and other natural resources. Caprinae habitat is being lost to forestry and agriculture, or is being severely degraded by livestock overgrazing (particularly by domestic sheep and goats). Caprinae are also prized for their meat, furs, and body parts for alleged medicinal properties, but hunting levels often exceed population capacities. Unfortunately, not only do each of these threats have serious implications for the long-term survival of Caprinae, many also occur simultaneously. As a result, most taxa are declining in numbers, densities, or both. Finally, most Caprinae are threatened because their metapopulations are becoming increasingly fragmented into very small, totally isolated populations (see also **Chapter 2**).

Total numbers *per se* may not always be the most important criterion, rather the dispersion and degree of isolation of populations of a taxon can be critical. As an example, all other conditions equal, two populations, each of several hundred with minor interchange, are often much less threatened than a metapopulation of the same total size but distributed among three times as many totally isolated sub-populations. This phenomenon is recognised in IUCN's new categories of threat (IUCN 1994), and it is becoming increasingly common for many Caprinae such as for goral and serow. These are relatively solitary animals and do not appear to live naturally in high densities, and with habitat destruction through logging and land clearing, their populations become highly fragmented. Populations of other caprins may live at extremely low densities (e.g. densities of blue sheep and some argali in parts of western China have been estimated at <0.1 animal/km^2 or even lower). Under these conditions, even though the total estimated number may be several thousand individuals, populations at such low densities are easily lost with any increase in exploitation levels, habitat loss/degradation, or both.

Figure 11.1. Proportions of Caprinae taxa classed according to the latest IUCN Red List categories of threat (IUCN 1994). Ratings are shown for global status (see Table 11.1.1).



A global classification for each taxon according to the latest IUCN Red List Categories of Threat, along with a summary of each taxon's global status from the country reports, are presented in Table 11.1.1. One of the criteria used by the new Red List system is "mature population" size, where "mature" refers to those individuals actively involved in reproduction (see IUCN 1994:10). Because few population estimates provided information on age-sex class, for assigning global status, the mature component was assumed to be ca. 50% of the total population estimate. This rough estimate is based on published (e.g. Geist 1971, Schaller 1977, Jorgensen *et al.* 1993) and unpublished (e.g. M. Festa-Bianchet, J. Fox, S. Lovari - pers. comm.) data; however, it may be an overestimate of effective population size if FitzSimmons' and Buskirk's (1992) calculations for bighorn sheep apply to other taxa in the subfamily.

11.1.1 Review of taxa

The following briefly summarises the conditions under which the various taxa exist.

Goral and serow

Habitat loss, and poaching for meat and medicinal use, clearly threaten almost all subspecies of goral and serow. As a result, two subspecies of serow are Endangered, and all but Japanese serow and Himalayan goral are classed at

Table 11.1.1. Summary of the global status of each wild Caprinae taxon.
Data are taken from the country reports (**Chapters 4** to **10**). The function of the table is to summarise the data necessary to describe conservation status and to allow determination of the new IUCN Red List Category of Threat (IUCN 1994). The "mature population" used to assess the IUCN Red List is taken as ca. 50% of the total estimated number (see text).

Taxon[1]	Total Number	Trend	Dispersion	Protected Areas	Threats	CITES	1996 IUCN Red List
Serow *Capricornis sumatraensis*						I	VUA2cd
Indochinese serow *C. s. maritimus*	?	⇓?	f	10 - IA	H,P,M	I	VUA2cd
Southwest China serow *C. s. milneedwardsii*	?	⇓	f,s	34 - ?	H,P,M	I	VUA2cd
Red serow *C. s. rubidus*	?	⇓	f,s,d	(8)? - IA	H,P	I	ENA2cd
Sumatran serow *C. s. sumatraensis*	?	⇓?	f,s,d	(23)? - ?	H,P,M	I	ENA2cd
Himalayan serow *C. s. thar*	?	⇓?	f,s?,d	35 - ?	H,P	I	VUA2cd
Japanese serow *Capricornis crispus*	≈100,000	⇑?		13 - A	H		LRcd
Formosan serow *Capricornis [crispus] swinhoei*	?	?		15 - ?	H,P,T		VUA2cd
Red goral *Naemorhedus baileyi*						I	VUA2cd
Tibetan red goral *N. b. baileyi*	?	⇓?	?,r	3 - IA	H,P	I	VUA2cd
Burmese red goral *N. b. cranbrooki*	?	?	?	1? - IA	H,P	I	VUA2cd
Long-tailed goral *Naemorhedus caudatus*						I	VUA2cd
Long-tailed goral *N. c. caudatus*	?	⇓?	f	(5)? - IA	H,P	I	VUA2cd
Evans' long-tailed goral *N. c. evansi*	?	?	?	3? - IA	H,P,M	I	VUA2cd
Grey or Chinese long-tailed goral *N. c. griseus*	?	⇓?	f,s	1 (12?) - ?	H,P,M	I	VUA2cd
Korean or Amur long-tailed goral *N. c. raddeanus*	?		f,s	(12)? - ?	H,P,M	I	VUA2cd
Himalayan goral *Naemorhedus goral*						I	LRnt
Western Himalayan goral *N. g. bedfordi*	?	?	f,s	48 - ?	H,P,L	I	LRnt*
Eastern Himalayan goral *N. g. goral*	?	?		16 - ?	H,P,L	I	LRnt
Mountain goat *Oreamnos americanus*	>80,000	⇔	s	? - A	-		LRlc
Northern chamois *Rupicapra rupicapra*							LRlc
Turkish chamois *R. r. asiatica*	?	?	?	11 - ?	P,L		DD

Table 11.1.1. Summary of the global status of each wild Caprinae taxon ... continued

Taxon[1]	Total Number	Trend	Dispersion	Protected Areas	Threats	CITES	1996 IUCN Red List
Balkan chamois *R. r. balcanica*	>17,000	⇔ ⇓	f,s	53 - A	H,P,T,G		LR$_{lc}$*
Carpathian chamois *R. r. carpatica*	9,000	⇔	f	>9 - A			LR$_{lc}$
Chartreuse chamois *R. r. cartusiana*	≥150	⇓?	r	0 - IA	P,L.C,T,G,N		CR$_{C2b,D}$
Caucasian chamois *R. r. caucasica*	<15,000	⇓	r	4 (12) - ?	P,L,C		VU$_{C1}$
Alpine chamois *R. r. rupicapra*	>380,000	⇔ ⇑		>125			LR$_{lc}$
Tatra chamois *R. r. tatrica*	860	⇓	r	2 (3) - ?	P,T,N		EN$_{C1}$
Southern chamois *Rupicapra pyrenaica*							LR$_{cd}$
Apennine or Abruzzo chamois *R. p. ornata*	400	⇑?	s, r	3 - ?	L,N	I	EN$_{D1}$
Cantabrian chamois *R. p. parva*	>8,000	?		2 - A			LR$_{lc}$
Pyrenean chamois *R. p. pyrenaica*	>26,500	?		18 - A			LR$_{lc}$
Barbary sheep *Ammotragus lervia*	?	⇓	f,d	9 - IA	H,P,L	II	VU$_{A2cd}$[3]
Blue sheep *Pseudois nayaur*							LR$_{nt}$
Tibetan Blue sheep or Bharal *P. n. nayaur*	?	⇓?	d	29 - ?	P,L		LR$_{nt}$
Sichuan Blue sheep *P. n. szechuanensis*	?	⇓?	d	11 - ?	P		LR$_{nt}$
Dwarf blue sheep *Pseudois [nayaur] schaeferi*	?	⇓	d	0 - IA	P		EN$_{A2d,B1+2e}$[4]
Himalayan tahr *Hemitragus jemlahicus*	?	⇓?	f	25 - IA	H,P,L		VU$_{A2cde}$
Nilgiri tahr *Hemitragus hylocrius*	≤2,500	⇓	f,s	7 - ?	P,N		EN$_{C2a}$
Arabian tahr *Hemitragus jayakari*	≈2,000	⇔	f,r,d	3 - ?	P,L,N		EN$_{C2a}$
Wild goat *Capra aegagrus*							VU$_{A2cde}$
Persian wild goat *C. a. aegagrus*	?	⇓	f	93 - ?	H,P,L		VU$_{A2cde}$
Turkmen, Pasang or Sind wild goat *C. a. blythi* (= *turcmenica*)	?	?	f,s,d	14 - ?	H,P,L		VU$_{A2cde}$
Chiltan wild goat *C. a. chialtanensis*	<500	⇓?	f,s,d	1 - IA	P,N		CR$_{C2b}$

Table 11.1.1. Summary of the global status of each wild Caprinae taxon ... continued

Taxon[1]	Total Number	Trend	Dispersion	Protected Areas	Threats	CITES	1996 IUCN Red List
Cretan wild goat *C. a. cretica*	>600	⇑?	r	2 - ?	P,G,T,N		VU$_{D1+2}$
Markhor *Capra falconeri*							EN$_{A2cde}$
Flare-horned markhor *C. f. falconeri*	>3,000	⇓?	f, s	23 -?	H,P,L,N		EN$_{C2a}$*
Tadjik markhor *C. f. heptneri*	>700	⇓	f, s, r	2 - IA	H,P,L,M,N		CR$_{C2a}$
Straight-horned markhor *C. f. megaceros*	<1,500	⇓?	f, s	1 - IA	H,P,L,N		EN$_{C2a}$
Alpine ibex *Capra ibex ibex*	25,000	⇔⇑	s	52 - A			LR$_{lc}$
Asiatic ibex *Capra [ibex] sibirica*	>250,000	⇔⇓	s	60 - ?	P,L		LR$_{lc}$*
Nubian ibex *Capra [ibex] nubiana*	?	⇓	f,s,d	26 - IA	H,P,L		EN$_{C2a}$
Spanish ibex *Capra pyrenaica*							LR$_{nt}$*
Spanish ibex *C. p. hispanica*	7,900	?	s	10 - A			LR$_{cd}$
Pyrenean ibex *C. p. pyrenaica*	10	?	1	1 - IA	?,N		CR$_{D}$[4]
Gredos ibex *C. p. victoriae*	3,300	?	1	1 - IA	?		VU$_{D2}$[4]
Walia ibex *Capra [ibex] walie*	≤400	?	1	1 - IA	H,P		CR$_{C2b}$
West Caucasian tur *Capra [ibex] caucasica*	<10,000	⇓	r	4 - ?	L,P		EN$_{A1d+2cde}$
East Caucasian tur *Capra cylindricornis*	>25,000	⇓?	r	9 - IA	P,L		VU$_{A1d+2cde,C1}$
Mouflon *Ovis orientalis*							VU$_{A2cde}$
Armenian mouflon *O. o. gmelinii*	?	⇓	f	18 - IA	P,L	II	VU$_{A2cde}$
Esfahan mouflon *O. o. isphahanica*	?	?	r	2 - ?	P?	II	VU$_{A2c}$
Laristan mouflon *O. o. laristanica*	?	?		3 - ?	P?	II	VU$_{A2c}$
European mouflon *O. o. musimon*	2,800	⇔	r	4 - ?	P	II	VU$_{A2cde,D1+2}$
Cyprian mouflon *O. o. ophion*	1,200	⇓	1	1 - IA	N	I	EN$_{A1a}$
Red sheep *O. o. orientalis*	? (see *gmelinii*)						

Table 11.1.1. Summary of the global status of each wild Caprinae taxon ... continued							
Taxon[1]	Total Number	Trend	Dispersion	Protected Areas	Threats	CITES	1996 IUCN Red List
Urial *Ovis orientalis*							VU A2cde
Transcaspian urial *O. o. arkal*	?	⇓	f?,d?	10[5] - ?	H,P,L	I	VU A2cde
Bukhara urial *O. o. bocharensis*	<1,200	⇓	f,s,d	3 - IA	P,L	I	EN A1cde,C1+2a
Afghan urial *O. o. cycloceros (= blanfordi)*	>12,000	⇓	f,d	25[4] - IA	P,L	I	VU C1*
Punjab urial *O. o. punjabiensis*	<2,000	⇓	f,s,d	11 - IA	P,L,N	I	EN A1cde,C1+2a
Severtzov's urial *O. o. severtzovi*	>2,000	⇓	d	1 -?	P,L,N	I	EN A2cde,C2b
Ladakh urial *O. o. vignei*	<2,100	⇓	f,s,d	4 - IA	P,L,N	I	EN A2cde,C1+2a
Argali *Ovis ammon*						II	VU A2cde
Altai argali *O. a. ammon*	?	⇓?	s,d	5 - ?	P,L	II	VU A2cde,C1
Kazakstan argali *O. a. collium*	>8,000	?		2 - ?	P,L	II	VU A2cde,C1
Gobi argali *O. a. darwini*	?	⇓?	?	2 - ?	P,L	II	VU A2cde,C1
Tibetan argali *O. a. hodgsonii*	?	⇓?	d	8 - IA	P,L	I	VU A2cde
Northern Chinese argali *O. a. jubata*	600-700	⇓?		1 - IA	P,N	II	EN C1+2a,D1
Tien Shan argali *O. a. karelini*	<10,500[6]	⇓	f,d	5 - IA	P,L	II	VU A2cde,C1+2a
Kara Tau argali *O. a. nigrimontana*	≈250	⇓	d	0 - IA	P,L,N	II	CR C2b
Marco Polo argali *O. a. polii*	<15,000	⇓		3 - IA	P,L	II	VU A2cde,C1
Bighorn sheep *Ovis canadensis*							LR cd
California bighorn sheep *O. c. californiana*	>6,800	⇔	f,s	? - A			LR cd
Rocky Mountain bighorn sheep *O. c. canadensis*	31,000	⇔	f,s[7]	? - A			LR lc
Peninsular bighorn sheep *O. c. cremnobates*	<2,500	⇓	r	? - IA	P,L,N	II	EN C1+2a[4]
Mexican bighorn sheep *O. c. mexicana*	? (>2,000)	⇓	f,s,i	0? - IA	P,L,N	II	VU D
Desert bighorn sheep *O. c. nelsoni*	? (15,000)	⇔	f,s	? - A			LR cd

Table 11.1.1. Summary of the global status of each wild Caprinae taxon ... continued

Taxon[1]	Total Number	Trend	Dispersion	Protected Areas	Threats	CITES	1996 IUCN Red List
Weems' bighorn sheep *O. c. weemsi*	? (500)	⇓	r	0? - IA	P,L,N	II	CR C2a[4]
Thinhorn sheep *Ovis dalli*							LR lc
Dall's sheep *O. d. dalli*	>97,000	⇔		>11 - A			LR lc
Stone's sheep *O. d. stonei*	14,500	⇔		>3 - A			LR lc
Snow sheep *Ovis nivicola*							LR cd
Okhotsk snow sheep *O. n. alleni*	>16,000	⇔		2 - ?	P		LR lc
Putorean snow sheep *O. n. borealis*	3,500	?⇑		1 -?	P,N		VU D2
Yakut snow sheep *O. n. lydekkeri*	>55,000	⇔		0 - ?	P		LR lc
Kamchatka snow sheep *O. n. nivicola*	>12,000	⇔		1 - ?	P		LR nt
Muskoxen *Ovibos moschatus*	>118,000[8]	⇔⇑	s,i	11 - A			LR lc
Takin *Budorcas taxicolor*						II	VU A2c,d
Golden takin *B. t. bedfordi*	≥1,200	⇓	f,s	2 - IA	H,P,T,N	II	EN A2cd,C2a,D1
Mishmi takin *B. t. taxicolor*	?	⇓?	?	3 - IA	H,P	II	EN A2cd
Sichuan takin *B. t. tibetana*	?	?	?	10 - ?	H,P,T	II	VU A2cd
White's or Bhutan takin *B. t. whitei*	?	?	f	6 - ?	H,P,L	II	VU A2cde

[1] **Taxon:** see **Chapter 3**
Total Number: Estimate of total numbers (mature population size ca. 50% of total); ? = even estimated numbers unknown. N.B. numbers may differ from those in the CBSG CAMP report (Killmar *et al.* 1993) because they were "guestimates" or have since been revised.
Population Trend: ⇑ increasing, ⇔ stable, ⇓ decreasing, ⇔ ⇓ some populations stable, others decreasing. ? = unknown; 1 = restricted to a single population.
Dispersion: f = fragmented; s = very small (<100 animals) populations; d = very low densities (<1 animal/km^2); r = geographically restricted distribution.
Protected Areas: No. of protected areas; (5)? = known in five protected areas, but total No. unknown; A = No. and/or size probably adequate for protection of taxon, IA = No. and/or size probably inadequate; ? = uncertain if No. and/or size adequate for protection of taxon.
Threats: H = habitat loss (logging, agriculture); P = poaching/over-hunting; M = medicinal use; L = competition/disease/habitat degradation from livestock; C = competition with wild ungulates; G = hybridization; T = tourism; N = population limitations (e.g. numbers, density, etc.).
CITES: Appendix I or II
1996 IUCN Criteria: Global status according to the new IUCN Red List Categories (IUCN, November 1994); CR = critical, EN = endangered, VU = vulnerable, LR = low risk, DD = data deficient. * taxon in at least one country qualifies for a higher category of threat.

[2] *Ammotragus lervia ornatus* is believed extinct in Egypt.

[3] Not possible to assess by subspecies, but most would be EN or CR – see country reports in **Chapter 4**.

[4] Priority rating depends in part on taxonomic status.

[5] Most protected areas contain very few urial.

[6] Largest component of total number, estimated by extrapolating extremely low densities (0.014-0.5/km^2) to very large areas.

[7] Many populations in USA contain <100 individuals.

[8] In addition, 3,000 muskoxen exist in introduced populations in Greenland, and ca. 300 in re-introduced populations in Russia.

least as Vulnerable, with several subspecies probably belonging in a higher category of threat than given in Table 11.1.1. Unfortunately, we know very little about the current distributions of most subspecies, and even less about their numbers (see **Chapter 12**); only the threats are indisputable. Conservation management should focus on preserving goral and serow habitats (mountain forests), while trying to meet human demands for firewood, timber and other resources. Both goral and serow may be suitable candidates for sustainable subsistence hunting programs, which may also help address the overhunting issue and encourage local conservation efforts.

Mountain goat

Mountain goat appears secure throughout North America.

Chamois

Among Northern chamois, the Chartreuse subspecies is critically threatened because only ca. 150 animals remain. Besides competition from other wild, introduced and domestic ungulates, they face the danger of hybridisation with introduced Alpine chamois (see **6.5 France**). Among the remaining subspecies, some are vulnerable, but the species' taxonomy needs reviewing. Southern chamois is in relatively good shape, and though Apennine chamois is technically Endangered, current conservation management appears successful.

Barbary sheep

As a species, Barbary sheep fits the criteria for Vulnerable, but because most subspecies exist at very low densities, and the species' total distribution is severely fragmented, perhaps it should be treated as if Endangered. The species is scattered over a huge area that encompasses much of North Africa, and inhabits very arid, unproductive mountain habitats. Most countries with Barbary sheep have no funds available to conserve these animals. Where re-introductions are considered, captive breeding records must be carefully assessed to ensure that breeding between subspecies has not occurred, otherwise unique natural genomes will disappear.

Blue sheep

Dwarf blue sheep, if taxonomically separate and not a phenotypic phenomenon, is at risk of extinction because of its restricted range and the threats it faces if not given immediate protection (see **7.1 China**). The other species of Blue sheep is currently not threatened globally but some populations are at risk because of their very low densities. Both Sichuan and Tibetan blue sheep may be candidates for sustainable, subsistence and trophy hunting programs, although caution is advised with low density populations (e.g. <1 animal/km^2) because of their extreme vulnerability to over-harvesting.

Tahr

Himalayan tahr is problematic. Known to be increasingly threatened by competition with livestock, loss of habitat, and hunting, there are only limited, solid population data. With conservative quotas and annual monitoring, there is probably a potential for limited subsistence hunting and also for some trophy hunting in appropriate populations.

The Arabian tahr's outlook is probably reasonable given the present management measures. Maintaining these conservation efforts (e.g. patrolling guarded areas) is essential for its continued survival, and further ecological research will only support and improve its conservation status.

C. Rice

A maternal group of Nilgiri tahr (*Hemitragus hylocrius*) grazing on open slopes in the Western Ghats of southern India.

Nilgiri tahr is the most threatened of all tahr, and if effective measures are not taken now, the status of this monotypic species will change to Critical. Populations are decreasing while habitat fragmentation and population isolation are increasing. Only two populations have >300 individuals, and most <100. Immediate action is needed to halt poaching and to provide protection for the remaining populations. Efforts will probably be most effective if an integrated conservation strategy is developed for all wildlife in the Western Ghats because of the region's unique fauna and flora (see **8.3 India**).

Wild goats, and Alpine and Asiatic ibex

The tendency for members of the genus Capra to occupy the most precipitous terrain used to result in a decreased vulnerability to hunting and competition with livestock. However, precipitous terrain is no longer as secure because restriction to predictable and limited habitat provides little protection against today's high-powered rifles and increasing motor vehicle access. With fewer than 500 individuals, the Chiltan wild goat of Pakistan, is the most endangered member of this species.

After being rescued from the brink of extinction (Stüwe and Nievergelt 1991), Alpine ibex are now considered safe with current conservation management. Both wild goat and Asiatic ibex also generally appear safe for now, but require constant monitoring because they could quickly become threatened. Wild goats usually live at low elevations in low productivity habitats that are readily accessible to humans. Both species often live in small isolated populations, at low densities, or both, and Asiatic ibex may not be as secure as some believe. Populations in some countries are already threatened (e.g. see **Chapter 7**). The agrimi is almost Endangered by criterion D (IUCN 1994), but current conservation efforts on Crete appear to be working.

Spanish ibex is taxonomically problematic, but whatever the outcome of any revision, genetic variation among its geographically widely separated subspecies must be considered in future conservation strategies.

Walia ibex is currently represented by a single population of ca. 400 individuals. The species is therefore at particular risk of extinction from stochastic events, as well as from human activities.

Tur

As with several Caprinae, threats originating with unstable political conditions (e.g. increased numbers and availability of firearms, loss of conservation controls, etc.) pose threats to these species, especially to West Caucasian tur. The taxonomic status of the two tur, a possible third species, and their relationship to other Caprinae (e.g. ibex) need to be explored.

Markhor

Markhor's restricted global distribution runs from the mountains north of the Amur Darya river in Turkmenistan, east through Afghanistan and Pakistan, just into the extreme northwestern part of India. Within this area, markhor populations are usually very small (<100 individuals) and isolated from each other. The total global population is probably no more than 5,500 animals and data indicate that numbers of all three subspecies are declining. Protected areas are generally inadequate in size and number, and though hunting is banned in Pakistan and India, conditions in Afghanistan are unknown, and a small number of Tadjik markhor are hunted legally each year in Tadjikistan and Uzbekistan. There is little evidence

R. Hess

Two adult male flare-horned markhor (*Capra falconeri falconeri*) fighting. Chitral Gol National Park, NWFP, Pakistan.

that moneys from these trophy hunting program are used for markhor conservation. The Tadjik subspecies is probably the most threatened of all markhor. Numbering probably <700 animals, it is a high priority taxon for conservation action, as are the other two subspecies.

Mouflon

Mouflon, like urial, suffer because they live at low elevations, usually in low productivity habitats that are also heavily grazed by livestock. The most important country for this species is Iran, but recent population estimates were difficult to obtain. Taxonomic uncertainties further complicate the conservation picture for mouflon. The whole question of mouflon taxonomy, particularly the validity of *O. g. laristanica* and *O. g. isfahanica*, as well as mouflon-urial relationships and hybrid populations needs revisiting using new data and a multi-disciplinary approach (see also **Chapters 3** and **12**).

Conservation measures for European mouflon appear satisfactory, although the species is problematic because all but two populations are modern introductions of generally uncertain pedigree. The Sardinian and Corsican populations by contrast, probably originated as early introductions by humans in the Neolithic or slightly later, but whether these populations represent early domesticates is debatable. A similar history is shared by the Cyprian mouflon. A major part of the population of this latter subspecies is reported to have declined recently by as much as 50% over four years (Hadjisterkotis and Bider 1992) giving rise to its Endangered status (Table 11.1.1).

Urial

Urial are especially threatened for several reasons. Like mouflon they inhabit low elevation, open areas that are often close to human settlements and thus heavily used by livestock. This proximity also makes them especially vulnerable to being hunted/poached. Their typical habitat is arid and of low productivity, so urial densities are often apparently naturally low ($<1/km^2$). Finally, they are highly prized by trophy hunters, so there is an obvious temptation to open or expand hunts for significant economic gain. Subspecies at particular risk are Bukhara, Ladakh, Punjab and Severtzov's urials. Without prompt and effective conservation actions, these four urial will continue declining and their status will quickly deteriorate to Critical.

Argali

Along with markhor and urial, argali are probably the most sought after Caprinae by trophy hunters. Inhabiting more accessible areas than species with similar ranges such as ibex, argalis are more vulnerable to poaching and hunting. Their habitat is also used more by livestock, so competition and habitat degradation are frequent problems. Some estimated population densities are extremely low ($<0.01/km^2$; see **Chapter 7**) and as such are seriously susceptible to overharvesting. Kara Tau argali, whose total number is ca. 250, is the most critical of all members of this species. A final conservation issue faced in some areas with argali, are contested borders (including armed conflicts) between neighbouring countries.

Thinhorn and Bighorn sheep

Both subspecies of Thinhorn sheep are currently secure in North America. For bighorn, work by Ramey and Wehausen (Ramey 1993, 1995; Wehausen and Ramey 1993) clearly indicate that major revisions are required to Cowan's (1940) taxonomy of the species, especially for desert-dwelling subspecies. It is very like that *Ovis canadensis weemsi*, *O. c. cremnobates* and perhaps *O. c. mexicana* will not be distinguished as subspecies separate from *O. c. nelsoni* (Ramey 1993, 1995; Wehausen and Ramey 1993). However, conservation of populations of these sheep on the Baja peninsula, in the extreme southwest United States, and in northern Mexico, is still essential, especially for genetic reasons. Most other bighorn subspecies appear to be at low risk, although the large number of small populations (<100 animals), particularly in the USA, is cause for concern and indicates the importance of maintaining and improving management efforts.

Snow sheep

This species appears to be satisfactory for now, though any increased level of use (e.g. poaching) would quickly lead to a decline in its status. Conservation of the only subspecies currently threatened, the Putoran snow sheep, appears to have been satisfactory to date (but see **7.2**).

Takin

China is the single most important country for takin. While more reliable data are required on all subspecies, Golden and Sichuan takin are readily accessible and need increased protection. The other two subspecies require surveying and co-operative conservation agreements among the various countries they inhabit (i.e. Bhutan, China, India [Assam], Myanmar). This may be difficult because many takin populations exist in sensitive border areas.

11.2 Priorities

From Table 11.1.1, it is apparent that a disturbingly large number of Caprinae are considered top priority for immediate conservation action. Priority is based primarily, but not exclusively, on the categories Critical and Endangered. They include (in taxonomic order):

Chartreuse chamois* (*Rupicapra rupicapra cartusiana*)
Barbary sheep (*Ammotragus lervia*)
Dwarf blue sheep* (*Pseudois* [*nayaur*] *schaeferi*)
Nilgiri tahr (*Hemitragus hylocrius*)
Chiltan wild goat (*Capra aegagrus chialtanensis*)
Markhor (*Capra falconeri*)
Pyrenean ibex* (*Capra pyrenaica pyrenaica*)
Walia ibex (*Capra* [*ibex*] *walie*)
Bukhara urial (*Ovis orientalis* [*vignei*] *bocharensis*)
Punjab urial (*O. o.* [*v.*] *punjabiensis*)
Severtzov's urial (*O. o.* [*v.*] *severtzovi*)
Ladakh urial (*O. o.* [*v.*] *vignei*)
Northern Chinese argali (*Ovis ammon jubata*)
Kara Tau argali (*O. a. nigrimontana*)
Peninsula bighorn* (*Ovis canadensis cremnobates*)
Weems' bighorn* (*O. c. weemsi*)
Golden takin (*Budorcas taxicolor bedfordi*)

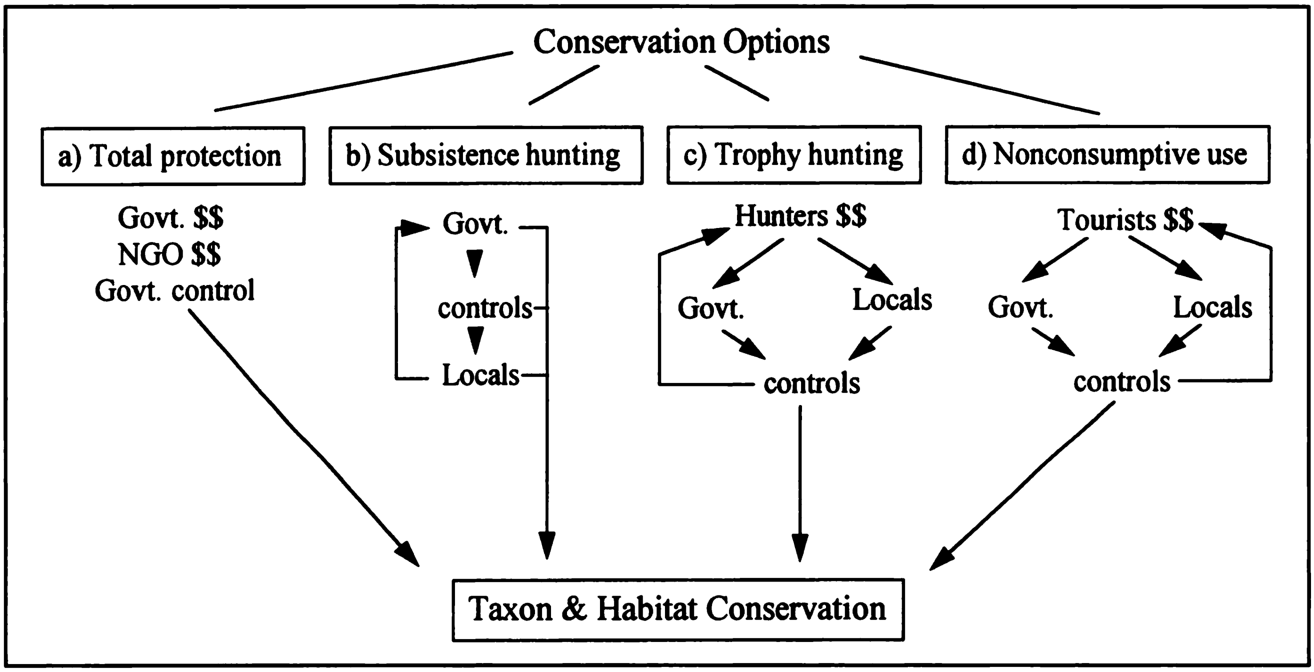
The conservation priority of above taxa marked with an *, depends somewhat on their taxonomic status. Although they represent unique gene pools, it is difficult to assess whether they should have a slightly lower conservation priority than the remaining members of the list. It must also be stressed that though taxa listed above are considered top priority for conservation action, and that the list includes all taxa classed as Critical, there are additional Endangered or Vulnerable subspecies (Table 11.1.1) also in need of quick and effective conservation actions. Most taxon-specific conservation actions have been recommended in the country reports (**Chapters 4 to 10**), with additional ones in **Chapter 12**.

11.3 Broad conservation options

The environments inhabited by most Caprinae are of relatively low productivity (see **Chapter 2**). Consequently, the natural fauna and flora, especially if in protected or at least well managed areas, may prove the most viable, and for humans, the most valuable use of such habitats. However, economic benefits from natural protected areas are usually significant and yet often overlooked (Thomas 1994). Besides their intrinsic value, wild Caprinae have many attributes that have actual or potential utility to humans, and thus are important to conserve (see also **Chapter 2**).

Of the possible options for Caprinae conservation, four appear appropriate (Figure 11.3.1). These options are not mutually exclusive, but do vary in the degree of inputs they require and potential for self-sufficiency. Total protection alone is not self-supporting and will require inputs from governments, and in some cases, also from international non-government organisations, to maintain protected areas and employ sufficient staff. The other three options show a range in levels of self-sufficiency or cost-recovery abilities from low potential (e.g. subsistence hunting) to high potential (e.g. trophy-hunting). However, for some of these options, costs (inputs) may also be relatively low (e.g. subsistence hunting programs). Captive breeding may be considered a "last-resort" option, partly because of its usually high cost, and also because of an inadequate infrastructure in many countries. Captive breeding facilities do exist in some countries, but show varying levels of success.

Figure 11.3.1. Main options for Caprinae conservation, together with the main linkages involved within each. The options are not mutually exclusive.



If conservation actions are to be successful they must consider and be sensitive to the needs of local people (e.g. Harris 1993; Lewis *et al.* 1990). Effective conservation strategies will also require appropriate legislation, sufficient field staff to enforce regulations, education programs for local people, and an understanding of local people's needs that are compatible with wildlife conservation. Protected areas are an obvious solution, though often they create conflicts with locals who need the areas for livestock grazing and/or for resource use (e.g. fuelwood gathering). Domestic livestock have been identified in most countries as creating significant problems for Caprinae, but how this conflict can be solved without creating further difficulties for Caprinae and for local people, will require creative solutions.

11.3.1 Total protection

While total protection may be an ideal conservation solution from the taxon's perspective, it is not always possible to apply this strategy effectively. For example, it requires a strong, clear legislative framework, and sufficient trained staff and resources, for protection to be enforced effectively. Also, full protection often can be provided only in areas such as national parks or wildlife sanctuaries. These areas require an administrative infrastructure together with a considerable financial commitment to establish and maintain. Depending on the degree of protection and operational procedures within a protected area, problems can develop because local people may lose access to essential resources and to a land base on which their livelihoods depend. Most probably, a range of protection measures will be required for all taxa, including some populations that receive total protection to ensure the long-term survival of the taxon. The range of protected reserves should be truly representative of a taxon's genetic and geographic diversity, but can include some areas where relatively intensive human activities might occur if controls on the levels of hunting and use of habitat resources are enforced.

11.3.2 Sustainable hunting

Hunting programs, if properly designed and controlled to be sustainable, have potential for benefiting conservation of many Caprinae. Guidelines for such programs are provided in **Appendix 1**.

11.3.2.1 Subsistence and recreation hunting

Both these types of hunting activities have strong potential for supporting Caprinae conservation, primarily because hunters are mainly locals or at least nationals. First, the activity fills various needs (e.g. food and other products for local subsistence economies), and second, it thereby encourages both local and national support for conservation. There are numerous examples of successful programs throughout the world that have generated large and widespread support for maintaining healthy populations of wild animals including for Caprinae.

Several elements appear to be critical to the success of subsistence and recreation hunting programs. First, success has been due to local support, and second it involved applied management and controls on resource use (Geist 1994). Trade-offs will be required where activities of locals have to be reduced if the wildlife are to survive (e.g. livestock grazing, fuelwood gathering, etc.). Also critical to success, benefits derived from use of the wildlife **must** be channelled back to local communities (e.g. Makombe 1994). Success of conservation actions are also higher where programs involve inputs by local users into both the decision-making and planning processes (e.g. Lewis *et al.* 1990). There are various models being developed, some are no doubt more appropriate than others for Caprinae (e.g. Edwards 1995), although we do not advocate commercial or market hunting (see Geist 1988, 1994) for any Caprinae.

11.3.2.2 Trophy hunting

In trophy hunting, primarily males are hunted, with usually horn size, and to a lesser degree taxon rarity, being the important criteria. Not all Caprinae are considered trophy species. Currently, the most desired are argali, urial and

Adult male argali (*Ovis ammon*) are one of the most highly prized trophies within the Caprinae. Frankfurt Zoo, Germany.

C.A.W. Guggisberg (WWF)

markhor. Hunters are prepared to pay relatively large sums of money to hunt them (Harris 1993; Stiver 1989). A typical fee in Central Asia for a current licence to shoot a trophy caprin can be over US $20,000. Guide and outfitter fees are additional.

A recent development in North America is to auction or raffle trophy hunts. Bidding systems vary, but basically involve hunters making offers or buying raffle tickets for a limited number of hunts for trophy animals. The highest bidder (or winning raffle ticket) receives the hunt, which may include guiding fees. Both systems have raised extremely large sums of money (e.g. sometimes >US $200,000/animal) which in most cases appear to have been used for Caprinae conservation and research (Festa-Bianchet 1995).

11.3.2.3 Trophy-hunting programs

Trophy-hunting programs are appropriate for Caprinae conservation only under certain circumstances (see **Appendix 1**) and should not be automatically recommended as means of conserving Caprinae, even when they could be biologically sustained (e.g. Harris 1993). These caveats are especially important for threatened taxa. Effective, sustainable programs that provide tangible and significant conservation benefits will be difficult to establish. The types of trophy-hunting programs that the IUCN/SSC Caprinae Specialist Group propose should meet certain criteria (see below and **Appendix 1**), and provide obvious benefits for the caprin and its habitat, local people, the trophy hunter, and the government agencies concerned with wildlife conservation and management.

11.3.2.4 Criteria for Caprinae trophy-hunting programs

For a Caprinae trophy hunting program to provide conservation benefit, it should a) be based on reliable population data that clearly demonstrate a harvest is sustainable, b) produce significant and tangible conservation benefits for the species and its habitat (with benefits to other native animal species as well), c) provide benefits to, and be in co-operation with, local people (i.e. those living in the immediate area), and d) provide quality animals for the hunter. Wherever possible, the benefits to the taxon should not be limited to the area where they are hunted, but be applied to the taxon as a whole throughout the country.

While it is important to address what is meant by "sustainability" and whether a program will be sustainable, for practical purposes much debate can be avoided by identifying and eliminating clearly **unsustainable** approaches. The over-riding philosophy for the IUCN Caprinae Specialist Group's Action Plan when making conservation decisions, especially where consumptive use is involved, is "**if in doubt, err on the conservative side**". This is simply because if mistakes are made and numbers were underestimated or under-harvested, or if threats were overestimated, animals will remain and conservation tactics can be modified. However, if numbers were overestimated and/or the population overharvested, the population or taxon can be quickly reduced or even driven to extinction (see Shackleton and Bunnell 1989) thus reducing or eliminating chances of recovery. Foster (1977) discussed an example of Caprinae harvest data being assessed over large geographic areas and leading to severe, and rapid declines in numbers in several populations.

A cautionary approach is obviously vital for threatened taxa. The guidelines in **Appendix 1** apply primarily to Lower Risk taxa, and also probably to some classed as Vulnerable where tight control and monitoring the effects of harvest are feasible. To hunt taxa considered to be at higher levels of threat, will require extreme caution and convincing justification (see criteria in IUCN 1994). Strict controls will be needed and enforced, harvest levels must be extremely conservative and demonstrably safe, and the conservation benefits must be applied quickly and effectively.

There are several reasons for recommending caution in developing any hunting program, particularly any involving trophies. These caveats are especially important where threatened taxa are involved. The four main ones are:

a) The most sought after trophy-species are often Endangered or Critical. The fewer there are of a taxon, the more some hunters are willing to pay to shoot it. This necessitates developing and enforcing stronger national and international controls over hunting and import-export of threatened taxa.

b) With the high monetary value placed on many Caprinae, the temptation to view trophy hunting primarily as a means of generating foreign exchange (either for government and/or personal gain) or for deficit reduction may be great. The emphasis will then be on short term economic gains at the expense of conservation and taxa.

c) In many areas, the quality of population data is very likely to be inadequate. Quality is limited usually because i) habitats are often remote and/or difficult to work in (e.g. forested habitats on steep slopes), ii) there are no practical census techniques (e.g. for serow, goral), iii) personnel have limited training in appropriate survey techniques (see below), iv) the most effective census methods (e.g. aerial surveys) may be unfeasible or not permitted, or v) because of some combination of these.

d) Contrary to a common belief, most trophy male Caprinae are not past their "prime" but are the main breeding males in a population. There are no data on the long-term (evolutionary) impact of their removal on population demographics, only on short term effects. However, it is quite probable that there will be some long-term negative effect. Therefore, harvest levels for trophy males must be relatively conservative until the long-term social and genetic effects of their removal have been studied (see also **Appendix 1**).

In conclusion, the Caprinae Specialist Group supports the limited use of sustainable hunting programs ***only*** as a means of creating conservation actions that benefit a taxon, its habitat, and wherever possible other native taxa in the same ecosystem.

11.3.3 Non-consumptive use

The potential of activities such as ecotourism specifically for Caprinae is relatively unknown, although Harris (1993), in his preliminary evaluations for Yeniugou (Qinghai, China), concluded that its value for conservation may be limited. Besides economic limitations, some taxa would probably be difficult to observe in the wild, either because of their visually dense habitat or because of the rugged topography they occupy. However, Caprinae viewing is a major tourist attraction in many protected areas in western Europe and western North America, though perhaps not always providing direct revenues. In some regions, viewing caprins could probably be emphasised as part of trekking-adventure holidays (e.g. in the mountains of India, Nepal, Pakistan) if disturbance to animals is minimised. Analysis of non-consumptive use with regard to the interest of the public (international and local), as well as its economic potential to provide actual conservation benefits is required. Recent evaluations of economic benefits from protected areas, clearly point to their importance for both conservation and the economy (Thomas 1995).

Acknowledgements: M. Festa-Bianchet, M. Gimenez-Dixon, R.B. Harris, S. Lovari, M.D. Pitt, and P. Wegge.

Chapter 12

General Conservation Actions and Implementation

D.M. Shackleton

The following global-level conservation actions and possible approaches towards their implementation, are given **in addition** to the individual country and regional conservation recommendations made by the various authors in **Chapters 4 to 10**.

12.1 Taxon-specific actions

12.1.1 Top priority taxa

For the top priority taxa identified in Chapter 11, most recommended actions have been outlined in the country reports (chapter sections given in brackets) of the appropriate chapters:

Chapter 4 – **Barbary sheep** (4.1, 4.2, 4.3, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13); **Walia ibex** (4.5, 4.13)

Chapter 6 – **Chartreuse chamois** (6.5); **Pyrenean ibex** (6.13)

Chapter 7 – **Dwarf blue sheep** (7.1); **Markhor** (7.2); **Bukhara urial** (7.2); **Severtzov's urial** (7.2); **Northern Chinese argali** (7.1); **Kara Tau argali** (7.2); **Golden takin** (7.1).

Chapter 8 – **Nilgiri tahr** (8.3); **Chiltan wild goat** (8.5); **Markhor** (8.1, 8.3, 8.5); **Punjab urial** (8.5); **Ladakh urial** (8.3, 8.5)

Chapter 10 – **Peninsula bighorn** (10.3); **Weems' bighorn** (10.3).

Recommended actions and implementation:

1) **Top priority taxa.** It is essential that action be taken immediately to limit further declines in numbers or distributions of the most threatened Caprinae listed above. Specific recommendations have been made in the country reports and further actions given below.

2) **Taxon-specific conservation measures.** The **Conservation measures proposed** in Chapters 4 to 10 for each taxon should be implemented as soon as possible in consideration with recommendations in **Regional summaries** and in this chapter.

12.1.2 Goral and serow conservation

Goral and serow are particularly problematic because their habitat makes them so difficult to census. Rather than using precious time and resources attempting to carry out large-scale population censuses, at least three other practical conservation solutions may be worth pursuing for these two species.

Recommended actions and implementation:

1) **Surveys.** Undertake relatively quick surveys and interviews of local people to locate several "large"

Typical serow (*Capricornis sumatraensis*) habitat of forested limestone mountains and hills in Thailand. Population surveys are obviously very difficult to carry out in such areas.

populations that represent each of the various goral and serow taxa, and that also represent a wide geographic range of each taxa within and among countries. This effort should be made in each of the countries where these species are found.

2) **Develop protected areas networks.** Once "large" populations have been identified, create a geographically widespread network of protected areas. Ideally there should be connection between them, but this is probably impossible if a sufficiently representative number of protected areas is to be established. Funds will probably be needed to undertake the protected population surveys and, in some cases, to acquire the land.

3) **Halt habitat loss.** Reduce habitat loss and degradation within and outside protected areas. Clearing land for agriculture and logging will be a difficult issue to deal with. The problem of habitat loss may be addressed through replanting schemes that provide a renewable source of firewood, and where applicable, by promoting programs that use alternative, sustainable fuel supplies (e.g. solar, biogas). Allowing collection only of dead wood is probably too easily circumvented by people girdling trees and gathering the wood when the trees/shrubs die. If the appropriate native fuelwood species are selected for restocking, understorey loss caused by browsing by domestic livestock may be alleviated.

4) **Control hunting.** Either ban, or at least impose strict controls on hunting, especially where medicinal trade is a threat. This will require not only tough legislation, but also staff to enforce the regulations. Unfortunately this action may encourage black market trade in parts.

12.1.3 Immediate action for markhor, urial and argali

With strong pressure to hunt these trophy animals, coupled with heavy livestock competition and declining numbers of most subspecies, immediate action is required. While it is necessary to obtain more reliable population and distribution data (especially for mouflon and urial in Iran), even without these data, action is also needed to deal with current levels of use of these three species. Action may be most effective if the various parties involved in their hunting, hunting management and conservation, meet to discuss common problems and solutions. If this does not occur, many of these animals will very probably be lost in the near future.

Recommended actions and implementation:

1) **Trophy Hunting Working Group.** Establish a working group under the IUCN/SSC Caprinae Specialist Group, to develop an interim approach to hunting these trophy animals. The Working Group's first task should be to organise a workshop. This would be a relatively small meeting with discussion papers prepared in advance. In addition to key Caprinae biologists from the countries with these three species, other professional biologists and representatives of hunting organisations (e.g. Conseil International de la Chasse et de la Conservation du Gibier [CIC], Safari Club International [SCI], Safari Outfitters, Glavbiocontrol) should also be members of the working group (see also **12.2.5** below).

2) **Surveys.** Survey the distributions and numbers of all taxa within the three species throughout their ranges. Initially it may be possible to survey only sample areas for each taxon. These should be randomly chosen to represent the taxon's recent historic range, thus allowing a broad estimate of its general status.

3) **CITES.** The current listing of argali (*Ovis ammon*) in Appendix II is probably inappropriate. Each subspecies should be reviewed independently to identify those that need raising to Appendix I (e.g. at least *O. a. jubata, O. a. nigrimontana*).

12.2 General conservation actions

Following are recommended actions that apply to the conservation of most taxa. An underlying philosophy to these recommendations is that involvement of local people at all stages is vital to ensure the success of almost any conservation action.

12.2.1 Surveys and censuses – techniques and training

The problems of inadequate population estimates and information on distributions, are common to many taxa. In many cases, personnel will require training in appropriate census techniques for Caprinae in mountain regions before reliable censuses can be made. One solution would be for a team(s) of IUCN Species Specialist Group members and others, with practical experience in ungulate surveys, to hold workshops at various locations around the world, to which biologists and technicians could be sent for training. Objectives of such workshops would not only be for participants to learn techniques, but also to provide them with sufficient skills to return home and instruct co-workers. To this end, initial workshop participants should be a) individuals who will be make making the surveys, and b) provided with materials, techniques and support to help them organise and run workshops themselves.

A second or additional solution would be to produce a handbook/guidelines for use either in the field and/or in workshops. Its contents should cover theory as well as logistical issues for Caprinae that live in mountains, in forested mountains, and at low densities, etc. However, techniques need to be developed that not only generate biologically useful and reliable data on Caprinae populations, but that are also relatively simple and inexpensive. This is especially important given the logistic and financial constraints typical in many areas with Caprinae. The IUCN/SSC Caprinae Specialist Group could act as the co-ordinator of these actions.

Recommended actions and implementation:

1) **Research.** The IUCN/SSC Caprinae Specialist Group, its members and other organisations with direct interests in Caprinae, should work together towards promoting research on practical and effective census techniques for Caprinae.

2) **Training workshop.** The IUCN/SSC Caprinae Specialist Group and other interested organisations should help develop and run workshops for training field personnel in census and survey techniques.

3) **Handbook.** A subcommittee of the IUCN/SSC Caprinae Specialist Group involving members and other invited individuals should work towards developing a field handbook on census and survey techniques for Caprinae.

4) **Distribution maps.** Baseline maps for plotting taxon distributions would be most useful for conservation if ONC 1:1,000,000 maps were used.

12.2.2 Taxonomy and genetic diversity

It is clear from the preceding sections of this Plan, that a total revision of the entire subfamily is necessary if long-term Caprinae conservation is to be effected. Not only is there biological justification for this task, but as Geist (1992) observed, a taxonomy has major implications for conservation legislation. The immediate benefits of a revised Caprinae taxonomy include:

a) improved CITES identification sheets to aid law enforcement officials in their task of controlling the illegal trade in taxa,
b) clarification of biological and legal aspects for conservation laws, and
c) an advance in our understanding of the phylogenetic relationships within the subfamily Caprinae.

However, it should also be borne in mind that most conservation actions do not necessarily require a formal taxonomy, especially where management units can be defined by other criteria (see Cronin 1993:345).

Recommended actions and implementation:

1) **Taxonomy Working Group.** Establish a Taxonomy Working Group within the IUCN/SSC Caprinae Specialist Group. This will require additional members to the Specialist Group (see below) with responsibilities to:
   1.1) organise an international workshop on Caprinae evolution and taxonomy; and
   1.2) revise the taxonomy of the Caprinae.

   To be useful, a revision of Caprinae taxonomy will require a multi-disciplinary, integrated approach involving DNA analysis, internal and external morphology, behaviour, zoogeography, palaeontology, and evolutionary history (Avise 1989; Cronin 1993; O'Brien and Mayr 1991; Ryder 1986). It will also require large sample sizes if it is to be a valuable revision (Cronin 1993). A revision would be most effectively achieved if a Taxonomy Working Group of the Caprinae Specialist Group is established with scientists from around the world representing disciplines that directly bear on taxonomic criteria. This action requires additional new members to the IUCN/SSC Caprinae Specialist Group. The working group's task would be to work co-operatively towards the goal of publishing a revised taxonomy of the subfamily, either in a single or a series of scientific reports. The working group should also seek input from outside the scientific community, from hunting organisations and government agencies.

   The Taxonomy Working Group needs to meet quickly to organise its philosophy/approach and to determine a division of labour. Its first tasks must be to establish guidelines and criteria, and decide the division of taxa among members. This may be best achieved through an international workshop on Caprinae evolution and taxonomy aimed at developing a recommended program for resolving taxonomic uncertainties pertaining to wild Caprinae populations.

2) **Conservation of maximum genetic diversity.** While it is clear that Caprinae taxonomy is problematic, taxonomic confusion must not be allowed to prevent or delay conservation. Our aim is maintenance of maximum genetic variation, not merely conservation of "taxa" *per se*. With this in mind, it will not be sufficient to preserve just one or two "representative" populations of a given taxon, or even one or two populations within a country. We must ensure that a taxon's broad geographic distribution is well represented through our conservation actions. Only in this way will we effectively maintain

current levels of potential genetic variability along with the supporting habitats.

Taxonomy is an area where regional co-operation can be vital. International co-operation and concerted action can ensure not only that adequate samples are available, but that the necessary wide geographic (genetic) representation is preserved. The alternative, to let countries address their own Caprin conservation issues in isolation, will most probably lead to an unsatisfactory, piece-meal solution that fails to address the fundamental conservation problems.

12.2.3 Maintaining genetic integrity

At least three issues are involved. First, for some Caprinae, threats to genetic integrity exist because non-indigenous taxa, often closely related, have been introduced into their range. Examples include, Alpine chamois introduced into Chartreuse chamois range in France, and into Balkan chamois range in the former Yugoslavia; European mouflon into chamois range in France and Italy; and Barbary sheep into some desert bighorn ranges in the USA. The dangers arise from hybridisation, increased competition, or both. If hybridisation occurs, even between subspecies, unique gene pools that were adapted to local conditions are lost. Second, wild species are sometimes used for cross breeding in an effort to develop better adapted breeds of domestic livestock (e.g. domestic goat × Nubian ibex in Israel – Rattner *et al.* 1985; domestic goat × Asiatic ibex and markhor in Pakistan – Rasool and Hussain 1993). If successful, such crosses can only threaten the genetic integrity of the wild taxon. Last, are cases where "re-introductions" have been made without using animals of the appropriate taxon (e.g. muskox from Greenland into Alaska, Alpine chamois into several European countries).

Recommended action:

1) **Re-introductions**. Future re-introductions and translocations of Caprinae should involve only taxa native to the area of re-introduction, and where appropriate, follow the guidelines of the IUCN/SSC Re-introduction Specialist Group (IUCN, in press).

12.2.4 Ecology

Basic population and ecological data on most Caprinae either do not exist or are extremely limited. Lack of biological information, especially of population dynamics and habitat requirements, severely restricts conservation actions. This is particularly true when attempting to determine the most appropriate measures to take or how best to apply them. For example, an understanding of a taxon's population dynamics is particularly important for assessing whether hunting programs will be unsustainable.

Recommended actions and implementation:

1) **Demography and ecology.** Each jurisdiction should be encouraged to assess the quality of its data on the demography and ecology of the Caprinae within its region to ascertain where there are major gaps. The Country Reports (**Chapters 4 to 10**) indicate many of the gaps in our knowledge about numbers, demographics and distributions of Caprinae, and thus provide a useful starting point. In many cases such biological surveys would be most efficient if carried out in conjunction with data gathering on other fauna and flora.

2) **Ecosystems research.** Due to the unique characteristics of mountain ecosystems (e.g. see Poore 1992; Shackleton and Bunnell 1989), researchers should consider initiating co-operative studies of ecosystem dynamics in various mountain regions. They could be modelled on such projects as the long-term research carried out in the Serengeti (Sinclair and Arcese 1995; Sinclair and Norton-Griffiths 1979).

12.2.5 International protocols for sustainable-use hunting

Potential limitations of hunting threatened Caprinae were discussed in **Chapter 11** (section **11.3.1**) and preliminary guidelines are presented in **Appendix 1**. Sustainable hunting can involve trophy hunting by fee-paying big-game hunters (usually foreign), and/or subsistence or recreational hunting by local people. An intensive cropping system as occurs in some east and southern African countries is not being advocated for Caprinae, nor are we considering economic benefits as being the primary purpose of such programs. Instead, any hunting is meant principally to be a means of promoting conservation of a taxon and its habitat (including the expansion and improvement of existing conditions).

Caprinae hunting programs are not universally appropriate. Trophy hunting would entail only removal of a small proportion of the mature male component of a population, the number being based on population-specific data and sound demographic and biological principles (see **Appendix 1**). Any hunting program should provide clear benefits for the conservation of taxa being hunted, its habitat and other members of biological community, and for local people. The rationale for employing trophy hunting in conservation of some threatened taxa is to provide funds for the conservation of the taxa and their habitats, and to gain the support of local peoples, by meeting the needs of trophy hunters. Subsistence or recreational hunting could include removal of a sustainable portion of both males and females. Emphasis in this latter type of hunting would be for food or recreation benefits for locals, in return for their supporting effective conservation regulations and their compliance with them (e.g. self-policing in remote areas, reduction of poaching, etc.). Taxa classed as Critical or Endangered would rarely be appropriate for any hunting programs; instead populations increasing significantly in numbers, or large stable populations would be most suitable.

Recommended actions and implementation:

1) **Sustainable hunting protocols.** Pursue international agreements on protocols for sustainable hunting of Caprinae, particularly for trophy hunting. Besides the relevant government agencies, such agreements should involve input from conservation (e.g. IUCN/SSC Caprinae Specialist Group, CITES, TRAFFIC International) and hunting organisations (e.g. CIC, SCI). A practical and effective procedure would be development of a common biological approach across countries, with modifications on their implementation according to local conditions (see also **12.1.3**).

2) **Research.** Encourage research projects on the long-term effects of removal of mature (trophy) males on genetic and social aspects affecting population dynamics. A small working group within the IUCN/SSC Caprinae Specialist Group could be established to develop and monitor sustainable hunting of Caprinae, and to liaise with the IUCN/SSC Sustainable Use of Wild Species Group.

3) **Management workshop/symposium.** Hold a workshop or symposium to explore the management strategies of hunted Caprinae populations. It may be appropriate to hold this in conjunction with the proposed workshops/symposia on markhor, urial and argali, and on census methods (see sections **12.1.2** and **12.2.1** above).

12.2.6 Conservation legislation and management

With poaching and habitat destruction (from various causes) being identified as two of the most frequent threats to Caprinae, and given that most countries have legislation in place to control such activities, it is obvious that greater efforts are needed to enforce existing laws. At the same time, new or stronger laws will be required along with their enforcement (see recommendations in **Chapters 4 to 10**). It is clear, particularly from North America and European experiences, that large, viable populations of Caprinae can be sustained over much of their natural range, even in the face of high human densities and related land-use impacts. Not only that, but wildlife such as Caprinae can be of significant and sustainable economic value (e.g. Geist 1994). However, both sustainable populations and economic benefits demand effective conservation legislation combined with active wildlife-conservation management, that together are directed by long-term management goals aimed at maintaining or restoring Caprinae to viable population levels.

Recommended actions:

1) **Enforce existing laws.** International organisations such as IUCN and CITES should increase their encouragement and support for enforcement of existing laws regarding the conservation of Caprinae.

2) **Review current laws.** Each jurisdiction should review the need for new or strengthened legislation for effective Caprinae conservation.

3) **Wildlife management.** Increase support for (or develop) effective government wildlife-conservation management agencies that are responsible for wild Caprinae.

4) **Management goals.** Develop long-term management goals for creating viable populations and their habitat. This is most essential in countries with declining numbers of Caprinae.

5) **Medicinal trade.** An estimate of the extent of medicinal trade involving Caprinae should be undertaken immediately in co-operation with TRAFFIC International and CITES.

6) **Involve local communities.** Develop legal frameworks that provide local people and communities with input into the decision-making process and economic benefits associated with Caprinae conservation.

12.2.7 Protected areas

Establishment of sufficient protected areas and staffing requirements is an action with significant benefits for all Caprinae. Currently, some taxa are poorly represented in protected areas (see **Table 11.1.1**). Marco Polo sheep is an obvious example because it occurs in only three (possibly 5) protected areas, despite a relatively wide distribution area. Attempts should be made to develop a network of protected areas that represent a taxon's geographic distribution and metapopulation (see Caughley 1994). For those taxa that exist in only one protected area, establishing additional ones may also involve founding new populations (see **12.2.3** above) to safeguard against stochastic events. Because of the habitats occupied by many Caprinae, protected areas often are, or will be, in mountain regions. Guidelines for protected areas in mountains have been published by IUCN (Poore 1992).

Recommended actions:

1) **Protected areas effectiveness.** Each jurisdiction should be encouraged to re-evaluate the effectiveness of current protected areas for each taxon in terms of:
   - the proportion of the taxon's global population protected;
   - if habitats/areas, critical for the survival of the taxon/population(s), are included;
   - the degree of the taxon's geographic distribution covered by the protected areas;
   - role of protected areas in halting fragmentation, and
   - adequacy of staffing levels, infrastructure and funding.

12.2.8 Co-operation and co-ordination

Direct interest in Caprinae conservation is diverse and ranges from individuals (e.g. hunters, nature-lovers), to government and non-government organisations (e.g. hunting organisations; trophy hunting organisations, government agencies and non-government conservation organisations). Given the widespread problems facing Caprinae, it is imperative that all those with direct interests in this group of ungulates, be encouraged to work even more closely together to avoid duplication and to optimise conservation efforts. Without a real and concerted effort to develop active co-operation and co-ordinated actions, wild Caprinae will only continue to decline.

Acknowledgements: M. Gimenez-Dixon, R.B. Harris, S. Lovari, M.D. Pitt, and P. Wegge.

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Appendix 1

Preliminary Guidelines for Sustainable Use of Wild Caprins

Per Wegge

A.1.1 Justification and potential

Provided certain biological and sociological conditions are fulfilled, wild caprins are a renewable resource that may be harvested sustainably and in the process furnish benefits to local economies and conservation objectives. Harvesting can be by local peoples for sustenance and/or recreation, as well as by foreign hunters for trophy animals. Because several of the species are in very high demand by exclusive trophy hunters, controlled trophy hunting programs can also yield substantial revenues that can benefit local communities and local conservation management (Harris 1993). Besides paying for operating costs of area management, the economic returns from such programs may augment the conservation efforts targeted for the harvested species and for biodiversity (Kiss 1990).

Sustainable production of animals for harvesting does, however, require a management plan and a population capable of sustaining the harvest. In particular, production of trophy males requires a large population base and good quality habitats (Wegge 1979). Hence, a properly planned hunting program can simultaneously provide for conservation of locally indigenous flora and fauna, and thus be complementary to other conservation efforts.

Few of the hunting programs currently in operation, provide for the distribution of generated revenues for conservation purposes or for local community development. Furthermore, few of the hunting programs are based on sufficient biological information and may not be ecologically sustainable. Not all caprin species or populations are of trophy quality, but hunting programs to enhance local sustenance may often be feasible if based on proper ecological information and if monitored adequately.

A.1.2 Theoretical considerations

We have only a limited picture of Caprinae population dynamics. What is available (e.g. Bauer 1986; Festa-Bianchet *et al.* 1994; Murphy and Whitten 1976; Pérez *et al.* 1994; Schaller 1977; Wegge 1979; Wehausen *et al.* 1987) indicates that most wild species of Caprinae are long-lived with relatively low recruitment rates, and poorly developed self-regulatory population mechanisms (i.e. fecundity and mortality appear only weakly related to density). Instead some species seem to be limited through environmental factors and unpredictable and harsh winters occasionally kill off fractions of the population (Burles and Hoefs 1984; Schaller 1977; Wehausen *et al.* 1987). Because environmental factors (drought, avalanches, excessive snow depths and icing) occur irregularly, densities in many caprin populations may fluctuate within wide limits over a time span of decades. However, urial and some mouflon inhabiting arid, low elevation rolling hills often give birth to twins and thus may have higher reproductive potential than other members of the genus (Schaller 1977; Valdez 1976). Whether this potential is regularly actualised depends heavily upon environmental conditions (Schaller 1977).

In the absence of a strong predation pressure and climatic events which kill off fractions of the population, density may exceed the long-term carrying capacity of the habitat. Due to time lags in density-dependent responses, the physiological conditions of individuals could deteriorate making them vulnerable to disease and other catastrophes, with subsequent large die-offs (see review in Dunbar 1992). However, Dunbar (1992) could find no published evidence that epizootics are typically related to poor body condition, but did find documentation of epizootics occurring when bighorns were in good physical condition (e.g. Festa-Bianchet 1988). Further, measures of range condition before, during or after bighorn sheep die-offs are almost never made (Ryder *et al.* 1994; Streeter 1970). At levels beyond carrying capacity, individual growth among young males and sexual maturation among females may also be retarded. Maintaining density below carrying capacity of the range may therefore increase the rate of male recruitment to the trophy size class and stimulate earlier sexual maturation among young females (Jorgenson *et al.* 1993). This may lower the mean age of harvestable trophy animals and increase net recruitment rates of both sexes. While "carrying capacity" is a useful theoretical concept, how to determine it in the field is as yet uncertain.

Most wild caprins probably have a natural survivorship pattern characterised by high postnatal and juvenile mortality (lambs and yearlings), followed by high survivorship among middle aged and older animals, and sharply increased mortality among the oldest segments of the population (e.g. Caughley 1966; Murphy and Whitten 1976; Stewart 1980). Known causes of mortality include inclement weather, predation during early life, and accidents and starvation induced by adverse winter conditions during old age (Burles and Hoefs 1984; Nichols 1978; Schaller 1977). Poor summer and autumn range conditions may predispose older animals to mortality during late winter. This is common among mature males under extra harsh winter conditions, because they are physiologically exhausted after the rutting season (Geist 1971). For some species, diseases are also major causes of mortality and often involve domestic caprins (e.g. Onderka and Wishart 1988; Onderscheka *et al.* 1988; Spraker *et al.* 1984).

"Trophy" animals are usually males, and trophy status is assigned primarily on horn size and development. Trophy hunting selectively kills the oldest males with the largest horns and with the largest body size, and hence highest social status. Therefore, although numerically only a small proportion of the total population, genetically, these males are also the most valuable breeders (Geist 1971). Their absence has been suggested to decrease population productivity through disruption of social processes (Bubenik 1971, cited in Stringham and Bubenik 1974; see also Heimer *et al.* 1984; Singer and Nichols 1992), but current evidence for this in *Ovis* is either weak (Singer and Nichols 1992) or shows no short-term effects (Hoefs and Barichello 1984; Murphy *et al.* 1990; Shackleton 1991).

Care must obviously be taken in any hunting plan when defining a "trophy" individual, especially when trophy criteria are based solely on horn characteristics. In some populations, due to individual growth rates, and/or sex ratios caused by recent demographic events, the majority of males may be "trophy" animals. (Shackleton 1976, 1990). Harvest levels of trophy males (see **A.1.3.2**) must be adjusted accordingly based on censuses and other population data (see **A.1.3.1**). The long-term genetic effects of trophy hunting must also be considered.

Social organisation, dispersal abilities and habitat use, all have important implications for Caprinae conservation and management. Most caprins are social species with strong cohesion among group members. For most of the year, a large proportion of males commonly live in bachelor groups and occupy separate ranges from females and young. In most species of *Ovis* and *Capra*, and perhaps other taxa, dispersal capacity and ability to colonise new ranges are poorly developed (Geist 1977; Heptner *et al.* 1966). Since most caprins typically inhabit rugged terrain interspersed with totally unsuitable habitat, a metapopulation often consists of local populations that have little or no interchange with neighbours, even over relatively short distances. Most sheep and sheep-like species inhabit open terrain which facilitates censusing numbers and determining population structure. The goats and goat-antelopes on the other hand, occupy more rugged or densely vegetated habitats and some are more active during poorer light conditions compared to sheep. Their habitat affinities and activity patterns make them particularly difficult to census (e.g. Maruyama and Nakama 1983). Except inside protected areas, where they quickly adapt to human presence if not persecuted, caprins are usually shy and flee in the presence of humans.

A.1.3 Management requirements

The country reports in **Chapters 4 to 10** repeatedly chronicle the decline of many Caprinae and point to poaching or overharvesting as one of the major causes. In other words, current levels of use of many taxa are not sustainable, and when coincident with other negative factors (e.g. habitat degradation and loss, and resource competition from livestock), only hasten the rate of decline. Under such conditions, management efforts need to change or even be implemented. Properly applied, controlled hunting programs can play a significant role when based on scientific data and with an ongoing monitoring program.

A.1.3.1 Biological survey and monitoring of the resource

Population numbers and composition are rarely static, and when a management program involves harvesting, populations need to be monitored frequently (e.g. annually). With regular and frequent censuses, it is possible to more easily assess whether a program is sustainable and make any necessary readjustments to harvest levels.

A properly conducted census of animal numbers and sex-age composition of the population(s) is a fundamental requirement for conservation of Caprinae, especially where harvesting is involved. For species living in open and relatively flat habitats, aerial surveys using fixed-wing aircraft can be an ideal method (helicopters create high levels of stress - see Bleich *et al.* 1994; MacArthur *et al.* 1982; Stemp 1983). In many countries, however, animals will have to be counted on foot along transects, from fixed observation points, or by systematic searches over the whole area. Species inhabiting treeless country (e.g. most *Ovis* and *Capra* species, blue sheep and tahr) lend themselves to direct ground counts using telescopes or binoculars based on systematic sampling of drainage systems and grazing plateaux, or from strategically located points near their predictable feeding sites. Forest and shrub dwelling species like serow, goral, takin and some tahr populations are more difficult to census. No standard techniques have yet been developed. A combination of direct observations at traditional feeding sites and pellet-group counts may yield useful qualitative indices for monitoring purposes. Inventories must not be restricted to a few localities known to contain animals, because some age and sex groups frequent less-used ranges, and estimates will be inflated. Also, since in many species, sexes live separately except during the rut (mating season), a census needs to be stratified so that it adequately encompasses all segments of the population. Depending on species, censuses may be more effective at certain seasons. For example, in some species large aggregations of both sexes or just males form in early spring, while in others, the rut or mating season is a time when all age-sex classes are together. Finally, where appropriate, intensive monitoring may involve mark-resight methods for estimating numbers (Neal *et al.* 1993). For other comments on censuses see also **12.1.1 Goral and serow conservation** and **12.2.1 Surveys and censuses – techniques and training.**

When collected over several years, certain additional census measures can yield valuable demographic information. Among the more useful are the number of young of the year per adult female, sex ratio among adults (>yearlings), and number and age-class of trophy-sized males. In many species, male and sometimes female age estimation is possible from counting horn rings (e.g. Geist 1966; Miura *et al.* 1987). In others, age approximation is possible from a combination of body size, coloration, and relative length of horns (e.g. horn as a proportion of ear length).

Valuable information may also be obtained from harvested animals. In good quality populations, i.e. when animal density is below carrying capacity and animals are not stressed from disturbance, individual growth and physiological conditions are optimum. This is manifested by large body and horn size relative to animal age. Measuring the length and circumference or diameter of annual horn sheaths and comparing these with the age as estimated from horn ring counts, can generate indices of condition to evaluate and compare harvested males (see also Bunnell 1978; Jorgenson and Wishart 1984; Shackleton 1973, 1976). High indices suggest that habitat quality and energetics are probably not limiting. Conversely, if animal condition is low (i.e. small sized horns relative to animal age), the population density may have surpassed the carrying capacity of the range, or there are other problems (e.g. diseases, parasites, severe winters). A horn growth index which may represent environmental conditions over a several years can be combined with physiological indices (e.g. body weight, skeletal ratios, fat indices). Combined with survey data of the live population, such indices are valuable tools for monitoring population and habitat trends (Wegge 1976).

Intensive population inventory (i.e. numbers and detailed age-sex classification) is not always feasible. Even where financial resources and trained assistance are adequate, it is usually advisable to undertake some form of preliminary pre-field survey assessment. Initially and prior to intensive population census, it may be useful to stratify the terrain into caprin management units and to determine the relative abundance (i.e. high-medium-low-nil) of caprins within each unit by interviewing knowledgeable persons who are familiar with the area and the particular population of caprins. In some circumstances, locals may be able to provide both historic and current population assessments, and with training, provide numerical estimates for some taxa. Such information, if not always precise, will often provide a useful baseline for future reference, and often a valuable guide in directing and prioritising field surveys for population inventory.

Caprinae harvest management plans may be developed gradually from a conservative beginning over a period of years, based largely or even solely on harvest-based data. However, whenever feasible, population censuses greatly increases the reliability of the harvest management data base and thus the managers', the public's and the politicians' confidence in the management regime.

A.1.3.2 Determination of sustainable quotas

The underlying premise of any wildlife harvesting scheme is that hunting mortality to a large extent compensates for losses that would otherwise occur due to natural causes. This implies that most mortality is density-dependent, and that mortality imposed by low hunting pressure would not affect total population size. There is little or no evidence to support this for wild Caprinae under natural conditions. Instead, hunting mortality is probably mostly additive and will therefore depress the number of adults in the population. However, two demographic responses may tend to counteract this effect to some degree. First, if density exceeds the carrying capacity of the range, removal of adult females may increase recruitment of young. Contrary to expectation, in bighorn sheep there is no evidence that lambs orphaned at the time of weaning have lower first-winter survival than lambs with mothers (Jorgenson *et al.* 1993). Second, the oldest males are highly vulnerable to winter mortality following the energy-draining period of the rut (Geist 1971). Selective harvesting of some of these may forestall their natural mortality and, hence, is not directly additive. A third aspect is predation. Although not adequately quantified and quite variable among species, predation can be a significant mortality factor in some caprin populations (Hebert and Harrison 1988; Schaller 1977; Skogland and Petocz 1975). Only to a limited extent will hunting mortality replace such losses under undisturbed, natural conditions. Hence, sustainable quotas will vary to some extent with existing natural predation levels, and to some extent with the caprin species itself.

In general, selective removal of older (trophy) males will lower mean male age and skew the sex ratio in favour of females (Wegge 1979). Theoretical and observed consequences of these changes were discussed in **A.1.2 Theoretical considerations** above. It appears that within limits, no short term adverse effects have been found in populations and species studied to date.

Ideally, hunting mortality should selectively remove only those individuals that were destined to die from natural causes shortly afterwards. This is impossible to achieve in practical management. Instead, quotas are deliberately set so they have minimal negative effects on population size and quality. In trophy hunting programs, the number of potentially harvestable males, as determined in part by the quality criteria set by the hunters, consist of several age classes among the very oldest males. If the number of males entering the trophy-size age class each year is known, then a certain proportion of these, spread among all trophy-sized males, may be harvested annually. The exact fraction varies with species and demographic characteristics of the particular population. Since estimating the annual recruitment rate to the trophy-size class requires sophisticated census data and life table analysis that are rarely achieved for most populations, a conservative approximate estimate must be used instead. For most species this quota could be set between 20 and 25% of the estimated number of trophy-sized males alive prior to the hunting season. In most cases, this is equivalent to <4% of the pre-hunting season total population (i.e. population size not immediately following parturition). Using conservative levels, selectively harvesting males, within a safe limit of 10 to 20% of the replacement of the trophy-size segment, is not expected to have any negative effects as long as the population is stable or increasing. Harvest levels in large, expanding populations may be increased perhaps in the absence or near-absence of predation. However, in all population states, frequent census and monitoring will be necessary to allow managers to make any necessary adjustments to harvest quotas.

Where subsistence hunting is combined with a trophy-male management program, only females (>1 year old) should be harvested along with trophy males. In stable populations with natural predation, an annual quota of between 2% and 5% of all females >1 year old in the population could be hunted. In large populations with little predation, that are either very dense or expanding, the annual female quota may be increased to <10% if carefully monitored annually to allow re-adjustment of the harvest level.

In populations and species hunted only for subsistence or non-trophy, recreational purposes, all sex- and age-classes may be harvested. As in trophy management, the annual quota must be adjusted according to population density and trend, and needs to consider the extent to which other mortality factors may be limiting. In stable populations with natural predators, quotas should not exceed 5% of the total pre-hunting season population, with most harvested animals being males (all ages) and young of both sexes. Where predation is not a major factor or where the population is shown to be large and expanding, the quota may be increased perhaps to 10%, again distributed preferentially among all males and young (young of year, yearlings). If the objective of such a management program is to maximise the production of meat and/or the number of hunting licences rather than the number of trophy males, few if any adult females should be harvested.

A.1.3.3 Length and time of the hunting season

The timing of the hunting season needs to take into account both biological and logistical factors. From a biological standpoint, the best time to shoot trophy animals is immediately after the mating season. Old, reproductively active males have the highest probability of dying over winter. Harvesting these in late autumn or early winter will minimise negative effects on mating and natural turn-over rate among males. No hunting should take place in mid to late winter, because animals are in poorer condition and tend to have a more clumped distribution. These conditions make them particularly vulnerable to disturbance, and weather conditions are not suitable for stalking. Spring hunts will harvest individuals that have survived the winter and therefore have a more pronounced effect on subsequent autumn male age structure. In many species, males tend to separate from females during summer. Because of logistic issues presumably mid to late summer and pre-rut autumn hunts should therefore cause less disturbance and provide the longest hunting season for males.

The length of the hunting season should be restricted. However, selective harvesting requires time. Also, trophy hunting is sometimes based on combined hunts, with a client having permits for more than one species. Guides and outfitters normally take two to four clients in a party per hunting trip, with two to three trips per season. Each trip lasts from one to three weeks, depending on access and number of species/client. In order to make trophy hunting economically viable for the professional outfitter, the hunting season should last for a minimum of six weeks, but not extend beyond ten weeks.

Subsistence or recreational hunting of other animals other than trophy males may take place before or after the trophy season, but not before the young of the year are weaned (Jorgenson *et al.* 1993). Preferably, hunting for trophies and for subsistence should not take place at the same time, as they may interfere with each other.

A.1.4 Operational requirements

A.1.4.1 Subsistence hunting

Where subsistence hunting is practised, law enforcement is more complicated, because such hunting usually takes place in the vicinity of remote villages. Delegation of authority to local village councils and fostering a sense of proprietorship to the wildlife resource from which they obtain sustainable benefits, is the often best long-term solution for stemming illegal and unsustainable harvesting of the resource (Kiss 1990; Makombe 1994). Bringing subsistence use under effective control is a complex problem, usually requiring knowledge of local conditions and attitudes. It rarely can be accomplished from centralised offices, but rather will most often require a serious effort to understand the roots of the problem, and to work with local people in finding solutions.

A.1.4.2 Trophy hunting

Trophy management requires good knowledge of population size, composition and distribution, and of ecological determinants of population performance. In addition, because operational costs are high (international marketing, government fees, local transport, guiding and field accommodation for clients), a sustainable program requires a high success rate among clients. Success in this context means shooting a trophy animal of acceptable size within a reasonable time. Hence, in order to provide for a high success rate, individual operators should be granted exclusive hunting rights to hunt trophy males in designated areas (hunting blocks) for a period of several years. A long-term lease of trophy hunting rights, for which the operator is charged concession fees in advance, acts as an incentive for proper management and safeguards against over-shooting. Through a long-term lease, the operator becomes familiar with the distribution and habits of animals within his hunting block, which facilitates stalking and selective harvesting. Conversely, if trophy hunting licences are given to new operators with no long-term self-interest in the area, success rate is usually lower and irregular harvesting is more likely to occur (Austegaard and Haugland 1993).

International trophy hunters demand high quality "service" for which they pay a high price. Thus, government agencies should provide practical assistance to operators. At the same time, to safeguard against ecologically harmful effects (e.g. cutting of fuelwood in areas of limited wood supply, access for motorable transport in fragile areas, littering and pollution), appropriate regulations and a code of conduct should be designed and enforced (Wegge 1976).

Control of hunting practices should be exercised by the responsible government agency. Harvested trophies should be presented for inspection and measurement (e.g. annual horn growth and ageing) shortly after completion of the hunt. Additional data from the harvested animals may be obtained for monitoring purposes (e.g. weight, organ samples). Some countries require that a government officer or scout accompany the hunting party. This provides added assurance that regulations are adhered to and could be combined with collection of animal census data.

A.1.4.3 Multipurpose management and local participation

Consumptive use of caprins through trophy management may take place in areas set aside specifically for the purpose, or in areas where other land use practices take place concurrently. However, in many countries, most caprin habits are also exploited by humans, primarily in the form of pastoralism. Also, hunting wildlife for meat and other products is often an integral part of the local subsistence economy. Hence, only in exceptional circumstances can areas be designated for exclusive trophy hunting without interfering with local land use practices. To achieve long-term conservation objectives, any sustainable hunting program needs to be integrated with local land uses and have the support of local communities. Failure to do so invariably leads to problems of illegal activities which undermine long term conservation goals (Kiss 1990; Lewis *et al.* 1990)

There are basically two questions about local participation that need to be resolved. First, any restrictions on traditional use of the land (control of livestock to accommodate wild species and cessation of subsistence hunting) need to be compensated for in the form of tangible benefits that are sustainable. A sufficient portion of the revenue from the trophy management program should therefore be channelled back to the communities. The exact amount or mode of return should be negotiated by leaders of affected local communities. Second, since traditional pastoralism and other activities may have to be regulated below ecologically optimum levels to maintain high quality caprin populations, combined management plans for the wild and domestic stock needs to be developed. Such plans are likely to include temporal restriction and spatial delineation of pastoral use, habitat management (especially grass burning), and low-level subsistence hunting. Control of predators and range use by tourist and traditional traders are often other issues that also need to be resolved.

To ensure long-term conservation of the caprin resource, the recommended model for a sustainable hunting program is to establish area-specific wildlife committees consisting of representatives of affected local communities, district officials (possibly including a livestock officer) and representatives of the local and central authority responsible for wildlife conservation. Following adoption of long-term management plans which provide for both local community development and conservation of the wild fauna, this committee should resolve and ensuing conflicts of the land use, allocate hunting quotas and revenues, and delegate responsibility of management, including law enforcement and environmental monitoring, to the appropriate participating partners. Here, models of local participation need to be established in such a way that local inhabitants develop self-interest in conserving the wild fauna (Austegaard and Haugland 1993; Edwards 1995; Harris 1993; Kiss 1990; Lewis *et al.* 1990; Makombe 1994; Wegge 1992; Yongsheng 1994).

A.1.6 Summary

Consumptive use through local subsistence and trophy management can contribute significantly to the conservation of wild caprin species. There are two main reasons for this. First, subsistence hunting may contribute to conservation because it meets traditional needs by local people. Alienating local communities from traditional resource use may otherwise lead to uncontrolled illegal harvesting and habitat deterioration. Second, trophy hunting, because of its unique customer base, may generate substantial revenues which can be used for local conservation purposes and local community benefits. At the same time, trophy hunting requires a high quality animal population base, which again is only maintained if habitats are maintained and other negative impacts are closely controlled.

Within limits set by ecological and demographic characteristics of the species and populations to be harvested, low level off-takes of 20 to 25% of all trophy size males (usually <4% of the total pre-harvest population) and up to 5% of all adult females, may be harvested each year without negative effects on population viability. The general prerequisites for implementing a consumptive utilization program are:

1) Prior to and after setting hunting quotas, populations are regularly (e.g. annually) monitored through appropriate census techniques.

2) Local communities are involved in the decision making process and benefit from hunting programs.

3) Professional hunting operations are given long-term lease contracts in specified areas and levied fees which allow for and promote sustainability of operations.

4) Trophy hunting operations are under government supervision and harvested animals are inspected and measured for monitoring purposes.

5) Tangible and effective benefits for the taxon, its habitat and other members of the ecosystem accrue from hunting.

Acknowledgements: R.A. Demarchi, M. Gimenez Dixon, M. Festa-Bianchet, J.L. Fox, V. Geist, R. B. Harris, J. Huot, S. Lovari, D. Shackleton, C.C. Shank and R. Valdez.

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Appendix 2

Position Statements of the IUCN Caprinae Specialist Group

A.2.1 Feral Caprinae (1/10/89)

Background

Feral animals are those which live as self-sustaining populations in the wild after a history of domestication. Traditionally, they have lain outside the responsibility of the IUCN, which is interested in truly wild taxa. Indeed, feral Caprinae are often a threat to the wild animals and habitats which IUCN seeks to protect. Some, however, have intrinsic value for the contribution they can make to the genetic diversity of livestock. For that reason feral populations were included in the FAO "Inventory of special herds" compiled by Mason (1979).

There is generally no problem in distinguishing wild from feral Caprinae (compared for example with distinguishing feral pigs from wild boar), although the status of some ancient forms, such as mouflon and agrimi (Cretan 'wild' goat), has been uncertain until quite recently. 'Breed type' in the agricultural sense is sometimes known, but more often is not.

Apart from the pre-historic introductions to Mediterranean and some other islands, feral Caprinae have almost all occupied their present environments for less than 500 years. Consequently they have usually had a detrimental effect on indigenous biota, especially on islands where browsing mammals have not been part of the evolutionary history. Hence, in places which have had a long history of human and animal influence, feral Caprinae may be tolerated by taking minimal action to protect other values (e.g. goats on Galapagos, sheep on Hawaii or Campbell Is.). Features at risk can include endemic or local flora and fauna, habitat, landform stability, and water quality.

This Position Statement tries to reflect agricultural, commercial, and historic criteria which are not pertinent to truly wild Caprinae, along with the sources of potential conflict summarised above. Because conflicts and value judgements depend so much on local situations, it can be only a general prescription for managing feral Caprinae. It is intended to be used by all types of managers, not just by SSC groups of IUCN.

Positions

In terms of the IUCN mandate, feral Caprinae should be exterminated unless there are defensible reasons for making an exception. The statements below can therefore be treated as a checklist of questions which can help managers to decide whether they have a justifiable case for making an exception in their particular situation.

1. Economic damage

Feral populations commonly inhabit areas of low commercial value (in the sense of market returns), but of high natural value. As such, they can be a drain on scarce conservation resources in terms of management costs to prevent degradation or to promote rehabilitation of indigenous biota. Feral populations may be responsible for losses of direct commercial significance in the short-term, such as annual forage production, or in the long-term, such as habitat stability. In the case of goats in the Australian outback, both are at risk. Where feral and domestic animals run together there may be risks from common parasites and viruses (e.g. foot and mouth disease).

2. Reserves and National Parks

By international convention, these areas are primarily places for indigenous biota and should not contain feral Caprinae, except in very specific, well defined and controllable circumstances. Such circumstances would be:

- if the population density can be kept low enough to pose no threat to flora and fauna;
- if the feral population can be fenced apart in a safe multiple use regime (e.g. sheep on Pitt and Campbell Is., New Zealand, but not in Hawaii Volcanoes NP);
- if the feral population is of special, local interest (e.g. goats in Snowdonia NP, Wales; rove goats in France), or of conservation interest as an ancient form (e.g. Soay sheep; mouflon in Europe);
- if there is no risk of hybridisation with truly wild Caprinae, whether within or outside a National Park. There do not seem to be any sympatric wild species and feral Caprinae, but on Crete, the ancient feral Agrimi is at risk from hybridisation with modern breeds of goats.

3. Scientific value

Feral populations have value as research tools illuminating the process of evolution under domestication (Soay sheep), or for studies of genetic adaptation when freed from domestic selection (British feral goats; Pitt Is. and Arapawa Is. sheep).

4. Commercial potential

Modern western agriculture has bred particular strains of animals that are dependent on high quality food and management, and by definition, feral animals are thus 'inferior'. However there are a few examples where feral populations have true commercial value or potential (goats in Australia and from Auckland Is., New Zealand, used for cashmere and angora fleece; goat meat production in New Zealand; early lambing and high survival in the UK and New Zealand feral sheep). Locally adapted feral populations may constitute ready sources of new genetic material of commercial importance.

5. Breeds – genetic value

Some feral populations are distinct breeds and can be very ancient (prehistoric Soay sheep, Agrimi, Sardinian mouflon), or more recent (putative Old English goats in New Zealand; Monte Cristo Is. goats, Italy; Tokara goats, Japan). Such animals have a value not only as a known breed, but also as contributors to genetic diversity in a more general sense. This is especially relevant to the diminishing gene pool of domestic stock documented by FAO and by rare breed societies. Can such minor (feral) breeds be tolerated *in situ*, uncontaminated by hybridisation? If not, can some be transferred to a rare breeds farm?

6. Historical knowledge

Origins and histories of feral populations are often unknown. Local history, traditions, colonisation, settlement patterns, and a sense of place may be illuminated and enhanced by studies of local feral Caprinae (e.g. Pacific and Caribbean Islands).

7. Recreational hunting

Sport hunting value should never, in itself, be a reason for maintaining a feral population if that population is damaging the environment (Hawaii, Santa Catalina Is.), or is competing with a wild population (mouflon vs. chamois). Sometimes, however, feral animals may be a convenient game animal to relieve hunting pressure from threatened wild animals.

8. Extermination

Living animals are more valuable than germ banks and their preservation *in situ* allows for continuing natural selection and adaptation. A management plan should consider whether extermination is essential or, whether animals can be tolerated, isolated where they are, or translocated elsewhere. Multiple-use of the threatened area may be impossible (see 'Background' examples). Is there an agency prepared to provide a home in captivity before the feral population disappears (e.g. goats of San Clemente Is., California)? If so, the animals translocated should be a genetically representative nucleus.

9. Agency co-operation

Feral populations impinge upon a wide range of values and interests. Consequently, it is advisable to canvas widely among Government agencies, commercial interests, and unofficial interest groups such as historians, breed societies, and wildlife parks in the course of arriving at a management strategy.

10. Principles

In general, feral animals have conditional rather than absolute values, so a hierarchy of basic principles can be followed in deciding how to deal with them:

1) Indigenous biota takes precedence over alien.
2) Truly wild animals take precedence over feral.
3) Ancient type takes precedence over modern.
4) True breed takes precedence over hybrid form.

A.2.2 Aspects of management and conservation of wild Caprinae, with emphasis on some Mediterranean and Asiatic taxa (15/6/87)

Introduction

The conservation of wild sheep, goats, goat-antelopes and related taxa is not only a matter of habitat protection, but also one of protection and management of vulnerable populations. **Granted habitat protection** and **granted protection from excessive hunting**, then Caprinae readily recover and thrive, becoming an economic asset. Small populations are vulnerable to even limited hunting. Where a species or subspecies numbering a few hundred are splintered into small, widely distributed, isolated populations, no biological case can be made for the killing of trophy males, which is to be condemned for these prime individuals may still provide an important gene contribution in such a small population. The genetic integrity of the species or subspecies is then at stake.

Legal trophy hunting may be condoned where research shows that cohesive populations of adequate size do exist, and where the population will not be adversely affected by the indirect effects of hunting.

Background

Strong pressure is being applied in some countries to open National Parks and Wildlife Preserves to hunting, using the argument that hunting would improve herd quality. It is also argued that only hunting will restore a herbivore/vegetation balance in the disturbed ecosystems of the parks.

These arguments, taken out of context, are not necessarily applicable and may fall into at least three categories.

Firstly, within a protected area the animals may appear to depress another species or suppress certain food plants, but a value judgement is then being made between the value of several species.

Secondly, it may be claimed that there are "too many animals for their own good" and that a supposed over population calls for culling. Often this reflects a misjudgement of the animals' condition or the inappropriate application of husbandry instead of ecological criteria.

Thirdly, it may be argued that the herbivore/vegetation/soil system is off its equilibrium. This is certainly of direct concern to managers or ecologists and may call for experimental intervention and intensified research.

The mouflon (*Ovis orientalis musimon*), several subspecies of Alpine chamois (*Rupicapra rupicapra*) and Spanish ibex (Capra *pyrenaica*) have been introduced to regions for hunting purposes. This is not objectionable, provided foreign sub-species and species are not introduced onto ranges of native taxa so that hybrids develops. This has happened extensively with deer in Europe and North America, where red deer, sika deer and wapiti are melting into one pool (Europe), or regional subspecific differences of white-tailed deer are disappearing due to transplants intended to "improve" blood lines (North America). Extinction via hybridisation is extinction.

We are concerned that in certain Far Eastern countries legal sport hunting is being permitted without adequate concern for conservation, i.e. sound inventory and planning. Wildlife is a national and international treasure with great potential for an extensive tourist industry and, when culling is properly regulated, a small-scale manufacturing industry, as it exists today in some countries. Living wildlife has great market value; dead wildlife has considerably less.

We are particularly concerned with the fate of argalis (*Ovis ammon*), heavily hunted for local consumption, and with the fate of the bharal (*Pseudois nayaur*), which is hunted for export to a luxury market in Central Europe.

We point to the historic fact that the export of wildlife products into luxury markets has often been deleterious to wildlife as well as to the development of an economically viable tourist industry based on wildlife. We also point out that the legally regulated consumption of wildlife in the absence of a market in dead wildlife has led to significant recovery of wildlife in North America, and to a large, labour intensive service and manufacturing industry.

Positions

A – It is recognised that under some circumstances protected Caprinae do cause economic damage to private or state property. Mitigating measures should be compensation, prevention and population control exerted by trained officials.

The last step (population control) should never be implemented before the first two have been thoroughly tested and proven inadequate. Furthermore, there should be an adequate number of protected populations, in biologically suitable habitat, before culling is permitted.

Where populations can sustain a regular and controlled harvest, full use should be made of all animal products, linked with a prohibition on the sale of any part of harvested animals by private people or private organisations. Such a prohibition, well enforced, is a proven and effective conservation measure.

B – In National Parks and Sanctuaries the primary objective is the maintenance of viable populations maintained by natural processes. Interventions must be minimal, well justified, and always compatible with the major objective. If control is necessary, such should be done by trained wardens only, and, where possible, the meat and by-products disposed in non market avenues (i.e. given to charity). No such control should be instituted unless preceded by a published scientific investigation on its necessity.

Efforts are encouraged to reintroduce extirpated predators, where and when feasible, to re-establish natural regulatory mechanisms.

Small body and trophy size are not sufficient conditions for intervention in protected populations.

C – There should be maintenance of habitat around protected areas, as well as management, so as to allow a maximum of use by caprins of areas in and out of the protected zone. There should be good gene flow between populations in and outside protected areas.

D – There should be sound research into the ecology of Caprinae, involving peer review, public debate and publication.

Priority should be given to the long term study of both robust and endangered populations, so as to find sound mitigation measures to support the latter. In many cases existing experience can be tested locally by experimental and adaptive management.

E – Non-native species and subspecies must not be introduced to an area, if remnants of aboriginal populations exist, or there is a source of native animals which could be used instead.

Furthermore, non-native species must not be introduced if related or unrelated native taxa are present and likely to receive direct/indirect deleterious impact (cf. IUCN Position Paper on Translocation of Living Organisms: Introductions, Reintroductions and Re-stocking).

F – Interagency, interdepartmental and international co-operation is essential, but frequently not existing in the management of wildlife. Such co-operation should be a high priority where caprins exist, because they are easily vulnerable to over-hunting and their ranges typically include the mountain ranges that often form international and other administrative boundaries.

Various measures, including the active involvement of government agencies, are to be encouraged in acquiring land, leases, easements, etc. to protect wild caprin populations.

G – Outside protected areas, the uncontrolled shooting of caprins should not be allowed. Wherever one can have it, hunting should be carried out with due attention to the fact that such can permanently disrupt the use of existing habitat. Well regulated hunting does exist in some countries and contributes effectively to the financial support of the conservation of caprins.

Research on hunted populations should be carried out to monitor possible adverse effects; it is most necessary, in the case of locally abundant but elsewhere decreasing taxa.

H – There is evidence that economic returns are greatest when policies emphasise living wildlife by depriving dead wildlife of value, as well as by regulating wildlife by law.

Appendix 3

Names and Addresses of Authors

(* denotes current Caprinae Specialist Group Member).

Dr. T. Adamakopoulos *
WWF Greece, 14 Asklepiou St., GR-106 80 Athens, Greece

Dr. A. Ahmad
Conservation Director, WWF-Pakistan,
c/o Department of Environmental Studies, University of Peshawar, UPO Box 1439, Peshawar, Pakistan

A.W. Akonda
Senior Research Officer (Wildlife), Department of Forests, Bana Bhaban, Gulshan Road, Mohakhali, Dhaka 1212, Bangladesh

Dr. C. Alados*
Instituo Pirenaica de Ecologia, Consejo Superior de Investigaciones Cientificas, Avda. Montañana, 177. Aptdo. 202, 50080 Zaragoza, Spain

Dr. P. Alkon*
Apt. 604, 2330 E. Nevada St., Las Cruces, NM 88001, U.S.A.

Dr. M. Amer
Undersecretary of State Zoos & E.W.S.,
Ministry of Agriculture, Central Veterinary Directorate, Zoo & Aquarium Directorate, Giza Zoological Gardens, 12613 Giza, Cairo, Egypt

S. Amgalanbaatar
Forestry and Hunting Institute, Ministry for Nature and the Environment, Khudaldaany gudamj-5, Ulaanbaatar 11, Mongolia

Dr. A.B. Arabuli
Institute of Zoology, Georgian Academy of Sciences, Chavchavadze str. 31, Tbilisi 380079, Georgia

Dr. S. Aulagnier*
Institut de Recherche sur les Grandes Mammiferes, Institut National de la Recherche Agronomique, C.R.A. Toulouse - B.P. 27, F-31326 Castanet-Tolosan Cedex, France

Dr. J.A. Bailey
Assistant Chief, Conservation Services Division,
State of New Mexico, Dept. of Fish and Game,
P.O. Box 25112, Santa Fe, NM 87504, U.S.A.

D. Ban-Ymari
Le Directeur des Parcs Nationaux et Réserves de Faune, Ministère du Developpement Rural, Secretariat d'Etat Charge de l'Environment, Direction des Parcs Nationaux et Réserves de Faune, B.P. 898, N'Djamena, République du Tchad

N. Bandak
R.S.C.N., P.O. Box 624907, Amman, Jordan

N. Barichello
R.R. 1, Site 20, C-76, Whitehorse, Yukon, Canada, X1L 4J1

Dr. J. Bauer
Johnstone Centre of Parks, Recreation & Heritage, Charles Sturt University, Panorama Avenue, Bathurst NSW 2795, Australia

Dr. J.R. Bider
Dept. of Renewable Resources, McDonald College, 21-111 Lakeshore Rd., Ste. Anne de Bellevue, PQ, Canada H9X 1C0

K. Bollmann*
Zoologisches Institut, Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland

Prof. Cai Gui-quan
Wildlife Biology, Northwest Plateau Institute of Biology, Academia Sinica, Xining, Qinghai 810001, China

Dr. A.A. Chaudhry*
Director, Punjab Wildlife Survey & Management Planning project, Punjab Wildlife Research Centre, P.O. Box 1513, Nishatabad, Faislabad, Pakistan

R. Daly
Office of the Advisor for the Conservation of the Environment, Diwan of Royal Court, P.O. Box 246, The Palace, Muscat, Sultanate of Oman

Dr. Ha Dinh Duc*
Centre for Natural Resources Management & Environmental Studies, University of Hanoi,
19 Le Thanh Tong, Hanoi, Viet Nam

Dr. A. Fedosenko
The Central Laboratory on Game Management & Nature Reserves, Losinoostrovskaya lesnaya dacha, Kvaztal 18, 129347 Moscow, Russia

Dr. M. Festa-Bianchet*
Départment de Biologie, Université de Sherbrooke, Sherbrooke, PQ, Canada, J1K 2R1

Dr. J.L. Fox*
Department of Ecology, University of Trömso, 9000 Trömso, Norway

Dr. M. Gallagher
Office of the Advisor for the Conservation of the Environment, Diwan of Royal Court, P.O. Box 246, The Palace, Muscat, Sultanate of Oman

Dr. P. Genov
Institute of Zoology, Bulgarian Academy of Sciences, Blvd. Russki 1, 1000 Sofia, Bulgaria

Dr. M. Giacometti
Untersuchungsstelle für Wildtierkrankheiten, Institut fuer Tierpathologie, Universität Bern, Länggass-Strasse 122, CH-3012 Bern, Switzerland

Prof. L. Gjiknuri
Head of Zoology, Fakulteti I Shekencave Natyrore, Universite de Tirana "Enver Hoxha", Tirana, Albania

Dr. H. Gossow
Institut für Wildbiologie und Jagdwirtschaft, Universität für Bodenkultur Wien, Peter Jordan Strasse 76, A-1190 Wien, Austria

Dr. M.J.B. Green
Protected Areas Data Unit, World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge, CB3 0DL, UK

Prof. Gu Jinhe*
Director, Xinjiang Institute of Biology, Pedology and Desert Research, Chinese Academy of Sciences, Urumqi, Xinjiang 830011, China

A. Gunn
Department of Renewable Resources, Government of the Northwest Territories, P.O. Box 1320, Yellowknife, NWT, Canada, X1A 2P9

Dr. K. Habibi*
5956 Hagadorn Road, East Lansing, Michigan 48823, U.S.A.

Dr. C. Hablützel
Schlössli, CH-3232 Ins, Switzerland

Dr. E. Hadjisterkotis*
Officer of the Game & Fauna Service, Churchill str., No. 3, Agios Dometios, Nicosia, Cyprus

F. Harper
Wildlife Section Head, B.C. Environment, Lands & Parks, 1259 Dalhousie Drive, Kamloops, B.C., Canada, V2C 5Z5

Prof. Dr. G. B. Hartl*
Institut fuer Haustierkunde, Biologiezentrum der Christian-Albrechts-Universität, Olshausenstraae 40, D-24118 Kiel, Germany

Dr. V. Hatzizvassanis
G. Papandreo 21, Ano Kalamaki, Athens, 174 56 Greece

C. Hays
Co-ordinator, Migratory Bird Program, Latin America Office of Migratory Bird Management, U.S. Fish & Wildlife Service, 4401 N Fairfax Drive, Arlington, VA 22203, USA

Dr. D. Hebert
Alberta Pacific Forest Industries Inc., P.O. Box 8000, Boyle, Alberta, Canada, T0A 0M0

Dr. R. Hess
Hinterwald, CH-6314 Unterägeri, Switzerland

Dr. J.C. Hillman
A/Head of Research, Ministry of Marine Resources, P.O. Massawa, Massawa, Eritrea

Dr. V. Hrabe
Institute of Landscape Ecology, Academy of Sciences of the Czech Republic, Kvetná 8, 60365 Brno, Czech Republic

Hu Defu
Xinjiang Institute of Biology, Pedology and Desert Research, Chinese Academy of Sciences, Urumqi, Xinjiang 830011, China

Dr. H. Hurni
Institut Geographisches, Gruppe für Entwicklung und Umwelt, Universität Berne, Quartiergasse 16, CH-3013 Bern, Switzerland

Mr. A.J.T. Johnsingh*
Wildlife Institute of India, New Forest, Dehra Dun 248 006, India

Dr. M.A.R. Khan
Incharge of Dubai Zoo, Horticulture & Public Parks Department, Dubai Municipality, P.O. Box 67, Dubai, United Arab Emirates

Prof. Dr. A. Kence*
Chairman, Department of Biology, Middle East Technical University, Faculty of Arts & Sciences, Inönü Bulvari, 06531 Ankara, Turkey

Dr. D. Klein*
Alaska Cooperative Fish & Wildlife Research Unit, 209 Irving Building, University of Alaska Fairbanks, Fairbanks, Alaska 99775-0990, U.S.A.

Dr. P.R. Krausman*
Wildlife and Fisheries Science, School of Renewable Natural Resources, College of Agriculture, University of Arizona, 325 Biological Sciences East, Tucson, AZ 85271, U.S.A.

Dr. B. Krystufek*
Slovene Museum of Natural History, Prirodoslovni Muzej Slovenije, Presernova 20, P.P. Box 290, Slo 61001 Ljubljana, Slovenia

Dr. Kuang Yang Lue*
National Taiwan Normal University, Ecology Laboratory, Department of Biology, No. 88 Roosevelt Road, Section 5, Taipei 11718, Taiwan

B. Lamarche
B.P. 4311, Nouakchott, Mauritania

Dr. S. Lovari*
Dipartimento di Biologia Evolutiva, Universitá di Siena, Via P.A. Mattioli 4, 53100 Siena, Italy

Dr. C. Magin
National Wildlife Research Center, P.O. Box 1086, Taif, Saudi Arabia

Dr. D. Mallon*
3 Acre Street, Glossop, Derbyshire SK13 8JS, UK

Dr. N. Maruyama*
Department of Environmental Science and Conservation, Faculty of Agriculture, Tokyo Noko University, 3-5-8 Saiwaicho, Fuchu, Tokyo 183, Japan

M. Mekonlaou
Le Chef de service Eco-Biologie, Ministère du Developpement Rural, Secretariat d'Etat Charge de l'Environment, Direction des Parcs Nationaux et Réserves de Faune, Service Eco-Biologie, B.P. 898, N'Djamena, République du Tchad

Dr. P. Munton
Department of Environment, P.O. Box 323, Muscat, Oman

Dr. A.I. Myslenkov*
Partizanskaya 19, Ternei, Primorsky Krai 692150, Russia

J. Newby
WWF - International, Avenue du Mont-Blanc, CH-1196 Gland, Switzerland

Dr. B. Nievergelt*
Ethologie & Wildforschung, Zoologisches Institut, Universität Zürich-Irchel, Gebude 25, Winterthurerstrasse 190, CH 8057 Zürich, Switzerland

Dr. M.B. Nimir*
Sudanese Environment Conservation Society, P.O. Box 44266, Khartoum Central, Sudan

Ning Luo
Xinjiang Institute of Biology, Pedology and Desert Research, Chinese Academy of Sciences, Urumqi, Xinjiang 830011, China

W. d'Oleire-Oltmanns
Landratsampt Berchtesgadener Land, Nationalparkverwaltung, Doktorberg 6, D 8240 Berchtesgaden, Germany

M.K. Oli
King Mahendra Trust for Nature Conservation, P.O. Box 3712, Kathınandu, Nepal
(*current address*:
c/o Dr. F.S. Dobson
Dept. of Zoology & Wildlife, 331 Funchess Hall, Auburn University, Auburn, AL 36849, USA)

Jigme Palden
Nature Conservation Section (NCS), Forestry Service Division, Thimphu, Bhutan

M. bin Abdul Rahınan*
Faculty of Resource Science and Technology, Univresiti Malaysia Sarawak, Jalan Datuk Mohamad Musa, 94300 Kota Samarahan, Kuching, Malaysia

G. Rasool*
General Secretary
The Belour Advisory and Social Development Organisation, P.O. Box 501, Gilgit, Northern Areas Pakistan

Dr. R.P. Reading
Northern Rockies Conservation Cooperative, Box 2705, Jackson, Wyoming 83001, USA

Dr. A.V. Romashin
Scientific Research of the Caucasian Reserve, 354341, Sochi A-341, ul. K. Marx 8 Kavkazskee, Gosudarstvenyi, Biosfiernyi Zapoviednik, Georgia

Dr. F. Roucher*
45 Chemin de la Buisse, 38330 Biviers, France

Dr. R.E. Salter
IUCN Country Advisor, IUCN Laos, P.O. Box 4340, Vientiane, Lao P.D.R.

Dr. C. Santiapillai
Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka

Chan Sarun*
Director, Forestry Department, Ministry of Agriculture, Phnom Penh, Cambodia

A. Serhal
Secretary General, Society for the Protection of Nature and Natural Resources in Lebanon, P.O. Box 11-5665, Beirut, Lebanon

Dr. D.M. Shackleton*
Department of Animal Science, University of British Columbia, Vancouver, B.C. Canada, V6T 1Z4

Dr. K. de Smet*
Ministerie van de Vlaamse Gemeenschap, Departement Leefmilieu en Infrastructuur, A.M.I.N.A.L., Copernicuslaan 1 bus 7, 2018 Antwerpen, Belgium

Dr. Jeko Spiridonov
Institute of Ecology, Bulgarian Academy of Sciences, str. Gagarin N 2, 1113 Sofia, Bulgaria

M. Sabit Tarhan
Tarim Orman ve Koyisleri Bakanligi, Orman Genel Mudurlugu,
Av ve Yaban Hayati Subesi Muduru, Ankara, Turkey

Dr. H. Tatwany
P.O. Box 1715, Riyadh 11441, Saudi Arabia

T. Tear
Wildlife Resources, College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho 83843, U.S.A.

Dr. M. Thévenot
Ecole Pratique des Hautes Etudes, Laboratoire de Biogrographie et Ecologie des Vertébrés, Place Eugène Bataillon, F-34095 Montpellier Cedex, France

Dr. H. Thing
Executive Director, Danish Polar Center, 3 Hausegrade, DK-1128 Copenhagen K Denmark

Sangey Thinley
Director of Forest, Minister of Agriculture, Thimphu, Bhutan

Prof. G. Tosi
Universitá di Milano, Dipartimento di Biologia, Sexione Ecologia, Via Celoria 26, 20133 Milano, Italy

Dr. R. Valdez*
Dept. of Fishery & Wildlife Sciences, College of Agriculture & Home Economics, New Mexico State University, P.O. Box 30003, Campus Box 4901, Las Cruces, NM 88003-0003, U.S.A.

A.T. Virk
Divisional Forest Officer, Wildlife, c/o Chief Conservator of Forests, Quetta, Baluchistan, Pakistan

Dipl. Ing. F. Voelk
Institut fuer Wildbiologie und Jagdwirtschaft, Universität fuer Bodenkultur, Peter Jordan Strasse 76, A-1190 Wien, Austria

I. Voloshina
Partizanskaya 19, Ternei, Primorsky Krai 692150, Russia

Prof. Wang Sung*
Department of VertebrateTaxa and Fauna, Institute of Zoology, Academia Sinica, 19 Zhong-guan-cun Lu, Haidian, Beijing 100080, China

Prof. Wang Zongyi
Director, Beijing Milu Ecological Research Centre, Nan Hai-zi, Milu Park, Nan Yuan, Beijing 100076, China

Dr. P. Weber*
str. M. Kogalniceanu nr. 19, 3125 Medias, Romania

Dr. P. Wegge*
Department of Biology and Nature Conservation, Agricultural University of Norway, P.O. Box 5014, N-1432 Ås, Norway

Dr. P.I. Weinberg
North-Ossetian State Reserve, Basijeva str. 3-8, Alagir, North Ossetia, 363200 Russia

Dr. Hartmut Wollenhaupt
Am Steinkopf 20, 34286 Spangenberg, West Germany

Dr. Won Pyong-Oh
Institute of Ornithology, Kyung Hee University, Seoul 130-701, South Korea

Yang Rongsheng
Institute of Geography & Commission for Integrated Survey of Natural Resources, Academia Sinica, Building 917, Bei Sha Tan, Beijing 100101, China

H. Yohannes
Head, Wildlife Conservation Department, Ministry of Agriculture, P.O. Box, Asmara, Eritrea

Dr. T. Zajac
Polska Akademia Nauk, Zaklad Ochrony Przvrody i Zasabow Naturalnych, Institute of Nature Protection, ul. Lubicz 46, 31-512 Krakow, Poland

Prof. Zhang Yongzu*
Institute of Geography & Commission for Integrated Survey of Natural Resources, Academia Sinica, Building 917, Bei Sha Tan, Beijing 100101, China

Dr. N. Zheleznov
Dept. of Nature of North-East USSR, Pacific Institute of Geography, Russian Academy of Sciences, Chukotka Department of Nature Management, P.O. Box 16, 686710 Anadyr, Chukotka Russia

Dr. H. Ziaie*
Department of Environment, Urumyeh, Iran

Appendix 4

IUCN Red List Categories

Prepared by the IUCN Species Survival Commission
As approved by the 40th Meeting of the IUCN Council, Gland, Switzerland
30 November 1994

I) Introduction

1. The threatened species categories now used in Red Data Books and Red Lists have been in place, with some modification, for almost 30 years. Since their introduction these categories have become widely recognised internationally, and they are now used in a whole range of publications and listings, produced by IUCN as well as by numerous governmental and non-governmental organisations. The Red Data Book categories provide an easily and widely understood method for highlighting those species under higher extinction risk, so as to focus attention on conservation measures designed to protect them.

2. The need to revise the categories has been recognised for some time. In 1984, the SSC held a symposium, 'The Road to Extinction' (Fitter & Fitter 1987), which examined the issues in some detail, and at which a number of options were considered for the revised system. However, no single proposal resulted. The current phase of development began in 1989 with a request from the SSC Steering Committee to develop a new approach that would provide the conservation community with useful information for action planning.

In this document, proposals for new definitions for Red List categories are presented. The general aim of the new system is to provide an explicit, objective framework for the classification of species according to their extinction risk.

The revision has several specific aims:

- to provide a system that can be applied consistently by different people;
- to improve the objectivity by providing those using the criteria with clear guidance on how to evaluate different factors which affect risk of extinction;
- to provide a system which will facilitate comparisons across widely different taxa;
- to give people using threatened species lists a better understanding of how individual species were classified.

3. The proposals presented in this document result from a continuing process of drafting, consultation and validation. It was clear that the production of a large number of draft proposals led to some confusion, especially as each draft has been used for classifying some set of species for conservation purposes. To clarify matters, and to open the way for modifications as and when they became necessary, a system for version numbering was applied as follows:

Version 1.0: Mace & Lande (1991)
The first paper discussing a new basis for the categories, and presenting numerical criteria especially relevant for large vertebrates.

Version 2.0: Mace *et al.* (1992)
A major revision of Version 1.0, including numerical criteria appropriate to all organisms and introducing the non-threatened categories.

Version 2.1: IUCN (1993)
Following an extensive consultation process within SSC, a number of changes were made to the details of the criteria, and fuller explanation of basic principles was included. A more explicit structure clarified the significance of the non-threatened categories.

Version 2.2: Mace & Stuart (1994)
Following further comments received and additional validation exercises, some minor changes to the criteria were made. In addition, the Susceptible category present in Versions 2.0 and 2.1 was subsumed into the Vulnerable category. A precautionary application of the system was emphasised.

Final Version
This final document, which incorporates changes as a result of comments from IUCN members, was adopted by the IUCN Council in December 1994.

All future taxon lists including categorisations should be based on this version, and not the previous ones.

4. In the rest of this document the proposed system is outlined in several sections. The Preamble presents some

basic information about the context and structure of the proposal, and the procedures that are to be followed in applying the definitions to species. This is followed by a section giving definitions of terms used. Finally the definitions are presented, followed by the quantitative criteria used for classification within the threatened categories. It is important for the effective functioning of the new system that all sections are read and understood, and the guidelines followed.

References:

Fitter, R., and M. Fitter, ed. (1987) *The Road to Extinction*. Gland, Switzerland: IUCN.

IUCN. (1993) *Draft IUCN Red List Categories*. Gland, Switzerland: IUCN.

Mace, G. M. *et al.* (1992) "The development of new criteria for listing species on the IUCN Red List." *Species* 19: 16–22.

Mace, G. M., and R. Lande. (1991) "Assessing extinction threats: toward a reevaluation of IUCN threatened species categories." *Conserv. Biol.* 5.2: 148–157.

Mace, G. M. & S. N. Stuart. (1994) "Draft IUCN Red List Categories, Version 2.2". *Species* 21–22: 13–24.

II) Preamble

The following points present important information on the use and interpretation of the categories (= Critically Endangered, Endangered, etc.), criteria (= A to E), and sub-criteria (= a,b etc., i,ii etc.):

1. Taxonomic level and scope of the categorisation process
The criteria can be applied to any taxonomic unit at or below the species level. The term 'taxon' in the following notes, definitions and criteria is used for convenience, and may represent species or lower taxonomic levels, including forms that are not yet formally described. There is a sufficient range among the different criteria to enable the appropriate listing of taxa from the complete taxonomic spectrum, with the exception of micro-organisms. The criteria may also be applied within any specified geographical or political area although in such cases special notice should be taken of point 11 below. In presenting the results of applying the criteria, the taxonomic unit and area under consideration should be made explicit. The categorisation process should only be applied to wild populations inside their natural range, and to populations resulting from benign introductions (defined in the draft IUCN Guidelines for Re-introductions as "..an attempt to establish a species, for the purpose of conservation, outside its recorded distribution, but within an appropriate habitat and eco-geographical area").

2. Nature of the categories
All taxa listed as Critically Endangered qualify for Vulnerable and Endangered, and all listed as Endangered qualify for Vulnerable. Together these categories are described as 'threatened'. The threatened species categories form a part of the overall scheme. It will be possible to place all taxa into one of the categories (see Figure 1).

3. Role of the different criteria
For listing as Critically Endangered, Endangered or Vulnerable there is a range of quantitative criteria; meeting any one of these criteria qualifies a taxon for listing at that level of threat. Each species should be evaluated against all the criteria. The different criteria (A–E) are derived from a wide review aimed at detecting risk factors across the broad range of organisms and the diverse life histories they exhibit. Even though some criteria will be inappropriate for certain taxa (some taxa will never qualify under these however close to extinction they come), there should be criteria appropriate for assessing threat levels for any taxon (other than micro-organisms). The relevant factor is whether any one criterion is met, not whether all are appropriate or all are met. Because it will never be clear which criteria are appropriate for a particular species in advance, each species should be evaluated against all the criteria, and any criterion met should be listed.

4. Derivation of quantitative criteria
The quantitative values presented in the various criteria associated with threatened categories were developed through wide consultation and they are set at what are generally judged to be appropriate levels, even if no formal justification for these values exists. The levels for different criteria within categories were set independently but against a common standard. Some broad consistency between them was sought. However, a given taxon should not be expected to meet all criteria (A–E) in a category; meeting any one criterion is sufficient for listing.

5. Implications of listing
Listing in the categories of Not Evaluated and Data Deficient indicates that no assessment of extinction risk has been made, though for different reasons. Until such time as an assessment is made, species listed in these categories should not be treated as if they were non-threatened, and it may be appropriate (especially for Data Deficient forms) to give them the same degree of protection as threatened taxa, at least until their status can be evaluated.

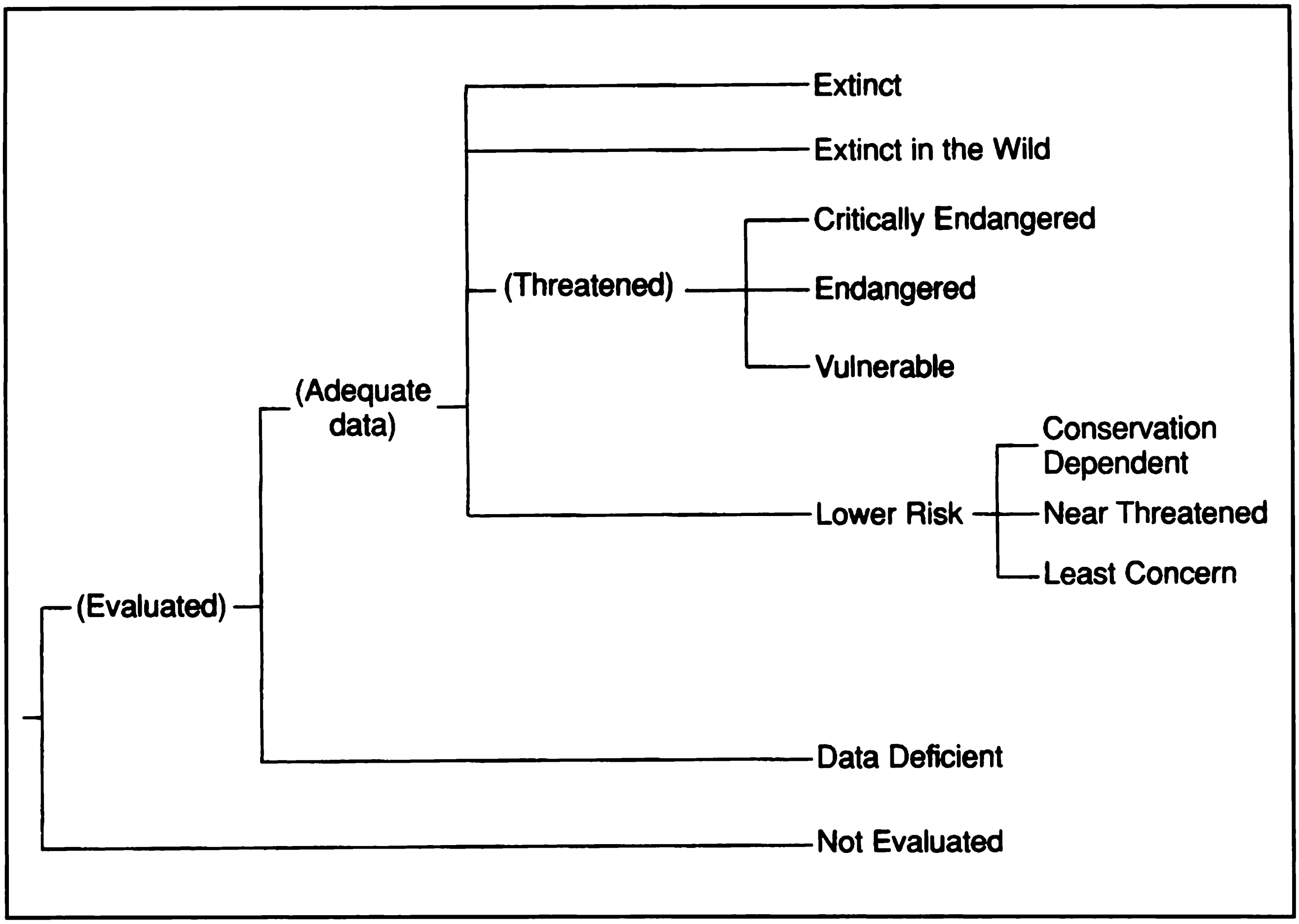

Figure 1: Structure of the Categories

Extinction is assumed here to be a chance process. Thus, a listing in a higher extinction risk category implies a higher expectation of extinction, and over the time-frames specified more taxa listed in a higher category are expected to go extinct than in a lower one (without effective conservation action). However, the persistence of some taxa in high risk categories does not necessarily mean their initial assessment was inaccurate.

6. Data quality and the importance of inference and projection

The criteria are clearly quantitative in nature. However, the absence of high quality data should not deter attempts at applying the criteria, as methods involving estimation, inference and projection are emphasised to be acceptable throughout. Inference and projection may be based on extrapolation of current or potential threats into the future (including their rate of change), or of factors related to population abundance or distribution (including dependence on other taxa), so long as these can reasonably be supported. Suspected or inferred patterns in either the recent past, present or near future can be based on any of a series of related factors, and these factors should be specified.

Taxa at risk from threats posed by future events of low probability but with severe consequences (catastrophes) should be identified by the criteria (e.g. small distributions, few locations). Some threats need to be identified particularly early, and appropriate actions taken, because their effects are irreversible, or nearly so (pathogens, invasive organisms, hybridization).

7. Uncertainty

The criteria should be applied on the basis of the available evidence on taxon numbers, trend and distribution, making due allowance for statistical and other uncertainties. Given that data are rarely available for the whole range or population of a taxon, it may often be appropriate to use the information that is available to make intelligent inferences about the overall status of the taxon in question. In cases where a wide variation in estimates is found, it is legitimate to apply the precautionary principle and use the estimate (providing it is credible) that leads to listing in the category of highest risk.

Where data are insufficient to assign a category (including Lower Risk), the category of 'Data Deficient' may be assigned. However, it is important to recognise that this category indicates that data are inadequate to determine the degree of threat faced by a taxon, not necessarily that the taxon is poorly known. In cases where there are evident threats to a taxon through, for example, deterioration of its only known habitat, it is important to attempt threatened listing, even though there may be little direct information on the biological status of the taxon itself. The category 'Data Deficient' is not a threatened category, although it indicates a need to obtain more information on a taxon to determine the appropriate listing.

8. Conservation actions in the listing process
The criteria for the threatened categories are to be applied to a taxon whatever the level of conservation action affecting it. In cases where it is only conservation action that prevents the taxon from meeting the threatened criteria, the designation of 'Conservation Dependent' is appropriate. It is important to emphasise here that a taxon require conservation action even if it is not listed as threatened.

9. Documentation
All taxon lists including categorisation resulting from these criteria should state the criteria and sub-criteria that were met. No listing can be accepted as valid unless at least one criterion is given. If more than one criterion or sub-criterion was met, then each should be listed. However, failure to mention a criterion should not necessarily imply that it was not met. Therefore, if a re-evaluation indicates that the documented criterion is no longer met, this should not result in automatic down-listing. Instead, the taxon should be re-evaluated with respect to all criteria to indicate its status. The factors responsible for triggering the criteria, especially where inference and projection are used, should at least be logged by the evaluator, even if they cannot be included in published lists.

10. Threats and priorities
The category of threat is not necessarily sufficient to determine priorities for conservation action. The category of threat simply provides an assessment of the likelihood of extinction under current circumstances, whereas a system for assessing priorities for action will include numerous other factors concerning conservation action such as costs, logistics, chances of success, and even perhaps the taxonomic distinctiveness of the subject.

11. Use at regional level
The criteria are most appropriately applied to whole taxa at a global scale, rather than to those units defined by regional or national boundaries. Regionally or nationally based threat categories, which are aimed at including taxa that are threatened at regional or national levels (but not necessarily throughout their global ranges), are best used with two key pieces of information: the global status category for the taxon, and the proportion of the global population or range that occurs within the region or nation. However, if applied at regional or national level it must be recognised that a global category of threat may not be the same as a regional or national category for a particular taxon. For example, taxa classified as Vulnerable on the basis of their global declines in numbers or range might be Lower Risk within a particular region where their populations are stable. Conversely, taxa classified as Lower Risk globally might be Critically Endangered within a particular region where numbers are very small or declining, perhaps only because they are at the margins of their global range. IUCN is still in the process of developing guidelines for the use of national red list categories.

12. Re-evaluation
Evaluation of taxa against the criteria should be carried out at appropriate intervals. This is especially important for taxa listed under Near Threatened, or Conservation Dependent, and for threatened species whose status is known or suspected to be deteriorating.

13. Transfer between categories
There are rules to govern the movement of taxa between categories. These are as follows: (A) A taxon may be moved from a category of higher threat to a category of lower threat if none of the criteria of the higher category has been met for five years or more. (B) If the original classification is found to have been erroneous, the taxon may be transferred to the appropriate category or removed from the threatened categories altogether, without delay (but see Section 9). (C) Transfer from categories of lower to higher risk should be made without delay.

14. Problems of scale
Classification based on the sizes of geographic ranges or the patterns of habitat occupancy is complicated by problems of spatial scale. The finer the scale at which the distributions or habitats of taxa are mapped, the smaller the area will be that they are found to occupy. Mapping at finer scales reveals more areas in which the taxon is unrecorded. It is impossible to provide any strict but general rules for mapping taxa or habitats; the most appropriate scale will depend on the taxa in question, and the origin and comprehensiveness of the distributional data. However, the thresholds for some criteria (e.g. Critically Endangered) necessitate mapping at a fine scale.

III) Definitions

1. Population
Population is defined as the total number of individuals of the taxon. For functional reasons, primarily owing to

differences between life-forms, population numbers are expressed as numbers of mature individuals only. In the case of taxa obligately dependent on other taxa for all or part of their life cycles, biologically appropriate values for the host taxon should be used.

2. Subpopulations
Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little exchange (typically one successful migrant individual or gamete per year or less).

3. Mature individuals
The number of mature individuals is defined as the number of individuals known, estimated or inferred to be capable of reproduction. When estimating this quantity the following points should be borne in mind:

- Where the population is characterised by natural fluctuations the minimum number should be used.

- This measure is intended to count individuals capable of reproduction and should therefore exclude individuals that are environmentally, behaviourally or otherwise reproductively suppressed in the wild.

- In the case of populations with biased adult or breeding sex ratios it is appropriate to use lower estimates for the number of mature individuals which take this into account (e.g. the estimated effective population size).

- Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g. corals).

- In the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.

4. Generation
Generation may be measured as the average age of parents in the population. This is greater than the age at first breeding, except in taxa where individuals breed only once.

5. Continuing decline
A continuing decline is a recent, current or projected future decline whose causes are not known or not adequately controlled and so is liable to continue unless remedial measures are taken. Natural fluctuations will not normally count as a continuing decline, but an observed decline should not be considered to be part of a natural fluctuation unless there is evidence for this.

6. Reduction
A reduction (criterion A) is a decline in the number of mature individuals of at least the amount (%) stated over the time period (years) specified, although the decline need not still be continuing. A reduction should not be interpreted as part of a natural fluctuation unless there is good evidence for this. Downward trends that are part of natural fluctuations will not normally count as a reduction.

7. Extreme fluctuations
Extreme fluctuations occur in a number of taxa where population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e. a tenfold increase or decrease).

8. Severely fragmented
Severely fragmented refers to the situation where increased extinction risks to the taxon result from the fact that most individuals within a taxon are found in small and relatively isolated subpopulations. These small subpopulations may go extinct, with a reduced probability of recolonisation.

9. Extent of occurrence
Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g. large areas of obviously unsuitable habitat) (but see 'area of occupancy'). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

10. Area of occupancy
Area of occupancy is defined as the area within its 'extent of occurrence' (see definition) which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may, for example, contain unsuitable habitats. The area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon (e.g. colonial nesting sites, feeding sites for migratory taxa). The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon. The criteria include values in km^2, and thus to avoid errors in classification, the area of occupancy should be measured on grid squares (or equivalents) which are sufficiently small (see Figure 2).

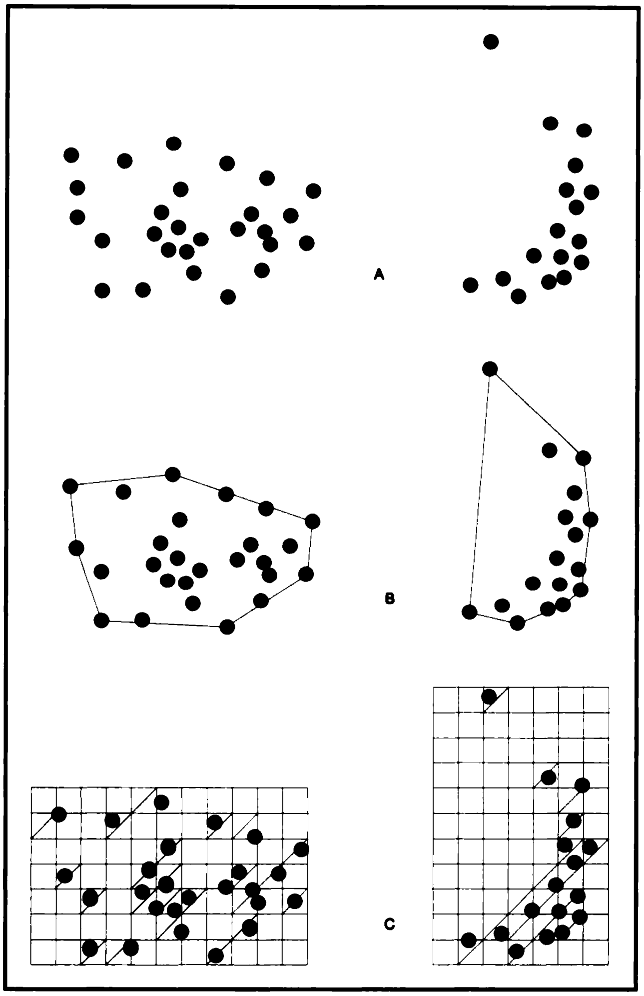

Figure 2: Two examples of the distinction between extent of occurrence and area of occupancy. (a) is the spatial distribution of known, inferred or projected sites of occurrence. (b) shows one possible boundary to the extent of occurrence, which is the measured area within this boundary. (c) shows one measure of area of occupancy which can be measured by the sum of the occupied grid squares.

11. Location
Location defines a geographically or ecologically distinct area in which a single event (e.g. pollution) will soon affect all individuals of the taxon present. A location usually, but not always, contains all or part of a subpopulation of the taxon, and is typically a small proportion of the taxon's total distribution.

12. Quantitative analysis
A quantitative analysis is defined here as the technique of population viability analysis (PVA), or any other quantitative form of analysis, which estimates the extinction probability of a taxon or population based on the known life history and specified management or non-management options. In presenting the results of quantitative analyses the structural equations and the data should be explicit.

IV) The categories [1]

EXTINCT (EX)
A taxon is Extinct when there is no reasonable doubt that the last individual has died.

EXTINCT IN THE WILD (EW)
A taxon is Extinct in the wild when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A taxon is presumed extinct in the wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the criteria (A to E) on page 390.

ENDANGERED (EN)
A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the criteria (A to E) on pages 390 and 391.

VULNERABLE (VU)
A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the criteria (A to D) on pages 391 and 392.

LOWER RISK (LR)
A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (cd)**. Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation programme targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.

2. **Near Threatened (nt)**. Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

3. **Least Concern (lc)**. Taxa which do not qualify for Conservation Dependent or Near Threatened.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it is has not yet been assessed against the criteria.

[1] Note: As in previous IUCN categories, the abbreviation of each category (in parenthesis) follows the English denominations when translated into other languages.

V) The Criteria for Critically Endangered, Endangered and Vulnerable

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria (A to E):

A) Population reduction in the form of either of the following:

1) An observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
   a) direct observation
   b) an index of abundance appropriate for the taxon
   c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   d) actual or potential levels of exploitation
   e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.

2) A reduction of at least 80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above.

B) Extent of occurrence estimated to be less than 100 km^2 or area of occupancy estimated to be less than 10 km^2, and estimates indicating any two of the following:

1) Severely fragmented or known to exist at only a single location.

2) Continuing decline, observed, inferred or projected, in any of the following:
   a) extent of occurrence
   b) area of occupancy
   c) area, extent and/or quality of habitat
   d) number of locations or subpopulations
   e) number of mature individuals.

3) Extreme fluctuations in any of the following:
   a) extent of occurrence
   b) area of occupancy
   c) number of locations or subpopulations
   d) number of mature individuals.

C) Population estimated to number less than 250 mature individuals and either:

1) An estimated continuing decline of at least 25% within three years or one generation, whichever is longer or

2) A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:
   a) severely fragmented (i.e. no subpopulation estimated to contain more than 50 mature individuals)
   b) all individuals are in a single subpopulation.

D) Population estimated to number less than 50 mature individuals.

E) Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer.

ENDANGERED (EN)

A taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future, as defined by any of the following criteria (A to E):

A) Population reduction in the form of either of the following:

1) An observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:

a) direct observation
b) an index of abundance appropriate for the taxon
c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
d) actual or potential levels of exploitation
e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.

2) A reduction of at least 50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d), or (e) above.

B) Extent of occurrence estimated to be less than 5000 km^2 or area of occupancy estimated to be less than 500 km^2, and estimates indicating any two of the following:

1) Severely fragmented or known to exist at no more than five locations.

2) Continuing decline, inferred, observed or projected, in any of the following:
a) extent of occurrence
b) area of occupancy
c) area, extent and/or quality of habitat
d) number of locations or subpopulations
e) number of mature individuals.

3) Extreme fluctuations in any of the following:
a) extent of occurrence
b) area of occupancy
c) number of locations or subpopulations
d) number of mature individuals.

C) Population estimated to number less than 2500 mature individuals and either:

1) An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, or

2) A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:
a) severely fragmented (i.e. no subpopulation estimated to contain more than 250 mature individuals)

b) all individuals are in a single subpopulation.

D) Population estimated to number less than 250 mature individuals.

E) Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer.

VULNERABLE (VU)
A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the following criteria (A to E):

A) Population reduction in the form of either of the following:

1) An observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is the longer, based on (and specifying) any of the following:
a) direct observation
b) an index of abundance appropriate for the taxon
c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
d) actual or potential levels of exploitation
e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.

2) A reduction of at least 20%, projected or suspected to be met within the next ten years or three generations, whichever is the longer, based on (and specifying) any of (b), (c), (d) or (e) above.

B) Extent of occurrence estimated to be less than 20,000 km^2 or area of occupancy estimated to be less than 2000 km^2, and estimates indicating any two of the following:

1) Severely fragmented or known to exist at no more than ten locations.

2) Continuing decline, inferred, observed or projected, in any of the following:
a) extent of occurrence
b) area of occupancy
c) area, extent and/or quality of habitat
d) number of locations or subpopulations
e) number of mature individuals

3) Extreme fluctuations in any of the following:
a) extent of occurrence
b) area of occupancy
c) number of locations or subpopulations
d) number of mature individuals

C) Population estimated to number less than 10,000 mature individuals and either:

1) An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, or

2) A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either:
   a) severely fragmented (i.e. no subpopulation estimated to contain more than 1000 mature individuals)
   b) all individuals are in a single subpopulation

D) Population very small or restricted in the form of either of the following:

1) Population estimated to number less than 1000 mature individuals.

2) Population is characterised by an acute restriction in its area of occupancy (typically less than 100 km^2) or in the number of locations (typically less than five). Such a taxon would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming Critically Endangered or even Extinct in a very short period.

E) Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

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Action Plan for African Primate Conservation: 1986-1990. Compiled by J.F. Oates and the IUCN/SSC Primate Specialist Group, 1986, 41 pp. (Out of print.)

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The Kouprey. An Action Plan for its Conservation. Compiled by J.R. MacKinnon, S.N. Stuart and the IUCN/SSC Asian Wild Cattle Specialist Group, 1988, 19 pp. (Out of print.)

Weasels, Civets, Mongooses and their Relatives. An Action Plan for the Conservation of Mustelids and Viverrids. Compiled by A. Schreiber, R. Wirth, M. Riffel, H. van Rompaey and the IUCN/SSC Mustelid and Viverrid Specialist Group, 1989, 99 pp. (Out of Print.)

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The Wild Cats: Status Survey and Conservation Action Plan. Compiled and edited by Kristin Nowell and Peter Jackson and the IUCN/SSC Cat Specialist Group, 1996, 406 pp.

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African Primates: Status Survey and Conservation Action Plan (Revised edition). Compiled by John F. Oates and the IUCN/SSC Primate Specialist Group, 1996.

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Palms: their conservation and sustained utilization. Status Survey and Conservation Action Plan. Edited by Dennis Johnson and the IUCN/SSC Palm Specialist Group, 1996, 116 pp.

Conservation of Mediterranean Island Plants. 1. Strategy for Action. Compiled by O. Delanoë, B. de Montmollin, L. Olivier and the IUCN/SSC Mediterranean Islands Plant Specialist Group, 1996, 106 pp.

IUCN/Species Survival Commission

The Species Survival Commission (SSC) is one of six volunteer commissions of IUCN – The World Conservation Union, a union of sovereign states, government agencies and non-governmental organizations. IUCN has three basic conservation objectives: to secure the conservation of nature, and especially of biological diversity, as an essential foundation for the future; to ensure that where the earth's natural resources are used this is done in a wise, equitable and sustainable way; and to guide the development of human communities towards ways of life that are both of good quality and in enduring harmony with other components of the biosphere.

The SSC's mission is to conserve biological diversity by developing and executing programs to save, restore and wisely manage species and their habitats. A volunteer network comprised of nearly 7,000 scientists, field researchers, government officials and conservation leaders from 188 countries, the SSC membership is an unmatched source of information about biological diversity and its conservation. As such, SSC members provide technical and scientific counsel for conservation projects throughout the world and serve as resources to governments, international conventions and conservation organizations.

The IUCN/SSC Action Plan series assesses the conservation status of species and their habitats, and specifies conservation priorities. The series is one of the world's most authoritative sources of species conservation information available to nature resource managers, conservationists and government officials around the world.

IUCN Communications Division
Rue Mauverney 28, CH-1196 Gland, Switzerland.
Tel: + +41 22 999 00 01, Fax: + +41 22 999 00 10
E-mail: mail@hq.iucn.org

IUCN Publications Services Unit,
219c Huntingdon Road, Cambridge, CB3 ODL, UK.
Tel: + +44 1223 277894, Fax: + +44 1223 277175
E-mail: iucn-psu@wcmc.org.uk

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