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**THE SNOW LEOPARD
CONSERVATION SCHEME**



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Ministry of Environment & Forests, Government of India
1988

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The Snow Leopard Conservation Scheme

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The Snow Leopard Conservation Scheme

Introduction

The Himalayas are the world's greatest mountain ranges and although they only comprise 7% of India's area, they constitute one of the country's most important natural assets. At the intersection between the temperate palaeartic and tropical oriental regions, and bordering on five separate biogeographical zones, the Himalayas encompass an enormous diversity of habitat types and plant and animal species, many of which are endemic. The great altitudinal span of the mountains, ranging from 300 to 8,500 m above sea level, merely adds to the climatic and biological diversity deriving from the geographical position of the range. Of equal importance in terms of natural resources is the arid Trans-Himalayan zone of Ladakh, lying in the rain shadow of the Himalayas proper. The Himalayas and Trans-Himalayas cover over 4,00,000 sq kms of India's land surface in the five states of Jammu and Kashmir, Himanchal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

The Plant and Animal Resources of The Himalayas

The broad vegetation types of the Himalayas range from the Chir pine and 'ban' oak communities of the foot-hills, to the mixed temperate forests of the intermediate altitudes containing 'moru' and 'kharsu' oaks, maple, walnut and conifers such as deodar, blue pine, spruce and fir. Higher up are the scattered birch and rhododendron woodlands, with rich meadow grasslands, thinning out with increasing altitude to the sparse alpine vegetation which finally gives way to bare rock and snow. The high altitude desert vegetation of the Trans-Himalayas consists of sparse grass and herb communities on soil-bearing gentler slopes, with trees such as willow and poplar in the narrow valley bottoms watered by glacier-fed rivers. In addition to many plants common to the varied biomes with which the Himalayas are contiguous, the mountains contain large numbers of endemic plant taxa, such as a profusion of balsams, rhododendrons and orchids.

The Himalayan fauna displays equally impressive diversity and uniqueness particularly amongst the birds and mammals. For example, Sikkim alone has more than 550 species of birds. Among the pheasants there is progression with increasing altitude from Kalij in the foot-hills to Kokias and Monal in the temperate mid-level forests, to snow-cock in the alpine areas. The Western Tragopan is an

example of a bird which is confined to one region of the Himalayas and the Mountain Quail serves as a reminder that the extinction process is as active in the high mountains as elsewhere. The rare Black-necked crane nests in the Trans-Himalayas of Ladakh.

Among the mammals, in addition to some species shared with the tropical and sub-tropical parts of India, the Himalayas contain whole assemblages of species which are unique to higher altitudes and in some cases endemic to relatively confined areas of the range. Small mammals include the Himalayan and Long-tailed marmots, pika, Himalayan squirrels and several species of voles which are found only in the higher reaches of the Himalayas, including the highly endemic Sikkim Vole. Among larger herbivores are the wild sheep and goats which display greater adaptive variation here than in any other part of the world. They include bharal, urial (shapu), Argali (nayan), ibex, markhor and Himalayan tahr, together with the serow, goral and the takin. The cervids have several Himalayan species including the highly endangered 'Hangul' or Kashmir Stag, and 'Shou' or Sikkim Stag and the Musk deer.

The lower altitudes of the Trans-Himalayas are occupied by Tibetan Wild Ass, Tibetan Gazelle and Chiru or Tibetan antelope—all species which occur outside Indian territory but within it are relatively rare. At higher altitudes the Trans-Himalayas are the home of the Wild Yak which is now extremely rare.

The Himalayas contain a large variety of carnivores, a number of which are endemic and either rare or of indeterminate status at the present time. The Himalayan Black Bear is widespread throughout the range and gives way to the Brown Bear at higher altitudes in the central and western Himalayas. There is also a good population of Brown Bear in the Rangdum Valley of Zaskar in the Trans-Himalayan zone. The Red Panda occurs in Sikkim and eastwards. The Binturong and Spotted Linsang have a similar range within India, whilst the Himalayan Palm Civet is distributed throughout the Himalayas. Mustelids are represented by the Himalayan Weasel, the Yellow-bellied Weasel and in the higher altitudes, the Pale Weasel. The Himalayan Yellow-throated marten is widespread and the Beech or Stone marten is found in the central and eastern Himalayas. The wolf occurs in the western Himalaya and Trans-Himalaya regions, as does the Hill Fox, a distinctive race of the Red Fox. Common leopard is widespread in the range, particularly at lower and medium altitudes. Lynx occurs in the Trans-Himalayas. Clouded leopard and a number of lesser cats are found in the eastern Himalayas—species, about the biology and distribution of which

very little is known. Some are undoubtedly quite rare. Pallas' cat is another rare felid of the Himalayas.

The largest Himalayan felid is the Snow Leopard. Within India it is confined to the Himalayas from Kashmir to the eastern portions of the range. This magnificent 'apex predator' is highly endangered and was the subject of a recent survey (1985-86) by a team from the Wildlife Institute of India in collaboration with the U.S. Fish and Wildlife Service and International Snow Leopard Trust. In the areas covered by this survey, the snow leopard was found to be nowhere abundant, but it was most numerous in central Ladakh, less so in southern Ladakh and present but scarce on the southern slopes of the Himalayas in northern Himachal Pradesh and Uttar Pradesh. There is a need for further general surveys of snow leopard distribution, particularly in the central and eastern Himalayas. A detailed study of the species' ecology has recently been commenced in central Ladakh by the Wildlife Institute of India, which should provide valuable information as a scientific basis for planning the conservation of this key species within India.

Serious field studies of not only snow leopard but almost all the major Himalayan species are urgently needed as our knowledge of their ecology is very poor and in many cases not even sufficient as a basis for sound conservation measures.

Present Conservation in The Himalayas

According to the recent 'Biogeography Report' (Rodgers & Panwar, 1988) some 5% of the 256,000 sq km of the Himalaya is presently under protected area status, in the form of 10 national parks and 46 sanctuaries. In the Trans-Himalayan zone there are two national parks, two sanctuaries and seven wildlife reserves covering a total area of approximately 9,000 sq kms. However, representative coverage is still very inadequate. Most of the protected areas that presently exist have problems. Final notification of national parks is still wanting in some, whilst in many adequate management machinery is yet to be established. Uncontrolled grazing and trampling by domestic stock, especially sheep and goats, are a widespread problem and trampling and habitat despoilation by human visitors are serious in areas such as the Valley of Flowers (U.P.). In the Trans-Himalayas in particular, increasing development activities and tourism are accelerating the rate of destruction in parts which were once regarded as inaccessible areas, apart from the presence of a few nomadic pastoralists.

Levels of habitat utilization, including the browsing and lopping of woody vegetation, which are acceptable at lower altitudes constitute serious destruction in high altitude areas due to the very slow plant regeneration on account of low temperatures and a prolonged winter season when growth stops altogether. Habitat fragility is further compounded by the thin soil layer, which lacks humus and moisture and is particularly vulnerable to wind and water erosion. Such management staff as do exist often have little understanding of the ecological processes peculiar to such areas and are generally not trained in the special techniques required for the protection of high altitude areas. Even living in and patrolling these inhospitable ranges require special training and equipment, which is not always available to forestry staff who, not surprisingly, tend to restrict their activities to the less hostile valleys and lower slopes.

Many of the populations of Himalayan wildlife are greatly reduced in numbers compared to former times. Fragmentation into small, hardly viable units is becoming increasingly common, as in the case of a 'population' of seven Nayan in Hemis National Park. The Shapu or Urial is perhaps the most endangered Himalayan ungulate in India. Apart from about 20 sq kms in Hemis National Park, there are no protected areas covering its range and Mallon estimates a total Indian population of 4-500 individuals. Apart from habitat destruction and severe competition from domestic stock for scarce food resources, there has been poaching in the past which has added to reduction in their numbers. In a number of cases it is probable that total numbers are approaching the minimum viable population for the species. Unless stringent protection can be provided, a number of extinctions are a certainty within the next two decades. This alarming situation is typified by the plight of the Snow Leopard whose numbers have been greatly reduced in India and adjacent countries by hunters and trappers in search of the prized pelt of the animal. Being a large carnivore capable of preying on domestic stock only adds to the Snow Leopard's problems. As wild prey numbers decline and those of domestic stock increase, the latter naturally form an increasing proportion of its diet and thereby bring this large cat into acute conflict with pastoralists and stock owners. In response to predation on their herds, the latter devise ways of eliminating the Snow Leopard.

These things are symptomatic of the ecological imbalance that is overtaking the entire Himalayan zone of the country. As always, predators at the apex of an ecological pyramid such as the Snow Leopard suffer the most—partly on account of their relatively smaller population size and also because of their potential for

conflict with owners of domestic animals. By the same token, the Snow Leopard provides a natural indicator of the ecological health of the ecosystem of which it is a part. If the populations of this apex carnivore are in good numbers, well distributed in relation to their food supply and show a ratio of age/sex categories that indicate normal reproduction, it can be safely deduced that the herbivore populations on which the Snow Leopard feed are in a healthy state and in good balance with the natural vegetation on which they depend for food. Adequate primary production and plant regeneration in turn indicate that the supporting soil layer is intact and free from disturbances that lower its fertility.

Snow Leopard Conservation

The Snow Leopard is considered endangered in all parts of its geographical range, including those within India. In a status report Chundawat et al (1986) estimate that within its range in India (see map) approximately 98,000 sq kms of habitat are available for the Snow Leopard. The table below shows that of this total habitat some 18,627 sq kms or approximately 19% is presently under protected area status in which Snow Leopard is reported to be present. There are proposals to considerably expand the area under protection still further (Rodgers and Panwar, 1988). It is highly pertinent to note that since the concept of a Snow Leopard Scheme was first mooted in October, 1986 the area of its habitat under protection has increased from 10,840 to 18,627 sq km, an increase of 8% which is highly satisfactory.

Apart from the total area protected, the manner of distribution of this total has to be considered. Presently there are some 26 national parks and sanctuaries in which Snow Leopard are reported to occur. These range from 29 to 4,000 sq kms in size, with a mean area of 716 sq km. Ten are over 500 sq km and only four are over 1,000 sq km. Snow Leopard normally exist at very low densities, which means that the majority of existing protected areas are too small to offer protection to a viable population of the species. Indeed it is certain that the smaller protected areas shown in the table do not offer protection to the entire annual range of even one individual. Thus, while they may have value in protecting small carnivores and the more localised herbivore species, these small protected areas must be discounted when considering effective conservation of the Snow Leopard.

Existing Protected Areas where Snow Leopard are reported to be present
WLS = Wildlife Sanctuary NP = National Park

State	Name of Protected Area	Area in sq kms
Jammu & Kashmir	Hemis NP	3,350
	Dachigam NP	141
	Kishtwar NP	425
	Changthang WLS	4,000
	Overa-Aru WLS	425
	Karakoram WLS	180
Himachal Pradesh	Great Himalayan NP (includes Thirthan WLS)	1,736
	Kanawar WLS	54
	Nargu & Winch WLS	278
	Kugti WLS	118
	Tundah WLS	64
	Siachu Tuan Nalla WLS	103
	Raksham - Chitkul WLS	138
	Lipa - Asrang WLS	109
	Pin (Spiti) NP (notified)	675
	Rupi Bhabha WLS	125
	Manali WLS	29
Uttar Pradesh	Nanda Devi NP	630
	Valley of Flowers NP	88
	Govind Pashu Vihar WLS	953
	Kedamath WLS	967
	Ascot Musk Deer WLS	600
Sikkim	Kangchendzonga NP	850
Arunachal Pradesh	Namdapha NP	1,807
	Moiling NP	500
	Mehao WLS	282
	Total No. of Protected Areas = 26	
	Total area = 18,627 sq km	
Mean area of Protected Areas = 716 sq km		

In addition to the fragmented nature of the present total Snow Leopard habitat under protection status, the quality of management of most of these high altitude parks and sanctuaries leaves much to be desired. Management plans are lacking and staffing is inadequate both in terms of numbers and the quality of training they have received for this specialised form of wildlife management. Equipment to enable staff to function in remote and hostile mountain environments is similarly largely lacking at present. It has to be borne in mind that high altitude conservation, while similar in broad principle to that of other biomes, requires specialised knowledge and approaches. Due to seasonal altitudinal migrations of the majority of species vast areas are involved and many regions are inaccessible for at least part of the year. New and upgraded management approaches and training are thus urgently needed if effective management is to be established in the existing protected areas.

It is thus not possible to be complacent about the present status of Snow Leopard conservation in India. The total area of habitat under protection, the nature of its distribution and small size of many protected areas and the general quality of management all require urgent attention if this apex predator of the high Himalayas is to be preserved.

The Concept of The Snow Leopard Scheme

Taking account of the vast array of unique plant and animal resources in the Himalayas and alarmed by the rapidly declining conservation status of these resources and accompanying ecological imbalance, the Snow Leopard Scheme is aimed at halting the forces of destruction and restoring and maintaining healthy balance in India's northern mountain ecosystems. Based on the scientific principle of the ecological pyramid and using the apex carnivore at the top of this particular pyramid as an indicator, the Scheme will be devised on the premise that in order to conserve the Snow Leopard we must systematically restore and protect the entire ecosystem of co-predators, herbivores, plants and soils of which this predator is but one component. This greatly threatened, magnificent large felid will thus be used as an evocative symbol for a project aimed not only at itself but at all the ecological components with which it has a network of interdependence. This network includes a system of pastoralism and other human activities in proper balance with the wild flora and fauna. The numbers of the components of this system will be so controlled as to prevent their exerting a negative influence inimical to the conservation of nature.

A model for the Snow Leopard project and its conceptual basis can be found in the very successful Project Tiger which was created in 1973 to offer more effective protection to the tiger and the lowland forest ecosystems of which it is part. Not only has the conservation status of this apex predator greatly improved (total numbers have more than doubled in 15 years), but the prey populations and habitats of all the fifteen Project Tiger reserves have shown marked improvement and increased ecological balance. A similar large scale restoration of the Himalayan wildlife ecosystems is envisaged as a result of the Snow Leopard Scheme.

As in the case of Project Tiger, the main modus operandi will be to create a network of special Snow Leopard reserves throughout the Himalayan and Trans-Himalayan zones and by this means to redress the comparative neglect in scientific conservation of these zones hitherto.

The number of special Snow Leopard reserves would be modest initially but would be added to in time, until fully representative protection is afforded to all the main sub-divisions of the mountain zones.

Commensurate with the high priority accorded to this project, the Government of India will make available special funding to enable the early creation and proper equipping and manning of the Snow Leopard reserves by the concerned States. As indicated in Appendix I, six of the proposed reserves are already in receipt of Central assistance. This totalled Rs. 56.767 lakhs during 1986-87 and 1987-88. Central Government grants will cover 100% of non-recurring costs in all areas brought under the aegis of the Scheme, as well as 50% of the recurring costs in the case of national parks concerned.

Whilst advice and overall direction of the Snow Leopard Scheme will be given by Central Government, execution will be carried out by the forestry and wildlife authorities of the five States involved in Himalayan conservation, viz Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh.

Objectives

In keeping with the foregoing, the objectives of the Snow Leopard Conservation Scheme may be stated as follows:

1. To provide effective protection to the Snow Leopard and its co-predators, prey species and habitats, comprising the Himalayan and Trans-Himalayan

ecosystems, so as to ensure their survival in perpetuity.

2. To promote an increase in numbers and distribution of Snow Leopards and other wildlife species whose populations have been severely decimated and to restore and maintain ecological balance in representative and viable portions of the high altitude wilderness.

3. To reduce and as far as possible eliminate all destructive influences in these habitats, including excessive grazing and trampling by domestic stock, lopping and firewood collection, poaching and unwise invasion of wilderness areas by road builders, the military and tourists.

4. To promote scientific study of the Himalayan Fauna and Flora and associated ecology, particularly in those aspects which will furnish a basis for their better conservation management.

5. To ensure appropriate recreational and educational use of Himalayan wildlife areas, which does not in any way conflict with objectives 1 to 3 above.

6. As a means of pursuing objectives 1 to 5 above, to establish and maintain a network of special 'Snow Leopard Reserves' in representative wildlife habitats. States will receive specific assistance and funding from Government of India in setting up, staffing and equipping these reserves, which will aim to embrace the best available knowledge and practices pertaining to the conservation of nature at high altitudes.

Proposed Snow Leopard Reserves

As in the case of Project Tiger, it is proposed to achieve the objectives of the Snow Leopard Scheme by the creation of a series of special reserves, which will offer a high degree of protection to carefully selected representative areas of high wildlife value in the Himalayan region. An initial list of thirteen protected areas proposed for establishment as Snow Leopard reserves is given in Appendix I, together with pertinent facts about the status and conservation value of each area. In addition to having Snow Leopard, each area proposed has other important wildlife species, many of which are endemic to particular parts of the Himalayan range and some of which are as highly endangered as the Snow Leopard itself. A variety of high altitude habitat types is also encompassed by these potential reserves, most of them in great need of careful protection and rehabilitation. In particular, overuse

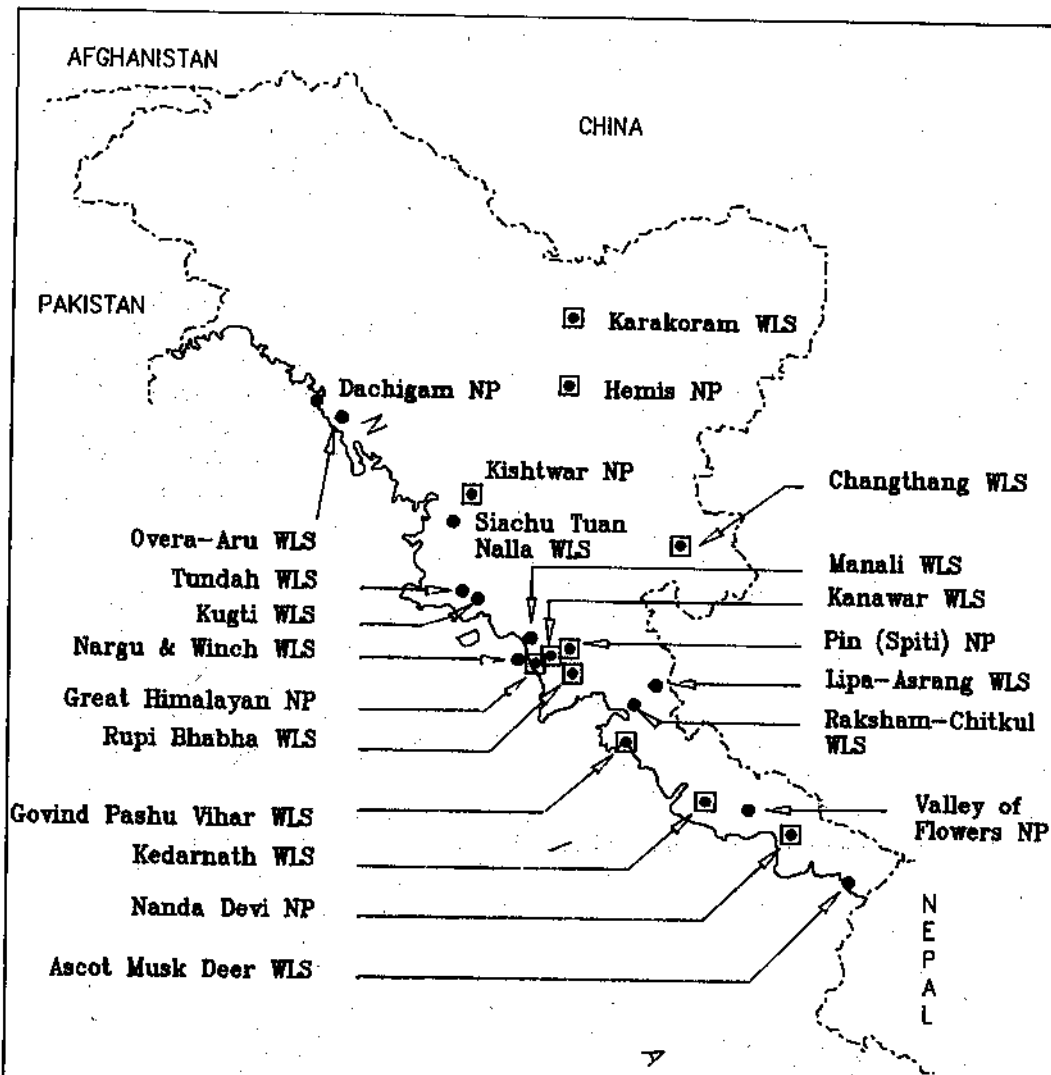
by man and his domestic animals is a common negative factor, except in the very highest altitudes above the permanent snow line. The 'Biogeography Report' recommends upgrading or extension of some of the proposed Snow Leopard areas. In most cases it should be assumed that such recommendations would be implemented as part of the proposal to make the area in question a Snow Leopard reserve.

The creation of these fourteen reserves at the initiation of the Snow Leopard Conservation Scheme would provide a basic coverage of good protected areas distributed along the Himalayan range. Additional reserves should be created later, which would progressively build up a more comprehensive network, encompassing more habitat types and a greater number of populations of some of the greatly endangered animal species. It is an important principle of sound conservation that a number of viable populations of a particular species is maintained so as to spread survival risk and ensure that various genetic combinations are perpetuated.

Although substantial funding and other assistance will be made available by Central Government, the main burden of setting up and administering the special reserves will fall on the five States in the Himalayan zone. As seen from Appendix I, a major portion of this burden will fall on Jammu and Kashmir which has both Himalayan and Trans-Himalayan biogeographic zones within its borders and contains some particularly critical high altitude wildlife areas. In this State Hemis is a key Snow Leopard area and Changthang is important for cold desert species. In Himachal Pradesh, which will have 2,570 sq kms under the Scheme, the Pin Valley National Park has recently been gazetted but needs greatly accelerated inputs if effective wildlife management is to be established. Together with Rupi Bhabha it contains the easternmost Ibex population, as well as Himalayan Tahr. In Uttar Pradesh (total 2,550 sq km), Nanda Devi and Govind Pashu Vihar are already gazetted but both need a detailed management plan, including provisions for zoning as a basis for rationalising future inputs. Tourism is a specific threat in Nanda Devi and careful plans for its control must be drawn up. Khangchendzonga in Sikkim is extremely important as sole representative of the central Himalayan zone (in India) with a long list of animal species containing western and eastern Himalayan faunal elements, including Nayan, Pallas' cat, Red Panda and Binturong as well as a number of lesser cats about which so little is known. Two Snow Leopard reserves are proposed for Arunachal Pradesh, totalling 782 sq km. However, it should be pointed out that in addition to these, 1,807 sq km of the Eastern Himalayan habitat of Snow Leopard already receives good protection in

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MAP SHOWING RANGE OF



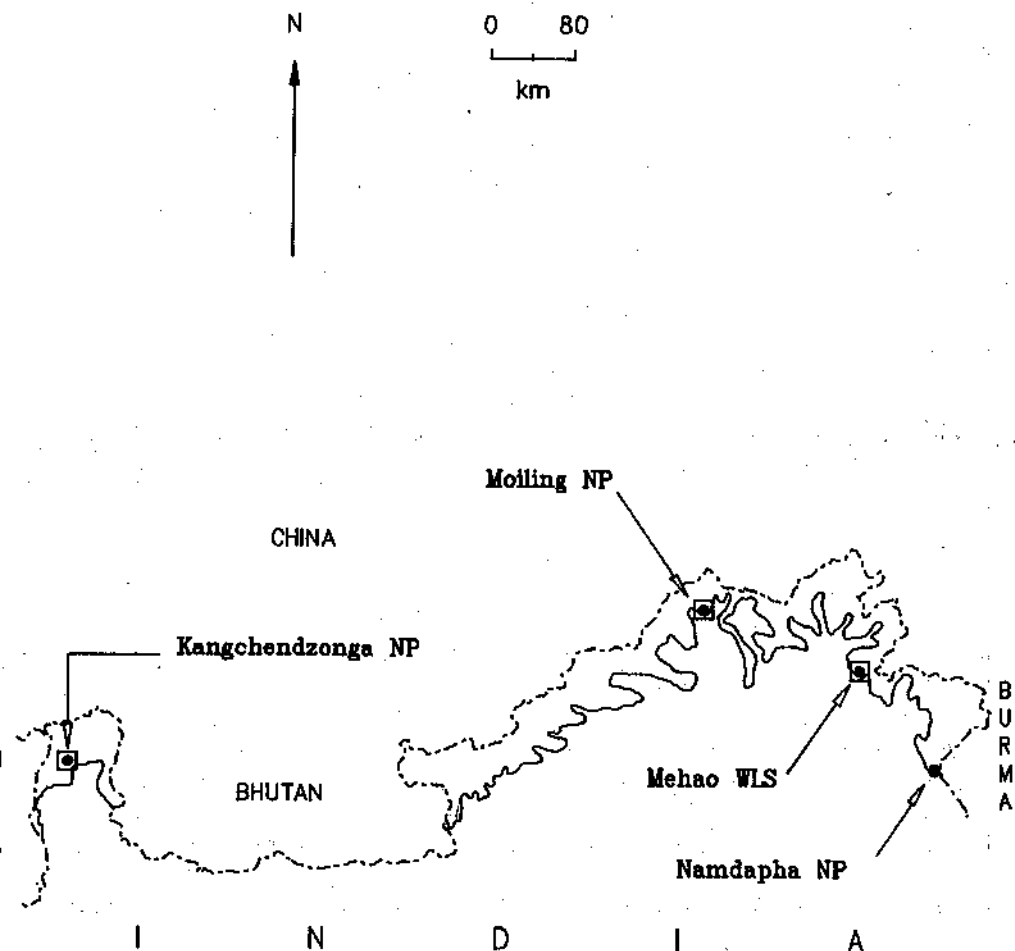
● Protected areas where Snow Leopard are reported to be present.

◻ Protected areas proposed for Snow Leopard Scheme — see Appendix I for details.

Source of original map : Atlas of Forest Resources of India
Government of India Copyright, 1975.

SNOW LEOPARD IN INDIA

Range of Snow Leopard taken to include the following habitat types as shown in the Forest Atlas of India : Subalpine Forest, Moist Alpine Scrub, Dry Alpine Scrub, Glacier and Barren land — see Chundawat et al, 1986 for details of areas and distribution of these respective habitat types within states.



the Namdapha National Park which is a Project Tiger reserve.

Implementation

Management Plans

An early priority in each of the proposed Snow Leopard reserves will be the production of a detailed management plan, based on clearly defined objectives. In addition to certain general objectives which will be common to all the reserves in the Scheme, each reserve should have objectives specific to the conservation of its own unique ecological characteristics and faunal and floral assemblages. Additional survey of proposed reserve boundaries will be needed in some cases as a pre-requisite of a management plan. In particular, it must be ensured that boundaries fully encompass the sum of seasonal ranges occupied by critical wildlife species including, of course, the Snow Leopard. Large differences between summer and winter ranges are characteristic of high altitude species. It may be necessary for some guidelines on survey design and management plan preparation to be issued centrally, so as to ensure a degree of uniformity in the quality of planning and management throughout all reserves in the Scheme.

Zoning of high altitude protected areas needs particular care. The practice, common in lowland reserves, of defining a central 'core' surrounded by a peripheral buffer zone is often not applicable to mountainous areas and if used may result in the core area being entirely valley bottom and the buffer high peaks or vice-versa. Clearly, representative portions of all altitudinal levels and their concomitant habitat types and animal species need the fuller protection offered by core area status.

Human Impacts

Careful attention will also have to be given by management to amelioration of the deleterious impacts of human activities, particularly excessive grazing by domestic stock. Unless the numbers of wild ungulates can be increased and the dependence of Snow Leopard on domestic stock reduced, there is little hope for an improved conservation status for this apex predator of the high mountains. Its predation on domestic stock must be reduced in order to remove one of the root causes of conflict with man which presently leads to its slaughter as a stock lifter. Poaching will also need to be vigorously tackled and much more effective protection than hitherto imposed on the reserve areas. Some form of monitoring

of human impacts will need to be set up in order to provide a measure of the effectiveness of management measures, as they are progressively implemented. Eco-development schemes tailored to the needs of high altitude people will also have to be devised in collaboration with agencies other than those responsible for forestry and wildlife. Such schemes should incorporate appropriate public education programmes, aimed at showing people at all levels the importance of nature conservation to human survival.

Special Procedures

In a limited number of cases special management procedures for highly endangered species, such as translocation, reintroduction or re-stocking may be necessary in order to facilitate restoration of natural community structure and ecological balance. Himalayan Tahr is a species already considered in this regard. However, programmes of this kind require expert advice and should not be thought of as a substitute for the imposition of effective protection measures which provide an adequate context for natural restoration in most cases.

Staff

It is likely that a lack of adequately trained and committed field staff will constitute a major constraint on the early implementation of management programmes. Working in high altitude areas requires special human qualities and specific training, over and above that imparted by existing wildlife or forestry courses. Mere human survival in the harsh environment of the mountains is an art in itself, apart from the fact that an understanding of high altitude ecology is essential to effective management. Transport and communications in these areas also present special problems. It thus seems imperative that a carefully designed training programme for the staff of reserves in the Snow Leopard Scheme will have to be set up, possibly for personnel who have already completed regular training in wildlife management at the Wildlife Institute of India. Possibly 1 to 2 month courses would be conducted from time to time based on one of the Snow Leopard reserves, depending on demand. Without well trained, equipped and motivated staff little progress is likely to be achieved in upgrading the quality of management. Norms for the appointment of field directors in charge of Snow Leopard reserves should be laid down, specifying for example, a minimum rank of D.C.F. for such posts, except in the case of very small reserves.

Equipment

Similarly, assistance will be needed in the provision of specialised equipment for working in the mountains. Personal items such as boots and heavy clothing, tents and cooking gear will have to be provided of a high standard if staff are to be encouraged to spend prolonged time in the field in the pursuance of their duties. Radio communication equipment will be essential for maintaining contact with headquarters in remote areas. Transport is an obvious need. Central selection and purchase of such equipment may prove to be the best way to proceed. A well equipped field force, with pride in their high standards, will go a long way towards achieving the objectives of the Scheme.

Research

Whilst the establishment of effective management and protection is a first priority of the Snow Leopard Scheme, research and study aimed at an increased understanding of the ecology of the wildlife species and their habitats must not be neglected. Indeed, such knowledge is essential for the proper design and fine tuning of management. Good programmes of study by visiting researchers should be encouraged, particularly where they conform to priorities established for Snow Leopard areas. However, in addition to such 'guest' research, each Snow Leopard reserve should plan a research and monitoring programme of its own and recruit appropriate biologists into the regular cadre to carry out this work under the supervision of the field director. Research should be perceived as an important long-term investment, not a luxury. At present our scientific knowledge of high altitude areas is, on the whole, poor and these areas can only be adequately conserved if our understanding of their ecological functioning is considerably increased.

Conclusion

The Snow Leopard Conservation Scheme will be unique in the world. In providing high quality protection to a great diversity of high altitude habitats and rare wildlife species, with the magnificent Snow Leopard at their ecological apex, the Scheme will ensure the survival of India's unequalled assemblage of mountain flora and fauna.

Bibliography

- Anon. (1980). Centrally sponsored scheme for National Parks and Wildlife Sanctuaries of Jammu and Kashmir Regions, Plan Period 1980-85. Department of Wildlife Protection, J & K Government, Srinagar. 38 pp.
- Chundawat, R.S., Rodgers, W.A. & Panwar, H.S. (1986). Status Report on Snow Leopard in India. Paper read at Fifth International Snow Leopard Symposium, Srinagar, Kashmir 13-15 October, 1986.
- Fox, J.L., Sinha, S.P. Chundawat, R.S. & Das, P.K. (1986). A survey of the Snow Leopard and associated species in the Himalaya of North-Western India. Project Completion Report. Wildlife Institute of India, U.S. Fish and Wildlife Service and International Snow Leopard Trust. 43 pp mimeo.
- Gaston, A.J., Garson, P.J. and Hunter, M.L. (1983). The Status and Conservation of Forest Wildlife in Himachal Pradesh, Western Himalayas. *Biol. Conserv.* 27: 291:314.
- Gaston, A.J., Hunter, M.L. & Garson, P.J. (1981). The Wildlife of Himachal Pradesh, Western Himalayas. Technical Note No. 82, School of Forest Resources, University of Maine. 159 pp.
- Greén, M.J.B. (1982). Status, distribution and conservation of Snow Leopard in North India. *International Pedigree Book of Snow Leopards*. 3: 6-10.
- Green, M.J.B. (1987). Protected Areas and Snow Leopard: their distribution and status. *Tiger Paper* 14 (4): 1-10.
- Lamba, B.S. (1985). Status Survey of Endangered and Threatened Species of Mammals and Birds at Nanda Devi National Park. (1981-84). India MAB Research Committee. *Zoological Survey of India*. 59 pp.
- Mallon, D. (1984). The Snow Leopard in Ladakh. *International Pedigree Book of Snow Leopard* 4 : 23-37.
- Rodgers, W.A. & Panwar, H.S. (1988). Planning a Wildlife Protected Area Network in India. Vol I. The Report. A Report prepared for the Department of

Environment Forests and Wildlife, Government of India at Wildlife Institute of India. 317 pp.

Schaller, G.B. (1977). Mountain Monarchs - Wild Sheep and goats of the Himalayas. The University of Chicago Press. Chicago and London. 425 pp.

APPENDIX I

Reserves proposed under the Snow Leopard Scheme

STATE	NAME OF AREA	PRESENT STATUS	AREA IN SQ.KM	ALTITUDINAL RANGE (M.a.m.s.i.)	HABITAT/FOREST TYPES	MAIN WILDLIFE SPECIES
Jammu & Kashmir	Karakoram WLS	WLS	180	3100-8000	Cold Steppe Scrub Glacier	Snow Leopard Lynx Wolf Ibex Bharal
Jammu & Kashmir	Changthang WLS	WLS	4000	4000-6500	Cold Grassland Cold Salt Marsh	Snow Leopard Wolf Wolf Lynx Wild Ass Bharal Black-necked Crane Bar-headed Goose
Jammu & Kashmir	Hemis *	NP	3350	4000-6000	Cold Steppe Scrub Cold Grassland Glacier	Snow Leopard Lynx Wolf Wild dog Weasel Nayan Bharal Ibex Urial

Note : Southern portion of Lughnak Valley (5-6000 sq km) should also be declared sanctuary as buffer to Hemis. This is the best Snow Leopard area in Zaskar and 250 Ibex were recently sighted there.

(* = already in receipt of Central assistance)

APPENDIX I (ii)

STATE	NAME OF AREA	PRESENT STATUS	AREA IN SQ KM	ALTITUDINAL RANGE	HABITAT/FOREST TYPES (M.a.m.s.i.)	MAIN WILDLIFE SPECIES
Jammu & Kashmir	Kishtwar *	NP	425	1700-4800	Temperate Broadleaf Temperate Conifer Alpine and Sub-alpine	Snow Leopard Black Bear Brown Bear Fox Serow Bharal Goral Ibex Musk Deer Pheasants
Himachal Pradesh	Pin (Spiti) *	NP (notified)	675	(Mean 3500)	Cold Steppe Scrub Alpine and Sub-alpine	Snow Leopard Lynx Ibex Tahr
Himachal Pradesh	Rupi Bhabha *	WLS	125	2250-5672	Temperate Broadleaf Temperate Conifer Alpine and Sub-alpine	Snow Leopard Lynx Ibex Tahr
Himachal Pradesh	Great Him- alayan & Kanawar	NP/WLS	1716 + 54	1500-6100	Temperate Broadleaf Temperate Conifer Alpine and Sub-alpine	Snow Leopard Brown Bear Bharal Ibex Musk Deer Tahr Pheasants

(* = already in receipt of Central assistance)

APPENDIX I (iii)

STATE	NAME OF AREA	PRESENT STATUS	AREA IN SQ.KM	ALTITUDINAL RANGE (M.a.m.s.l.)	HABITAT/FOREST TYPES	MAIN WILDLIFE SPECIES
Uttar Pradesh	Nanda Devi	NP	630	3500-7800	Temperate Conifer Alpine and Sub-alpine	Snow Leopard Brown Bear Bharal Serow Tahr Musk Deer Pheasants - Monal
Uttar Pradesh	Govind Pashu* Vihar	WLS	953 (Of above 300 sq km proposed as N.P.)	1400-6300	Sub-tropical Pine Sub-tropical Dec- iduous Temperate Broadleaf Temperate Conifer Alpine and Sub-alpine	Snow Leopard Leopard Brown Bear Black Bear Fox Sambar Serow Goral Bharal Tahr Musk Deer Flying Squirrel Pheasants

(* = already-in receipt of Central assistance)

APPENDIX I (iv)

STATE	NAME OF AREA	PRESENT STATUS	AREA IN SQ KM	ALTITUDINAL RANGE (M a.m.s.l.)	HABITAT/FOREST TYPES	MAIN WILDLIFE SPECIES
Uttar Pradesh	Kedamath	WLS (Of above 300 sq km proposed as N.P.)	967	1300-7000	Sub-tropical Pine Sub-tropical Deciduous Temperate Broadleaf Temperate Conifer Alpine and Sub-alpine	Snow Leopard Leopard Brown Bear Black Bear Flying Squirrel Sambar Bharal Serow Tahr Musk Deer Snow Cock Kaleej Monal
Sikkim	Khangchen-dzonga *	NP (Proposed to extend N.P. to 946 sq km)	850	1800-8500	Temperate Alpine and Sub-alpine	Snow Leopard Black Bear Wolf Pallas' cat Red Panda Lesser cats Binturong Wild Ass Bharal Serow Goral Nayan Tahr Pheasants

(* = already in receipt of Central assistance)

APPENDIX I (v)

STATE	NAME OF AREA	PRESENT STATUS	AREA IN SQ.KM	ALTITUDINAL RANGE (M.a.m.s.l.)	HABITAT/FOREST TYPES	MAIN WILDLIFE SPECIES
Arunachal Pradesh	Mojling *	NP (Proposed to extend NP to 800 sq km plus buffer WLS of 700 sq km)	500	2000-3400	Temperate Broadleaf Temperate Conifer Sub-alpine Alpine	Snow Leopard Lesser cats Binturong Red Panda Gaur Serow Hornbills
Arunachal Pradesh	Mehao *	WLS	282	330-3560	Valley Evergreen Hill Evergreen Moist Deciduous Temperate Broadleaf Temperate Conifer Sub-alpine Alluvial grassland Wetland/swamp	Snow Leopard Clouded Leopard Tiger Lesser cats Red Panda Binturong Elephant Musk Deer Serow Hornbills

(* = already in receipt of Central assistance)

APPENDIX II

Recommended staffing patterns for Proposed Snow Leopard reserves during the initial 3 years of the Scheme

Reserve	Gazetted Officers	Range Officers	Foresters	Forest Guards
Karakoram	Nil	1	1	4
Changthang	1 DCF	4	6	16
Hemis	1 DCF 1 ACF	4	6	16
Kishtwar	1 DCF	2	2	6
Pin	1 DCF	2	3	8
Rupi Bhabha	1 ACF	2	1	3
Great Himalayan & Kanawar	1 DCF	3	4	12
Nanda Devi	1 DCF	2	3	8
Govind Pashu Vihar	1 DCF	3	3	10
Kedarnath	1 DCF	3	3	10
Khangchendzonga	1 DCF	3	4	12
Motling	1 DCF	2	3	7
Mehac	1 ACF	1	2	5

APPENDIX III

Recommended format for preparation of proposals seeking Central financial assistance under the Scheme

In making a proposal for Central Government assistance for a particular reserve under the Snow Leopard Scheme, a statement should be provided clearly showing (a) the existing situation and (b) planned needs with respect to each of the following. All statements should be quantified as precisely as possible and detailed cost estimates provided for each item.

1. Introductory statement
2. Status of notification of the protected area
3. Boundary description and demarcation
4. Management Plan
5. Human presence/impacts and proposals to reduce these by e.g. relocation of villages, provision of alternatives, eco-development etc.
6. Staffing pattern
7. Training plans
8. Infrastructure (buildings, check-posts, roads etc.)
9. Transport (jeeps, mules/horses, yaks etc.)
10. Radio communications
11. Other equipment, including for research and monitoring (camping gear, high altitude clothing, binoculars etc.)
12. Compensation (e.g. for cattle kills)
13. Research and monitoring
14. Special requirements not covered by the above.

Budget should be divided into recurring and non-recurring sections and phasing of expenditure over the current and four subsequent financial years shown.

