

# **A REGIONAL PERSPECTIVE FOR SNOW LEOPARD CONSERVATION IN THE INDIAN TRANS-HIMALAYA<sup>1</sup>**

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## **ABSTRACT**

The Trans-Himalaya is a vast biogeographic region in the cold and arid rain-shadow of the Greater Himalaya and is spread over three Indian states. From the conservation standpoint this region has several unique characteristics. Unlike most other biogeographic regions of the country, it has wildlife, including large mammals, spread over the entire region. Another feature is that the harsh climate and topography provides limited agricultural land and pastures, all of which are currently utilized by people.

The harsh environment has given rise to a specialized assemblage of flora and fauna in the region that include the endangered snow leopard, a variety of wild sheep and goat, Tibetan antelope, Tibetan gazelle, kiang and wild yak. The snow leopard is one of the most charismatic species of the Trans-Himalaya. This apex predator, with a wide distribution, has ecological importance and international appeal, and is eminently suitable to be used as both a 'flagship' and an 'umbrella species' to anchor and guide conservation efforts in the Trans-Himalayan region.

Among the 10 Biogeographic Zones in the country, the Trans-Himalaya has a comparatively large Protected Area (PA) coverage, with over 15,000 km<sup>2</sup> (8.2 %) of the geographical area under the network. In spite of this, the bulk of the large mammal populations still exist outside the PAs, which include highly endangered species such as snow leopard, chiru, wild yak, Ladakh urial, kiang and brown bear.

Given the sparse resource availability in the Trans-Himalaya and the existing human use patterns, there are few alternatives that can be provided to resource dependent human communities in and around PAs. The existing PAs themselves pose formidable conservation challenges and a further increase in their extent is impractical. The problem is further compounded by the fact that some of the large PAs have unclear boundaries and include vast stretches that do not have any direct wildlife values. These issues call for an alternative strategy for conservation of the Trans-Himalayan tracts based on a regional perspective, which includes reconciling conservation with development.

In this paper we stress that conservation issues of this region, such as competition for

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forage between wild and domestic herbivores and human-wildlife conflicts need to be addressed in a participatory manner. We suggest an alternative scheme to look at the zonation of existing PAs and also the Trans-Himalayan region as a whole, to facilitate better conservation in the region. Also, we emphasize that there is a vital need for additional resources and a formal setup for regional planning and management under a centrally sponsored scheme such as the 'Project Snow Leopard'.

## INTRODUCTION

Wildlife in India, especially the large mammals are primarily concentrated in the Protected Areas (PAs), which too have become habitat islands, isolated by vast stretches of unsuitable habitat for wildlife. Human population has been constantly increasing in the country and has recently crossed the one billion mark. At present about 4.7% of the country's 3.3 million km<sup>2</sup> geographic area is under National Parks (NPs) and Wildlife Sanctuaries (WLS), and there are plans to increase this to *ca.* 5.7% in order to make the PA network biogeographically more representative (Rodgers *et al.* 2000). The human pressure on India's wild lands has been constantly increasing, with more and more cases of serious conflicts between people and parks being reported. Wildlife conservation in India has a long history of management through 'policing' the PAs. It is only in the past two decades or so that conservationists and park managers have realized that exclusion of people completely from PAs is not a viable option - a realization that has thrown up numerous challenges. The fact that a majority of Indian PAs have not been legally gazetted due to non settlement of the rights and concessions of local communities residing inside the PAs also calls for a review of this situation. Fortunately, the proposed amendment to the Indian Wildlife Protection Act by inclusion of two additional categories of PAs *viz.* Conservation Reserve and Community Reserve would provide a pragmatic solution to this hitherto unresolved issue through rationalization of PA boundaries.

PAs in India and elsewhere are meant to preserve and protect a range of conservation values. Each PA has specific objectives of management. Many of the objectives and conservation issues are common to a vast variety of PAs. One such objective for most Trans-Himalayan PAs is the conservation and maintenance of a viable snow leopard (*Uncia uncia*) population as a 'flagship species' (Mathur 2001). Further, when conservation objectives and issues are similar, solutions may be as well, although adaptations for local conditions may be necessary. Often, managing and monitoring all aspects of biodiversity in a PA is difficult and hence, managers tend to concentrate on focal species that guide conservation efforts for the area (Simberloff 1998). As per a critique on the single species management approach by Simberloff (1998), these species may be 'flagship species'; one that is 'normally a charismatic large vertebrate, one that can be used to anchor a conservation campaign because it arouses public interest and sympathy'. Or it may be an indicator species, one that is usually sensitive to disturbance in the ecosystem that they represent and their population abundance is indicative of a healthy ecosystem. A third species oriented approach is to have an 'umbrella species', which needs such large tracts for its conservation that saving this species automatically saves an entire range of species occurring within its habitat.

The snow leopard is a charismatic large carnivore, distributed over most of the Trans-Himalaya and the Greater Himalaya. The sympathy and appeal that the snow leopard has drawn internationally is self-evident. The International Snow Leopard Trust (ISLT), an organization completely dedicated to the cause of the snow leopard conservation has been in existence for over two decades now, with programmes in several of the 13 range countries including India. Within India as well, an entire conservation and management program focused on the snow leopard was proposed several years ago, some what along the lines of Project Tiger (Anon. 1988). Apart from its appeal in garnering public support and funding, which renders it a valuable flagship species for conservation, its large home ranges and ubiquitous distribution in the Indian

Trans-Himalaya make the snow leopard a suitable umbrella species as well. Importantly, the serious conservation issues in the Trans-Himalayan region – livestock grazing and associated out-competition of wild prey as well as livestock depredation—both involve or affect the snow leopard directly or indirectly. It is therefore imperative that the snow leopard conservation in the Trans-Himalaya should have a regional perspective involving range states and line agencies, which influence its conservation status in one way or the other.

In this paper we use the above reasoning to say that the snow leopard qualifies both as a flagship and an umbrella species representing the Trans-Himalayan ecosystem and that its conservation would mean the conservation of the Trans-Himalayan region as a whole. We also try to detail how the resource-deficient Trans-Himalayan region is special, where most of the region still has wildlife values and where communities or individual families have traditional rights over all usable land. Hence, conservation challenges of the region will not be addressed by merely increasing the area under PA network, but by ensuring effective conservation measures in the larger region and by increasing the stake of the local communities in snow leopard conservation by providing viable livelihood support options.

### **THE TRANS-HIMALAYAN LANDSCAPE**

The Trans-Himalayan region is a cold, arid, mountainous landscape that covers the rain shadow regions immediately north of the Himalaya. The region is characterized by severe winters lasting over six months, with temperatures dropping to as low as - 50°C in some places. Another characteristic of the region is the short plant growth season of merely two to three months, when productivity is usually low. These harsh conditions have given rise to hardy and highly adapted flora, fauna and people.

Within India, the Himalaya and Trans-Himalaya are included in six states. Of these, the Ladakh region of Jammu and Kashmir, Lahul-Spiti region of Himachal Pradesh, and northern Sikkim have Trans-Himalayan areas that cover approximately 1.85 lakh km<sup>2</sup> (Rodgers *et al.* 2000). Uttaranchal and Arunachal Pradesh, along with the other three states mentioned above, have alpine and high arid areas on their northern boundaries that also comprise snow leopard range in India. The entire Himalayan block (2.1 lakh km<sup>2</sup>) is classified as the Biogeographic Zone 02 (Province A to D), or ‘Himalaya’ (Rodgers and Panwar 1988), but the highest reaches, the Greater Himalaya, that constitutes the snow leopard range, is a narrow belt quite distinct in topography, climate and vegetation from the rest of the Himalaya.

The Trans-Himalayan region in India forms the catchment of three major rivers. In the northwest, the Indus, with its major tributaries - Zaskar and Shyok, drains the entire Ladakh region. South of this, the Chenab river, with its tributaries, the Chandra and Bhaga rivers, drains the Lahul valley. East of Lahul is the Spiti valley that drains into the Sutluj river, which passes through the Kinnaur region. Within India two provinces in the Trans-Himalaya are recognized (Rodgers and Panwar 1988). The ‘Ladakh Mountains’ constitute approximately 60% of the Trans-Himalayan zone and is spread in the Kargil, Zaskar, Leh, Nubra, and Lahul-Spiti regions of Jammu and Kashmir and Himachal Pradesh. These areas are mostly rugged mountains and valleys and have a large altitudinal range from 2,200m in the Kargil and Nubra regions to over 7,000m in the Karakorum range. The second province is the ‘Tibetan Plateau’ that constitutes the

remaining 40% of the Trans-Himalaya. This region includes Changthang in Ladakh, parts of Spiti and the northern plateaus of Sikkim and is characterized by vast plains, rolling mountains and some large high-altitude lakes. Most of this region lies above an elevation of 4,200m.

In spite of the overall low numbers of species of plants and animals in the Trans-Himalaya (Das 1966), the region is home to an array of highly specialized assemblage of flora and fauna. There are over 600 flowering plants and numerous species of graminoids many with significant ethnobotanical value as medicinal plants, forage for livestock, or fuel (Kala 2001). The region is also home to over 225 bird species, including numerous breeding waterfowl (Pfister 1998, Singh and Jayapal 2001). Some of these species, such as the black necked crane (*Grus nigricollis*) and the bar headed geese (*Anser indicus*) are of considerable conservation significance. The region has gained further importance as it has over six species and sub-species of wild sheep and goats that are an important genetic resource from the region. There are numerous mammal species in the region that are classified in the Schedule I and II of the Indian Wildlife (Protection) Act 1972 and some of these are listed in Appendix 1. Ecological information on all species from India is scarce, however, some details about bharal and snow leopard are known (Chundawat 1992). Ibex ecology was described by Bhatnagar (1997) and Manjrekar (1997). Information on the status and distribution of species have been reported by Fox *et al.* (1991), Mallon (1991), Shah (1994, 1996), Chundawat and Qureshi (1999) and Bhatnagar and Wangchuk (2001).

Local people enjoy traditional rights over much of the area and most usable land is already utilized as pastures, agricultural land, and for the collection of fuel, fodder and housing material. Although data on land ownership are not easily available, bulk of the land is State owned with traditional rights of use held by communities or individuals.

### **SNOW LEOPARD – AN ELUSIVE CARNIVORE**

Snow leopards are elusive cats with a potential range of approximately 2.4 million km<sup>2</sup> in the arid mountain tracts of Central Asia, the Trans-Himalaya and the Himalaya (Jackson and Hunter 1996). Even though they have a relatively large global range, they have gone extinct locally at many of the sites and at present are distributed in fragmented populations spread over less than 1.6 million km<sup>2</sup> (Jackson and Hunter 1996). A coarse, but best available estimate of their global population is 4,500 - 7,500 animals. In India, they range over some 75,000 km<sup>2</sup>, yet number only 200 to 600 (Fox 1994). Because of this precarious status, the snow leopard is included in the Schedule I of the Indian Wildlife (Protection) Act 1972 (Anon. 1992) and as 'endangered' in the IUCN's Red List (Nowell and Jackson 1996).

Snow leopards prefer rugged mountain tracts with abundant prey and stalking cover (Schaller 1977, Jackson and Ahlborn 1984, Chundawat 1992, McCarthy 2000). However, in much of the Tibetan plateau and Mongolia, snow leopards occur in open, rolling habitats where shrubs and outcrops offer cover for stalking of abundant prey (Mallon 1984, Schaller *et al.* 1988, McCarthy 2000). The primary prey species of snow leopards in their range are bharal (*Pseudois nayaur*) and ibex (*Capra ibex sibirica*), although others such as urial (*Ovis orientalis*), argali (*Ovis ammon*), markhor (*Capra falconeri*), wild goat (*Capra aegrus*) and marmot (*Marmota spp.*) may also be important locally (Schaller 1977, Chundawat and Rawat 1994). Estimates suggest that

each snow leopard needs approximately 20 to 30 adult bharal annually (Jackson and Ahlborn 1984). Other estimates suggest that snow leopards need *ca.* 730 kg of meat annually from their large prey species such as bharal, and other smaller ones such as domestic sheep, goats, marmots and birds (Chundawat and Rawat 1994). Snow leopard distribution and status in the wild may then be adversely impacted by low density, leading to increased depredation on domestic stock. This inevitably results in conflicts with resident herders (Oli *et al.* 1994, Mishra 1997, Jackson 2000, Bhatnagar and Wangchuk 2001).

While a limited number of studies have yielded modest information on the snow leopard ecology (Chundawat 1992, Jackson 1996, McCarthy 2000), even less information on population status across the range is available. The population and range figures above are largely educated guesses, however, snow leopards most certainly occur in small and isolated populations, thus increasing the threat of the extinction (Jackson and Ahlborn 1990). Information on population status and structure is however very important to determine viability of populations. The reason for the lack of information on populations of snow leopard is because of the elusive nature of the species and the harsh habitat that it occupies. Snow leopards tend to move, bed and mark along linear geographical features such as crests, major ridgelines, at the base of cliffs and in gullies. Monitoring for signs along these features is the best possible way at present of estimating snow leopard population trends in an area (Jackson and Hunter 1996). This practice is however not in wide use at present. Use of genetic tools and camera trapping are other viable alternatives for gathering information on snow leopard abundance but are expensive.

The fact that the snow leopards have a wide distribution in the Trans-Himalaya and that they are the apex predator in most of this region enables the species to be used as a 'flagship species' and an 'umbrella species' to guide conservation efforts in the region, as was recognized by the Government of India in the 1980's (Anon. 1988). In this paper we reckon that all conservation activities directed at snow leopards would benefit the ecosystem, and any conservation activity in the region including livelihood support to the local communities will also benefit the snow leopard directly or indirectly.

Although snow leopards are present on the southern slopes of the Greater Himalaya bulk, of their range in India falls in the Trans-Himalayan region and thus this region forms the primary focus of this paper.

## **EXISTING CONSERVATION SCENARIO IN THE HIMALAYA - WILDLIFE PROTECTED AREAS IN THE REGION**

Keeping our focus on snow leopard conservation, we mention here PAs in the Himalaya and the Trans-Himalaya. However, realizing that relatively small area in the Himalaya would qualify as snow leopard habitat, the discussion in the subsequent sections primarily deals with the Trans-Himalayan region.

Reliable information regarding the presence of snow leopard is absent for most PAs in the Indian Himalaya. Based on information that we have gleaned from literature and our own studies, there are 25 PAs within India that have potential for snow leopard occurrence (Mallon 1987, Anon. 1988, Fox *et al.* 1988, Bhatnagar 1997). Of these, two are National Parks (NP) and three are Wildlife Sanctuaries (WLS) in the Trans-

Himalaya, together constituting *ca.* 15,000 km<sup>2</sup> or 8.2 % of the Trans-Himalayan zone in India (Table 1, Fig 1 a, b). There are nine NPs and 11 WLS in the Greater Himalayan zone with a coverage of a further *ca.* 15,000 km<sup>2</sup> (7.6 % of the zone 02) that may have snow leopards. Most of the PAs in the Greater Himalaya have very small portions in snow leopard habitat and the extent of such areas is not yet documented. Further, in at least three NPs and five WLS of this region with an area of 6,600 km<sup>2</sup>, the presence of snow leopard is very doubtful. (Table 1).

**Table 1: Protected Areas in the Trans-Himalaya and the Himalaya within India with potential for snow leopard occurrence. Figures in parenthesis are % of the PA category in the biogeographic zone. Total land area in the Trans-Himalaya is ca. 1,84,900 km<sup>2</sup> and in the Greater Himalaya is ca. 2,10,600 km<sup>2</sup>.**

Sr. No.	PA Name*	Biogeog. Zone (Rodgers <i>et al.</i> 2000) & State*	Area (km <sup>2</sup> )*	Remarks
<b>Trans-Himalaya</b>				
1	Hemis NP	1A, Jammu & Kashmir (J&K)	4100	
2	Pin Valley NP	1A, Himachal Pradesh (HP)	675	
	<b>Total</b>		<b>4,775, (2.6%)</b>	
3	Karakorum WLS	1A, J&K	5000	Boundaries not well demarcated
4	Changthang WLS	1B, J&K	4000	Small portion of PA is snow leopard habitat
5	Kibber WLS	1B, HP	1401	
	<b>Total</b>		<b>10,401, (5.6%)</b>	
<b>Grand total for Trans-Himalaya</b>			<b>15,176, (8.2%)</b>	
<b>Greater Himalaya</b>				
6	Gangotri NP	2B, Uttaranchal (UT)	2390	Small portion of PA is snow leopard habitat
7	Kanchendzonga NP	1B, 2C, Sikkim	1784	
8	Great Himalayan NP	2A, HP	754	Small portion of PA is snow leopard habitat
9	Nanda Devi NP	2B, UT	630	
10	Govind NP	2B, UT	472	
11	Kisthwar NP	2A, J&K	400	
12	Dachigam NP	2A, J&K	141	?
13	Valley of Flowers NP	2B, UT	88	?
14	Namdapha NP	2D, Arunachal Pradesh (AP)	1985	?
	<b>Total</b>		<b>8,644, (4.1%)</b>	
15	Kedarnath WLS	2B, UT	957	Small portion of PA is snow leopard habitat
16	Sangla WLS	2B, HP	650	
17	Askot WLS	2B, UT	600	Small portion of PA is snow leopard habitat
18	Govind Pashu Vihar WLS	2B, UT	481	Small portion of PA is snow leopard habitat
19	Rupi-Bhaba WLS	2A, HP	125	
20	Lipa-Asrang WLS	2A, HP	31	
21	Dibang WLS	2D, AP	4149	?
22	Sechu Tuan Nala WLS	2A, HP	103	?
23	Sainj WLS	2A, HP	90	?
24	Kanawar WLS	2A, HP	54	?
25	Manali WLS	2A, HP	32	?
	<b>Total</b>		<b>7,272, (3.5%)</b>	
<b>Grand total for Greater Himalaya</b>			<b>15,916, (7.6%)</b>	

\* Information based on Rodgers *et al.* (2000)

? Snow leopard presence doubtful

It is evident from Table 1 that 17 of the 25 PAs (68%) with a potential for snow leopards are smaller than 1000 km<sup>2</sup>, with five of them being smaller than 100 km<sup>2</sup>. There are a further three PAs in the 1001 to 2000 km<sup>2</sup>, two in the 2001 to 4000 km<sup>2</sup>, and three in the > 4000 km<sup>2</sup> range. In areas where PAs are habitat 'islands' the smaller PAs, especially those smaller than 100km<sup>2</sup>, have little potential for long-term maintenance of viable snow leopard populations (Jackson and Ahlborn 1990). Even within the larger PAs there are numerous limitations at present. From Table 1 and Fig 1, it is apparent that the PA network in the Trans-Himalayan and the Greater Himalayan zones though comparatively large in extent, is not really representative. Also, it is evident that the region has some of the largest PAs in the country (Rodgers *et al.* 2000). However, the following facts need to be critically examined:

1. Some PAs such as the Karakorum WLS are large, but have unclear boundary demarcation. There are over 15 towns and villages and numerous military establishments within the area. The human population in the region is over 10,000 (Anon. 1998a). There is also a great amount of military activity and vehicular traffic in the area, and all these factors render the area barely qualified as a wildlife sanctuary. This, and other similar areas, however, inflate the proportion of area under PA network in the zone.
2. Most PAs have up to 50% of their area under permanent ice or glaciers, sheer and large rock faces, most of which have little wildlife values, thus further inflating the size, but not contributing to the wildlife values directly.
3. There are no Reserve Forests in the Trans-Himalaya that usually buffer disturbances in most wildlife PAs elsewhere in the country. Hence it is only the PAs in the Trans-Himalayan areas that have any legal status for the conservation of the native biodiversity.

### **CONSERVATION ISSUES IN THE TRANS-HIMALAYA**

A variety of physical, biotic and political characteristics of the Trans-Himalaya influence conservation issues that are peculiar to the region. Chief among the challenges is the limited resources available to the native population of the region. These populations which mostly occur at low to moderate densities of <2 persons per km<sup>2</sup>, are primarily agro-pastoral, or, as in the Tibetan Plateau zone, are largely nomadic pastoralists. Human populations are increasing in the region with the breakup of the traditional polyandrous system and with fewer people opting for becoming celibate monks and nuns (Anon. 1998a, Mishra 2000). An important factor that needs to be considered is that in the harsh Trans-Himalayan landscape there is hardly any area that is not already in use by people at some time or the other during the year. Arable land is mostly limited to alluvial fans, and some stable areas in the valley bottoms. Almost all the available arable land is already under cultivation and all pastures are grazed by the domestic stocks at least seasonally. Addition of newer areas under some poverty alleviation schemes incorporate development of expensive and long flow irrigation systems. Our observations show that these most frequently end up as failures since most of such channels are damaged by avalanches or are washed away by floods or simply break up due to the unstable substrate. National parks and sanctuaries in India do not permit consumptive use and require resettlement of people outside such areas (Anon. 1992). The point that we are driving at is that the Trans-Himalayan region offers no or very few alternatives for resettlement of people outside PAs. The region has other peculiarities such as very poor road access, power supply, and difficult

communication, apart from a harsh climate during much of the year. These features of the region thus do not allow scope for conventional industrial development and employment in the region, as is possible in other regions of the country.

A very important characteristic of the Trans-Himalayan area is that it provides almost continuous wildlife habitat (Fox *et al.* 1991, Chundawat and Qureshi 1999, Bhatnagar and Wangchuk 2001). Most of the region has large mammals, including the snow leopard and wolf, but the densities may vary greatly from very poor areas to small pockets that may be rich in some large mammals. This means that a large amount of wildlife may actually be occurring outside existing PAs. In Nepal, for example, over 60% of the snow leopards are thought to occur outside PAs. In India, our coarse estimate is that of the probable maximum of 600 snow leopards in India (Fox 1994), *ca.* 80% may be occurring outside PAs. Among other endangered wildlife species such as the Tibetan antelope, Tibetan gazelle, Tibetan argali, brown bear, and kiang, substantial populations occur outside existing PAs (Chundawat and Qureshi 1999, Bhatnagar and Wangchuk 2001). Mishra, *in prep.* has found that in Spiti, the Tabo area that is not within any PA has bharal densities that are higher than the Kibber Wildlife Sanctuary. Shah (1996) has found remnant populations of the highly endangered Tibetan gazelle and argali in unprotected areas in northern Sikkim. In such a scenario we need to reconsider the approach of having large national parks and wildlife sanctuaries as 'inviolable areas' in the region. The problem is further compounded as none of the PAs have management plans that provide a clear vision for wildlife conservation.

Conservation issues common to the area primarily relate to deficiencies of infrastructure and staff for PA management, grazing competition between wild and domestic herbivores, conflicts relating to damage to crops and livestock by wildlife, some levels of poaching of snow leopard and prey species, wildlife diseases and political issues. These issues were also flagged as the most important ones in a meeting between scientists and managers at Leh (Mathur 2001). We now examine these issues in some detail:

### **Infrastructure and staff for PA management**

In the harsh environs of the region, there is a severe shortage of staff, effective infrastructure and funds for the management of the PAs. For example Ladakh has *ca.* 13,100 km<sup>2</sup> under its PA network with a total park staff of merely about 20. This translates to 655 km<sup>2</sup> to every park staff - a completely ineffective strength to manage the region under any circumstance, but especially so under the difficult climatic and topographic conditions in the Trans-Himalaya. The numerous existing tasks of the Wildlife Department range from protection, tourism management, verification of compensation claims to nature education activities in the PAs spread all over the *ca.* 45,000 km<sup>2</sup> Ladakh region. We also understand that most park staff lack the necessary clothing, equipment and housing necessary for effective work in the region. It is an urgent requirement for the Centre and State Governments to provision the necessary resources to these areas for effective conservation in the region. An effective means of doing this could be through revival of the 'Snow Leopard Scheme' of the Govt. of India (Anon. 1988).

## **Grazing Competition Between Wild and Domestic Herbivores**

The bulk of the region has dependence on livestock. While some of the people are agro-pastoralists, many are entirely pastoral. Estimates range from 10 to a few hundred livestock heads per household in the region (Mishra 1997, Richard 1999, Bhatnagar and Wangchuk 2001). Livestock population in the Indian Trans-Himalaya has been growing continuously in the past decades, as evidenced by data available from Ladakh, where the livestock population has almost doubled between 1972 and 1992 (Anon. 1998a, Bhatnagar and Wangchuk 2001). Even though conclusive information on habitat degradation, and direct competition between domestic and wild herbivores from the region has just started coming (Mishra *in prep.*), it is evident from some preliminary studies that the present livestock grazing levels in areas such as eastern Ladakh and Spiti may already be unsustainable (Bhatnagar and Wangchuk 2001, Mishra *in prep.*). The potential impacts of excessive grazing by livestock include depletion of the scarce forage for wildlife, habitat degradation, disease transfer, and reduction in the breeding performance of both wildlife and domestic stock (Mishra *in prep.*).

Conclusive studies to ascertain impacts of livestock grazing need to be taken up at many sites. There is also an urgent need to see how the pastoral and agro-pastoral communities of the region can be drawn into a trade-off that reduces their dependence on large livestock holdings, while at the same time helps in improving their standard of living. An example for such an effort was made by the Nature Conservation Foundation, Mysore, and details are given in Box 1.

### ***Box 1***

#### ***Kibber Grazing Reserve***

The Nature Conservation Foundation, a science and conservation organization based in Mysore, signed a written agreement with the village council of Kibber in Spiti two years ago, where both these institutions resolved to protect a 5 sq. km area completely for wildlife. The rangeland area has been traditionally used for livestock grazing and collection of fuel, and medicinal plants. Two years of protection is already showing signs of wildlife recovery, as indicated by the increased use of the area by bharal. The compensation costs for lost grazing are being met with by the Van Tienhoven Foundation in the Netherlands, and the project is being implemented voluntarily by scientists associated with the Nature Conservation Foundation and the Wageningen University. The International Snow Leopard Trust has recently joined hands with the initiative, and these institutions are working together towards off-setting the costs that the local people are bearing for living with wildlife (through programs in conservation education, supporting self managed insurance schemes, value addition to local handicrafts), and towards enabling the local people to benefit from the wildlife they share their resources with (wildlife tourism).

## **Conflicts Relating to Damage of Crops and Pastures by Wild Herbivores**

The Jammu and Kashmir Dept. of Wildlife Protection staff in Leh has been receiving compensation claims for damage to crops by species such as bharal and urial. The extent of such damage is not yet clear, but there is an increasing trend in such claims. There is a need to have a better record of conflict cases. 'Hotspots' of such conflict

zones should be clearly identified and if any are found, participatory exercises should be taken up to minimize the losses.

In a surprising development some nomads and state Govt. officials claim that the kiang are now damaging the winter pastures of the valuable *pashmina* or Cashmere goats in Changthang (Fox *et al.* 1991, Richard 1999, Bhatnagar and Wangchuk 2001). It has been argued that such claims are largely baseless and are probably a result of reduced tolerance levels among the people in recent times (Richard 1999, Bhatnagar and Wangchuk 2001).

### **Livestock Depredation by Wild Carnivores**

Livestock depredation seems to be a serious conservation issue in the Trans-Himalayan region. As indicated earlier, livestock rearing at present forms an important part of the local economy and any loss to livestock results in a direct monetary loss to the local herders. Park staff in Ladakh report that often up to 60% of their annual outlay goes in meeting the livestock depredation compensation claims filed by people (Rauf Zargar, Wildlife Warden, Leh, Pers. Comm.). Damage to livestock takes place in the pastures as well as in the night time corrals. In India's Trans-Himalayan zone only three studies have as yet quantified the extent of livestock damage due to depredation by wild carnivores. These studies are by Mishra (1997) from Spiti, Bhatnagar *et al.* (1999) from the Hemis NP, Ladakh and by Jayapal (2001) from Zaskar, Ladakh. The damage to livestock in many of these areas is quite high and in some villages up to 14 animals per household have been lost in an year. The monetary loss to households in the Hemis NP averaged *ca.* Rs. 12,000/- during 1996-97 (Bhatnagar *et al.* 1999). This study also showed that over 40% of the losses were taking place in the corrals, an aspect that can be dealt with more easily than the damage in pastures. Small and effective means of alleviating these conflicts have been developed in Hemis NP, which have potential for replication elsewhere (See Appendix 2).

### **Integration of Efforts by Different Government Departments and Non-Government Organizations**

Owing to the remoteness of the Trans-Himalayan region, the state governments have resorted to a system of governance that is called 'Single Line Administration'. Under this system, the district head, the District Commissioner (DC) or the Additional District Commissioner (ADC) becomes the head of all Government Departments working in the region. In addition, the Ladakh region, that constitutes bulk of the Trans-Himalayan region in India, has a Ladakh Autonomous Hill Development Council (LAHDC), a form of local Government.

In consultation with the Wildlife Department in Ladakh, it was apparent that inter-agency cooperation and coordination in the region is lacking, leading to inefficient functioning by the wildlife department (Mathur 2001). Examples of major developmental activities being undertaken inside wildlife PAs were cited as cases when the Wildlife Department had to stop such activities when they were well underway. This earned the ire of the local people as well as the respective Government Departments undertaking the work. For these reasons, we feel that the 'Single Line Administration' would facilitate coordination between departments more effectively, specially if there are relevant policies and practices in place that make it imperative on

the respective DCs or ADCs to keep wildlife conservation interest in mind before approval of any development schemes.

The Ladakh region has an added advantage of the existence of numerous non-government organizations (NGOs), many of which have a good reputation of grassroots work in the fields of alternative sources of energy, organic agriculture, and education. This is a resource that should be effectively tapped for conservation related work.

### **Political Issues**

The entire Trans-Himalayan region has international borders. Ladakh has a large and hostile border along the west and northwest with Pakistan held Kashmir called the Line of Control (LoC). On the north and east is the international border and the Line of Actual Control (LAC) with China. Himachal Pradesh and Sikkim also share borders with China. Numerous stretches along these borders are disputed territory. Species such as the Tibetan antelope, argali, kiang and Tibetan gazelle occur at numerous places along and across the border with China (Fox *et al.* 1991, Shah 1996, Chundawat and Qureshi 1999, Bhatnagar and Wangchuk 2001). Good snow leopard, ibex and urial habitat occurs along the LoC. Often due to the sensitive nature of the region the Wildlife Departments have little control over the region. There is heavy presence of defence forces on both sides and wildlife of the region might also be a casualty to the frequent skirmishes. The problem is compounded when these may be the only places within the country where a species occurs. Trans-border conservation of these species is thus of high priority.

As mentioned above, the region has three different state legislations. Jammu and Kashmir has a separate Wildlife Protection Act, which places endangered species such as the Tibetan antelope and brown bear under Schedule II, for which hunting licenses may be given. The entire region spreads across three states and inter-state collaboration in conservation efforts though difficult, is nevertheless necessary. A point to note here is that trade in certain wildlife products is not yet banned in the state of Jammu and Kashmir.

What we want to stress here is that the political dimension is important to consider while planning any large-scale conservation effort in the Trans-Himalayan region.

### **Poaching of Snow Leopard and Prey Species**

Sport hunting was quite widespread during the British period in the Trans-Himalaya (Stockley 1928, Ranjitsinh 1981). Even after independence the trend continued till the early 1980's when the defence forces, Government officials and others were known to hunt in various parts of the Trans-Himalaya, especially in Ladakh. This had decimated the populations of numerous species in the region (Ranjitsinh 1981, Fox *et al.* 1991). Recently, however, there is evidence of a decline in hunting in many parts of the Trans-Himalaya, with the revival of some wildlife populations in the region such the Ladakh urial (Chundawat and Qureshi 1999).

Buddhism is the dominant religion in most of the Trans-Himalayan region in India and hunting is generally not practiced, unless it is in retaliation to some damage to their property. However, in western Ladakh and in Lahul, hunting might still be an issue.

Again, little information exists on the extent of poaching going on in the region. Some illegal trade in wildlife products, including snow leopard parts and *shahtoosh*, may be occurring in the region (Wright and Kumar 1997). We understand from the Wildlife Department in Leh that no license has been issued since the mid-1980's. Until trends in poaching and wildlife trade in the region are better documented and understood suitable measures cannot be devised and undertaken to minimize the problem.

### **Wildlife Diseases**

Wildlife disease can be damaging and may even lead to the extinction of small populations. This is particularly true for small, isolated populations of the Tibetan gazelle in Ladakh, and snow leopard in parts of the Trans-Himalaya. Information on wildlife disease from the region is, however, completely absent and there is an urgent need to generate such information.

### **The Way Forward**

Some measures that could be undertaken in the region to aid conservation have already been discussed above in the section dealing with conservation issues in the Trans-Himalaya. What we give below is an indicative way of planning wildlife conservation in the region as a whole. We understand that these ideas will have to be fine tuned through wider stakeholder consultations. What we have tried to argue so far is that:

- Most of the large mammals in the Trans-Himalaya, need large areas given the sparse resources, and seasonal movements.
- Even though we have some large PAs in the Trans-Himalaya at present, the effective areas important for wildlife within them are usually small. Some of them may not even qualify as a PA.
- For existing PAs an effective vision for management is mostly absent.
- PAs usually form an important resource for native people, for whom few alternative livelihood options are available. Traditional concept of large inviolate PAs is not practical in the region.
- Most wildlife in the region is usually outside the existing PAs and simply adding more areas under the PA network may not be a viable solution.

Based on the conservation issues presented above, and the almost continuous wildlife distribution in the region, we feel that snow leopard conservation in the Trans-Himalaya has to be planned with a regional perspective, in which the native people are taken as an integral part of the conservation efforts. Having large inviolate national parks and sanctuaries does not seem viable in the region. The shift of focus for conservation in private lands is a need recognized by conservationists worldwide (Knight 1999, Norton, 2000). Using this line of thinking we feel that continuing with the existing scheme of PAs may not work in the Trans-Himalayas and we now need an alternate paradigm for wildlife conservation in the region. One of the ways of moving ahead is to carefully work on the zonation of existing PAs and of the larger Trans-Himalayan landscape in general.

### **An Alternate Zonation Concept**

#### **Zonation Within Existing PAs**

PAs in India have zones of varying landuse, such as a core zone, which is inviolate, and a buffer zone that may have multiple-use (Anon. 1992, Sawarkar 1995). The latter zone

further may have areas earmarked for forestry operations, tourism and other consumptive uses. Our information suggests that none of the existing PAs in the Trans-Himalaya have cores and buffers delineated. The NPs are essentially 'core zones' in their entirety. With the enhancement in the legal status of the WLS following the 1991 amendment of the Wildlife (Protection) Act, 1972, the entire area of approximately 15,000 km<sup>2</sup> mentioned in Table 1 has technically become a 'core zone'. Continuing with this practice, as we have already seen, is not pragmatic. We thus suggest that for the existing five PAs in the Trans-Himalaya we change the management zonation approach by carefully delineating core zones in a mosaic, with a buffer area all around. The difference from the existing scheme, primarily is that we do not take impractically large areas of a few thousand km<sup>2</sup> as inviolate core zones.

The steps to be followed may be as follows:

- Carefully survey all PAs to determine areas that have high wildlife value, either in terms of presence of an endangered species such as snow leopard, Tibetan gazelle or argali, or in the presence of a large diversity of large mammals. The latter might be one valley that has say species such as snow leopard, wolf, Tibetan argali, bharal, Tibetan gazelle, and kiang.
- Designate such area as a core zone using a participatory approach (see also Box 1).
- Have at least one such area for every 100 km<sup>2</sup> of the PA, although a more sound basis based on species movements may need to be developed.
- The peoples rights may need to be settled using innovative schemes such as those outlined in Box 1 and in the section on conservation efforts below.
- The buffer zones would be all the remaining area in the PA where traditional use may continue. Attempts would however, be made to minimize the negative impacts of human use.
- Focused studies that help in determining suitable levels of use need to be encouraged.

### **In Areas of the Trans-Himalaya Outside Existing PAs**

As mentioned earlier, most of the Trans-Himalaya constitute wildlife habitat and there are cases where either an endangered species may be occurring in unprotected areas or such areas may be having higher wildlife densities. In the alternate approach, we suggest further four landuse zones, which have subtle differences in their management objectives. The first zone is the 'Conservation Zone' which is a small, carefully researched and selected area preferably measuring more than 10 km<sup>2</sup>, and where ever possible, up to 100 km<sup>2</sup>, where the local people agree to give up their rights in exchange of some development schemes (Box 1). These are then surrounded by 'Alternate Livelihood Zone' where the various Government departments' work together to limit livestock numbers and dependence on natural resources. This zone also can have agriculture based and other non-polluting industries. The third zone can be 'Urban Zone', which includes areas that have lost all value for maintenance of wildlife. The fourth zone can be 'Limited Value Zone' which includes unusable areas under permanent ice and large rock faces.

These zones would go a long way in addressing the issue of conservation and development using a regional perspective.

## **Areas with Information Gaps and Indicative Actions**

### **Additional Livelihood Options**

At present, we have the options of cash crops such as green peas and potato that can be marketed as fresh vegetables in markets in the plains and locally. To minimize the loss through decay during transportation to markets, part of the produce could be processed locally into processed food products or health food. Another industry suggested is electronic industry that is usually less polluting to the environment. The region needs better schools and colleges and has potential for establishment of national level educational institutions. For all these activities, enhancement of the present infrastructure is extremely important. Ladakh already attracts large number of international and domestic tourists. The benefits from tourism are however largely limited to a very small population within Ladakh. There is tremendous potential for development of ecotourism schemes in the region that would enable tourism to take place in a sustainable manner and with substantial benefits reaching local residents. The potential for the development of nature tourism and handicraft based industry should thus be explored as a means of alternative livelihoods. This however, should not be developed as the only means of sustenance of families.

Some highly innovative nature tourism schemes are being developed for Ladakh by organizations such as the Snow Leopard Conservancy, The Mountain Institute along with local organizations such as Ladakh Ecological Development Group (Jackson, Rodney and Jain Nandita, pers. comm.).

### **More Effort Needs to be Devoted to Establish Optimal Stocking Densities for Livestock in Different Parts of the Range**

Grazing competition between livestock and wild herbivores seems to be a significant conservation issue. However, quantitative information on impacts of this is grossly lacking from the region. The studies should also try to determine stocking densities that enable wildlife to exist at levels that allow them to breed and sustain a healthy population. These studies will be crucial for recommendations for the permitted grazing in the multiple-use areas.

### **Levels of Perceived and Actual Conflict Between Wildlife and People Need to be Established**

Data on actual levels of conflicts, the wildlife species involved and conflict 'hotspots' is often lacking from the region. For designing any conflict resolution scheme, such data is of immense importance. With such information, mitigation measures such as corral improvement, in small, but effective ways should then be taken up to resolve the issues (See also Appendix 2). Innovative livestock insurance schemes are also an important possibility. These can be taken up in conjunction with programmes that help in actual reduction of the damage. One such scheme has been designed in Baltistan where the community managed insurance funds are complemented by money generated through wildlife tourism (Hussain 2000). Resolving conflicts effectively will have a two pronged benefit. One is that the monetary loss to the local herders will be reduced and second is that they will be more sensitive to conservation efforts.

## **Conservation Awareness Initiatives**

Conservation awareness initiatives that illustrate the peculiarities and fragility of the local environment need to be taken up for the local people, tourists and importantly, the district Government officials and politicians. For the latter these may be in the form of relevant directions from various Central Ministries for keeping wildlife conservation perspective in view when developing conservation schemes.

## **Proactive Policies and Guidelines from the Wildlife Department**

The Wildlife Department, in collaboration with scientific organizations needs to develop Management Plans for the existing PAs with relevant zonations in place. All other potential areas that could serve as the revised 'Core Zones' need to be surveyed immediately. Issues relating to infrastructure need to be addressed to the Ministry of Environment and Forests. The revival and redrafting of the 'Snow Leopard Scheme' (Anon. 1988) could be an ideal opportunity to bring in the suggested changes in the conservation of the region.

The Wildlife Institute of India, Dehradun, along with its partners, the International Snow Leopard Trust and the US Fish and Wildlife Service have already undertaken a step in the direction of generating information on the gap areas and also conservation efforts that enable better trained staff with sound management plans in place. The programme also intends to try and influence policy for conservation in the region (Anon. 2001).

## **Conclusions**

The above mentioned approach of reconciling conservation concerns with development planning would lead to improved standards of living through increased employment, better education, increased agricultural returns, increased value for livestock products, increased ecotourism and wildlife viewing. Use of conflict alleviation measures would provide suitable alternatives to people and enable them to give up the 'core areas'. This would also reduce livestock grazing pressures in some areas; reduce human-wildlife conflicts, and lead to the revival of wildlife in most areas in a manner that is more acceptable to the local people, politicians and conservationists alike. Undoubtedly, a regional perspective for conservation and development cannot be developed overnight. What is however needed is a beginning of planning, integrating and implementing of a wide array of conservation measures, based on an understanding of the ecology, environment and developmental needs of the Indian Trans-Himalaya, which is a vast landscape with unique biodiversity.

It would also be essential to revive the 'Project Snow Leopard' to deal with the regional planning issue by evolving a framework for conservation and development in a participatory manner. The urgency of reviving the 'Project Snow Leopard' cannot be overemphasized given the conservation challenges facing the vast Trans-Himalayan landscape and the crisis for survival of snow leopard – the flagship species of the region.

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**Large mammals of the Indian Trans-Himalaya along with their legal conservation status**

Species	Scientific Name	Indian Wildlife Protection Act 1972	IUCN Category (CAMP Workshop – Anon 1998b)
<i>Ungulates</i>			
Siberian ibex	<i>Capra ibex sibirica</i>	I	<i>Vulnerable</i>
Tibetan argali	<i>Ovis ammon hodgsoni</i>	I	Critical
Ladakh urial	<i>Ovis orientalis vignii</i>	I	Endangered
Bharal	<i>Pseudois nayaur</i>	I	Low Risk
Tibetan antelope	<i>Pantholops hodgsoni</i>	I	Critical
Tibetan gazelle	<i>Procapra picticaudata</i>	I	Critical
Tibetan wild ass	<i>Equus kiang</i>	I	Vulnerable
Wild yak	<i>Bos grunniens</i>	I	Critical
Large carnivores			
Snow leopard	<i>Uncia uncia</i>	I	Endangered
Lynx	<i>Lynx isabellina</i>	I	?
Tibetan wolf	<i>Canis lupus chanko</i>	I	Vulnerable
Wild dog	<i>Cuon alpinus</i>	?	Critical
Red fox	<i>Vulpus vulpus</i>	?	Low Risk
Brown bear	<i>Ursus arctos</i>	I	Low Risk

### **An example of participatory efforts in managing livestock depredation related conflicts. Corral improvement work in Hemis NP by the International Snow Leopard Trust and local agencies.**

**Snow Leopards, Local People and Livestock Losses: *Finding Solutions using Appreciative Participatory Planning and Action (APPA) in the Markha Valley of Hemis National Park, Ladakh***  
(October 6-26, 1999)

Sponsored by: International Snow Leopard Trust in collaboration with  
LEDeG (Ladakh Ecological Development Group) and The Mountain Institute  
Funded by: IFAW, Natural Partnerships Program and A Private Donor

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An effort was made by ISLT and collaborative agencies to resolve depredation related conflicts in the Hemis NP, Ladakh. This was done in a step-wise manner where first a survey was conducted covering most of the villages in the NP to gather information on depredation trends, hotspots and circumstances of the depredation cases. Once the hotspots were identified preliminary consultations with the villagers for joint work to alleviate their problem were held. This was followed by a workshop that helped in designing a work plan for carrying out the activities. Once this process was completed the program is being monitored by the villagers and agencies such as the Snow Leopard Conservancy. The following text is largely excerpted from the Executive Summary of the Workshop Report prepared by Dr. Rodney Jackson:

Livestock depredation is emerging as a significant issue across the Himalaya, including Hemis National Park (HNP) in Ladakh. Some consider that this protected area harbors the best snow leopard population in India, but local herders perceive the endangered snow leopard as a serious threat to their livelihood. A survey sponsored by the International Snow Leopard Trust (ISLT, Bhatnagar *et al.* 2000) found high rates of livestock depredation by snow leopard and wolf and crop damage from blue sheep and in nearly all of the 15 settlements of HNP. Interviews with village leaders, farmers and herders representing 79 households indicated that a total of 492 animals (with a market-value estimated at Rs.10 lakh or US\$ 23,250) were killed by predators between January 1998 and March 1999. The worst case involved a snow leopard that entered a night-time village corral and then killed 53 sheep and goats belonging to a single household. In 1996, the Ladakh Wildlife Department initiated a compensation program, but by late 1997 the number of claims filed exceeded the budget allocated and the Department was forced to suspend the program. Consequently, relations between wildlife officials and local people have also suffered, making management of this important protected area more difficult.

A People-Wildlife Planning Workshop was convened in Leh and the Markha valley of Hemis National Park in an attempt to seek alternative solutions to this vexing problem. Sponsored by ISLT, and with the collaboration of the Ladakh Ecological Development

Group (LEDeG), the objectives of the workshop were to: (1) Prepare an Action Plan assisting villagers and the local protected area authority (Jammu & Kashmir Wildlife Department) to identify cost-effective, sustainable and ecologically compatible means for reducing livestock losses especially from snow leopard; (2) Train representatives from local NGOs, Wildlife Department and villagers in APPA (Appreciative Participatory Planning and Action) techniques pertaining to applied People-Wildlife management; and (3) Increase understanding and awareness about people-wildlife relationships, in particular the importance of conserving snow leopards, their prey and habitat.

The 3-day introductory workshop session in Leh was attended by 26 representatives from NGOs, government and the general public. It highlighted the need to increase public awareness of snow leopard conservation and the importance of Hemis National Park as a significant repository of high-altitude trans-Himalayan biodiversity.

Participants developed an Action Plan, using a special food-web poster and game, for implementation over the next year in local schools and villages by LEDeG, SECMOL, and Leh Nutrition Project (LNP) with ISLT providing training and materials.

#### **The APPA approach**

The Mountain Institute provided workshop facilitation, using a highly participatory planning process known as Appreciative Participatory Planning and Action (APPA) which draws upon traditional Participatory Rural Appraisal (PRA) tools. APPA operates under the premise that the best results occur when local communities take a leadership role, focus on their opportunities rather than problems, and build on past successes. It is practiced through a four-step iterative process (4-D's) which seeks to build consensus through (1) discovering the community's strengths and valued resources (Discovery); (2) envisioning short-term and long-term development scenarios if feasible resources were suitably mobilized and the community acted in concert (Dream); (3) designing an action plan for guiding change in ways that emphasize what the community can accomplish on its own while diminishing long-term dependence on outside financial and technical resources (Design); and (4) spurring participants to begin realistic community-improvement actions immediately, rather than waiting for external agents to act (Delivery).

This was followed by a 14 day session in Markha village, a hamlet of 26 households located in prime snow leopard habitat in Hemis National Park. It was attended by 14 persons (including resource specialists) from LEDeG, Leh Nutrition Project, Sheep Husbandry Department, J&K Wildlife Department, Autonomous Hill Council, WWF-India, a University, The Mountain Institute (Nepal and Sikkim) and the International Snow Leopard Trust (India and USA).

Workshop participants were trained in each technique after which villagers participated in the sequential series of planning exercises, including resource mapping, seasonal agricultural activities, trend-lines, the delineation of depredation 'hotspots' and ranking of pastures, sources of livestock mortality, indigenous livestock guarding methods and 'good shepherding practices', income sources and opportunities, and the nature of existing village institutions. These activities indicated that greatest loss resulted from snow leopards killing livestock in the night-time corrals located in Markha's winter pastures, and that the problem could be largely or entirely avoided by ensuring all corrals were predator-proof.

Using similar participatory tools, workshop participants and villagers then spent several days discussing, designing and refining a set of remedial measures to reduce depredation losses which (1) met the funding conditions set by the donor (ISLT) and (2) achieved high design standards mutually agreeable to all parties, including the

experts attending the workshop. To receive donor support, the solution had to benefit both snow leopards and humans, involve a significant contribution (such as labor or materials) from the community, benefit all households, be monitored to ensure proper implementation, and have a designated party be responsible for maintaining any infrastructure improvement. The preferred solution had to comply with the park's regulations, be ecologically sound, socially responsible and cost-effective.

The participants concluded that the best solution involved the replacement of the four existing corrals with predator-proof structures constructed of stone and mortar with a wire-mesh roof. An Action Plan was prepared listing each of the activities to be undertaken, where, by whom, by when, along with an indicator(s) for measuring the effectiveness of the undertaking. An agreement was drawn up and signed specifying the conditions, roles and responsibilities of the signatory parties, namely ISLT and the leaders for each corral user group. The Markha villagers agreed to provide all labor and on-site materials (stone and mud) required for corral improvement, while ISLT provided off-site materials (wire mesh, roofing poles, doors and related hardware) along with technical assistance and oversight. ISLT also agreed to provide mesh for predator-proofing corral windows in Markha and Chalak, under the stipulation that the owners assume responsibility for strengthening the doors if required to prevent predators from entering the pen. Project activities were implemented in the summer of 2000 under an MOU with the LNP (the most active local NGO in Hemis National Park) and supported by ISLT's staff in India. The Snow Leopard Conservancy is largely continuing the programme & its follow-up.

Workshop participants recommended that the APPA approach be applied in other settlements to reduce people-wildlife conflicts due to crop and livestock damage. Such participatory planning initiatives could be undertaken by a small team of 2-3 trained persons from local NGOs and government line agencies. Participants felt that this approach is especially helpful in strengthening local capacity for planning and development, and in making such interventions more effective, less costly and more sustainable. Finally, it was recommended that a community-based tourism training workshop be held in Ladakh in order to explore options for increasing trekking revenues for local people as a means of helping to offset livestock and crop losses.

## Figures

Fig. 1b. Existing National Parks and Wildlife Sanctuaries in the Snow Leopard Range in the Trans-Himalayan (Province 1A, 1B, and 1 C) and Greater Himalayan (Province 2A to 2D) biogeographic zones of India (Rodgers & Panwar 1988).  
 PAs in Western and Northwestern Himalaya (Jammu and Kashmir, Himachal Pradesh and Uttaranchal)

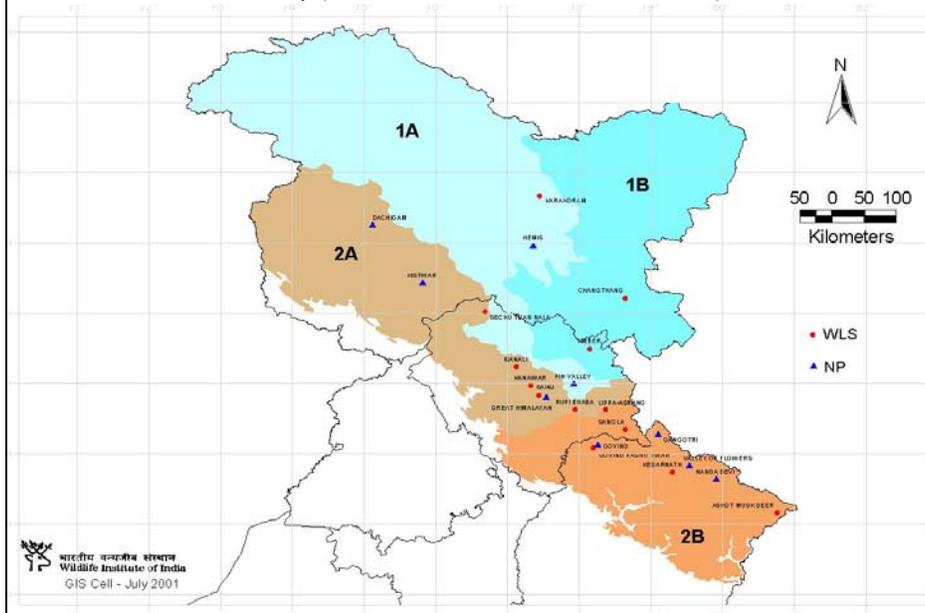


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