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# The Role of Incentive Programs in Conserving the Snow Leopard

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**Abstract:** *Pastoralists and their livestock share much of the habitat of the snow leopard (*Uncia uncia*) across south and central Asia. The levels of livestock predation by the snow leopard and other carnivores are high, and retaliatory killing by the herders is a direct threat to carnivore populations. Depletion of wild prey by poaching and competition from livestock also poses an indirect threat to the region's carnivores. Conservationists working in these underdeveloped areas that face serious economic damage from livestock losses have turned to incentive programs to motivate local communities to protect carnivores. We describe a pilot incentive program in India that aims to offset losses due to livestock predation and to enhance wild prey density by creating livestock-free areas on common land. We also describe how income generation from handicrafts in Mongolia is helping curtail poaching and retaliatory killing of snow leopards. However, initiatives to offset the costs of living with carnivores and to make conservation beneficial to affected people have thus far been small, isolated, and heavily subsidized. Making these initiatives more comprehensive, expanding their coverage, and internalizing their costs are future challenges for the conservation of large carnivores such as the snow leopard.*

El Papel de Programas de Incentivos en la Conservación del *Uncia uncia*

**Resumen:** *Pastores y su ganado comparten gran parte del hábitat del leopardo *Uncia uncia* en el centro y sur de Asia. Los niveles de depredación de ganado por leopardos y otros carnívoros son altos, y la matanza en represalia por pastores es una amenaza directa para las poblaciones de carnívoros. La reducción de presas silvestres por cacería furtiva y la exclusión competitiva por ganado también representa una amenaza indirecta para los carnívoros de la región. Los conservacionistas que trabajan en estas áreas no desarrolladas que enfrentan serios impactos económicos por pérdidas de ganado han impulsado programas de incentivos para motivar a las comunidades locales a que protejan a los carnívoros. Describimos un programa piloto de incentivos en India enfocado a reducir pérdidas debido a la depredación de ganado y a incrementar la densidad de presas silvestres mediante la creación de áreas libres de ganado en tierras comunales. También describimos como la generación de ingresos de artesanías en Mongolia esta ayudando a reducir la cacería furtiva y la matanza en represalia de *Uncia uncia*. Hasta ahora, sin embargo, las iniciativas para compensar los costos de convivir con carnívoros y hacer que la conservación sea benéfica para la gente afectada han sido pequeñas, aisladas y fuertemente subsidiadas. Hacer que estas iniciativas sean más integrales, aumenten su cobertura e internalicen sus costos son retos futuros para la conservación de carnívoros mayores tales como el leopardo *Uncia uncia*.*

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## Introduction

Conserving large-bodied species such as large carnivores and herbivores near human settlements often involves costs to resident peoples. These include financial losses due to crop and property damage by large herbivores, live-stock predation by large carnivores, and injury or even loss of human life caused by wildlife (Oli et al. 1994; Sekhar 1998; Madhusudan & Mishra 2003). It is increasingly clear that to further coexistence in wildlife habitats where local people live and use natural resources, there is a need not only to estimate and offset economic costs but to make wildlife conservation beneficial to people (Prins 1992; Prins et al. 2000). This understanding has come with the realization that centrally administered preservationist programs relying entirely on the use of force to attain conservation goals have limited applicability in wildlife habitats owned or traditionally used by local communities. Unless there are tangible economic returns, local communities are unwilling and often unable to adopt conservation-friendly practices in the course of their production and consumption activities. Incentive programs endeavor to set in place conditions under which local communities will be economically willing and able to conserve nature (McNeely 1988; Western et al. 1994; Emerton 2000). Incentives are generally not based on a direct valuation of a region's biodiversity or natural resources; instead, they focus on practices that favor their conservation (Bromley 1994). We describe two incentive programs that have been developed recently in the snow leopard habitat of India and Mongolia and discuss their roles in wildlife conservation.

The snow leopard (*Uncia uncia*) occurs in the high mountains of south and central Asia, with a confirmed presence spanning 12 countries (Fig. 1). Despite its wide geographical distribution over an area of 2.3 million km<sup>2</sup> (Fox 1994), the species continues to be highly threatened. It is categorized as endangered in the World Conservation Union (IUCN) Red Data Book and is listed in Appendix 1 of the Convention on International Trade in Endangered Species (CITES). Snow leopard habitat is characterized by cold, arid and semiarid shrubland, grassland, or barren areas (Jackson 1996) that have seen little industrial development thus far. Pastoralism and agropastoralism continue to dominate land use in snow leopard range, with 7 of the 12 range countries having more than a quarter of their total land area under permanent pastures (CIA 2002; FAO 2002). Although the human population density within snow leopard habitat is relatively low, at least 10 of the range countries have a growing human population, a substantial proportion of which (>50% on average) is involved in agropastoral activities and lives below national poverty lines (>40%; CIA 2002; FAO 2002).

Traditional and extensive livestock production systems are an important form of land use and means of livelihood in areas within the snow leopard's range. These

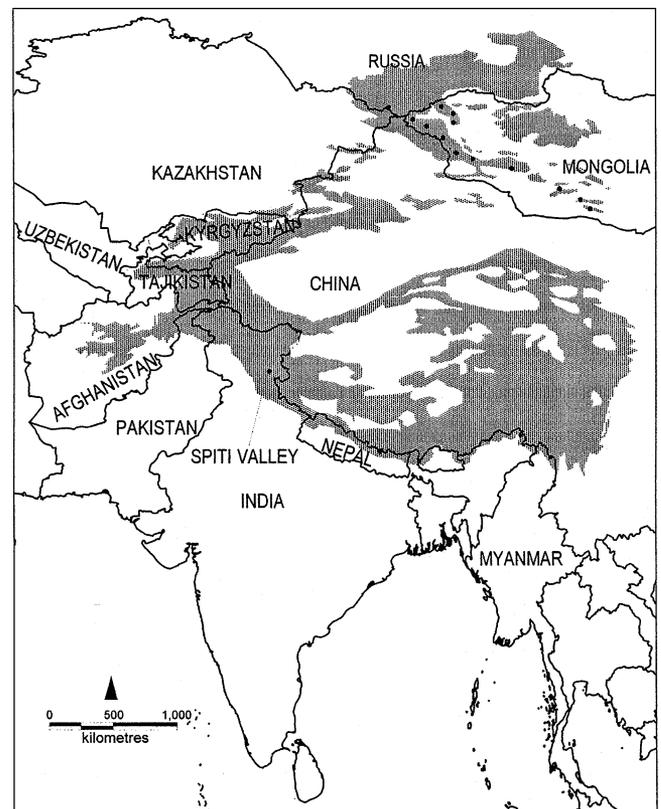


Figure 1. Global distribution (12 countries) of the snow leopard (*Uncia uncia*). Its occurrence in Myanmar is yet to be confirmed. Our conservation program sites are marked with filled circles.

areas are also home to sympatric large carnivores such as the wolf (*Canis lupus*), dhole (*Cuon alpinus*), and lynx (*Lynx lynx*). The levels of livestock predation by the snow leopard and other carnivores are believed to be high. The few studies that have quantified the conflict report average annual losses of up to five livestock heads per family to these predators (Oli et al. 1994; Mishra 1997; Jackson & Wangchuk 2001). This constitutes a significant proportion of the herd in areas where the mean number of livestock per family is small (e.g., 13 livestock heads per family and an annual loss of 12% of the herd; Mishra 1997).

The financial losses are particularly damaging because they occur in regions with underdeveloped economies. They provoke retaliatory persecution of snow leopards and wolves, which remains one of the most widespread and direct threats to the carnivores (McCarthy 2000; Jackson & Wangchuk 2001). Impoverishment of prey populations has long been recognized as a serious indirect threat (Schaller et al. 1988). Hunting for meat is believed to be a widespread cause of prey declines (Schaller et al. 1988; McCarthy 2000). Recent evidence suggests that prey populations can also decline and become extinct due to forage competition with livestock (Mishra 2001; Mishra

et al. 2002). Curtailing retaliatory killing and restoring wild prey populations are perhaps the most important conservation needs of these carnivores today.

## Protecting with People: a Conservation Initiative in India

### Landscape, Ecology, and Society in Spiti Valley

Spiti Valley (lat 31°35'–33°0'N; long 77°37'–78°35'E; Fig. 1) is located in the western Trans-Himalaya in the Indian state of Himachal Pradesh. This high-elevation (3350–6700 m) region is believed to have been inhabited by people for the past three millennia. Spiti's present inhabitants number about 10,000 and are mainly agropastoralists of a Buddhist denomination. Like elsewhere in the Indian Trans-Himalaya, the entire 12,000 km<sup>2</sup> catchment of River Spiti, including two wildlife reserves, is grazed by livestock. The snow leopard and wolf are the large carnivores requiring the most conservation attention in this region. They are also responsible for high levels of livestock predation.

We investigated the relationships between pastoralism and wildlife conservation in Spiti Valley. To understand the severity of livestock grazing as a conservation issue affecting the presence of large carnivores, we evaluated human-wildlife conflicts and forage relations between livestock and wild herbivores. We monitored animal production in two rangelands differing in livestock density over 3 years and found that individual livestock production was negatively correlated with stocking density. Using animal production models, we then estimated the point of resource limitation for herbivores in these rangelands. Our surveys across Spiti's rangelands established that over four-fifths of the rangelands were overstocked, meaning that they were grazed at livestock densities at which livestock production is compromised due to resource limitation (Mishra et al. 2001).

Our studies of large-herbivore diets revealed considerable diet overlap between the principal wild prey species, the bharal (*Pseudois nayaur*), and the seven species of livestock that graze Spiti's rangelands. We also found that, as a consequence of this high diet overlap and resource limitation imposed by livestock, bharal density declined in rangelands with high livestock density as a result of competition, the variation in bharal density being brought about by variation in fecundity and neonate mortality (Mishra 2001; Mishra et al. 2001). Theoretical analyses of body masses of livestock and the Trans-Himalayan wild herbivore assemblage further suggested that a history of intensive and pervasive livestock grazing may already have precipitated the local extinction of many other wild prey species through competitive exclusion (Mishra et al. 2002). Impoverishment of wild prey populations appeared to be the most important threat to

conservation of wild carnivores. We found that a large livestock population (10 times the population of bharal in our study area) relative to wild prey populations and poor antipredatory livestock management were responsible for high levels of livestock predation by snow leopards and wolves (Mishra 1997, 2001).

The value of livestock that families believed they lost to wild carnivores was estimated at half their average annual per capita income. The existing compensation scheme of the wildlife department for livestock lost to carnivores was ineffective as a result of bureaucratic apathy, the time and costs involved in securing compensations, and low compensation rates (estimated to offset only 3% of the total loss; Mishra 1997). Owing perhaps to their Buddhist values, the villagers seemed to persecute carnivores only occasionally, but there was a deep resentment among them against large carnivores and against wildlife managers. We also learned of the occasional poaching of wild prey by army personnel with the complicity of the villagers.

Our research program combined ecological studies with attempts to understand the socioeconomic and political contexts within which these human-wildlife relationships were embedded and within which conservation initiatives would have to be designed and implemented. We conducted interviews and participant observation studies over several years and found that the economy is currently in a state of radical flux. What was, until two decades back, a largely barter-based subsistence economy is rapidly being integrated into mainstream markets and is already a predominantly cash-based economy (Mishra 2000). Over the last 8 years there has been sharp rise in the number of tourists and trekkers visiting the area.

Despite these changes, the people continue to maintain many aspects of the traditional agropastoral lifestyle (Mishra 2001; Mishra et al. 2003). Most important, the traditional social framework for collective decision-making and implementation, the village council, is still robust (Mishra et al. 2003). The council is appointed on rotation, functions democratically, and is responsible for village administration. It is the arbiter of all decision-making pertaining to collective work, settling disputes, ensuring equal access of families to common resources, and equitable distribution of responsibilities among them. Most of the grazing land is communally owned by village councils, many of which have traditionally leased out parts of their distant pastures to nomadic graziers from other parts of the Himalaya. The local livestock is owned by individual families, though they are herded communally (Mishra et al. 2003).

The villagers bear heavy costs related to the presence of large carnivores and derive virtually no benefits from wildlife conservation. Livestock grazing has caused the impoverishment of wild prey populations. The traditional local institutions have retained their ability to evolve and implement collective decisions within villages, indicating

that the necessary conditions for sustainable coexistence between people and wildlife, as set out by Grootenhuis and Prins (2000), have been met. Finally, the villagers had a readiness to explore newer economic options. With this background knowledge, we designed an incentive program at an experimental scale that aims to offset the costs of conservation to local people, to make wildlife conservation beneficial to them, and to extend their limits of tolerance toward wild carnivores. We also sought their commitment in assisting in the recovery of wild prey populations.

### Designing the Incentive Program in Spiti Valley

We developed an incentive program for Kibber, one of the largest villages in Spiti Valley. Our research suggested that the recovery of prey populations required a reduction in stocking densities and/or the creation of grazing-free areas. Through participant observation and semi-structured interviews on local herding practices, it became evident that a reduction in stocking densities was not an immediately feasible option because livestock still offer many goods (milk, meat, wool, manure) and services (draft power, religious ceremonies) for which there are no ready substitutes. Further, at the level of the individual family—the unit of livestock ownership—herd sizes were not very large, but because the communally owned grazing land was limited in area, there was an effective overstocking of rangelands. The interviews also revealed a readiness on the part of the villagers to take ownership and contribute premiums for their livestock if a communal insurance fund were set up to offset the costs of livestock losses. Therefore, rather than attempt to reduce livestock holdings, we made efforts to free an area from livestock grazing and other human use and to set up a locally managed communal insurance program.

Following this groundwork, under the aegis of the Nature Conservation Foundation, we initiated consultations with the village council of Kibber. We suggested that in exchange for monetary compensation for lost grazing the council set aside a part of its regularly grazed rangeland for wildlife by implementing a moratorium on all forms of extractive use. The council had, in the past, leased out grazing land to nomadic herders against cash payments. We used these traditional leases as a guideline to negotiate the extent, duration, and rate of lease. The village council held discussions with all families and responded to their concerns regarding the lease. They were agreeable to most of the terms, but requested a reduction in the size of the proposed grazing set-aside, and wished to retain complete rights over water (used for irrigation) from the set-aside. These requests were incorporated into the lease agreement. The council nominated a committee of 10 villagers to oversee its implementation. The agreement was signed by the council and the Nature Conservation Foundation in 1998. The village designated

approximately 500 ha (6% of their regularly used grazing land) as an area to be free of livestock grazing and human use for 5 years. As an incentive for compliance, and as compensation for lost grazing, the Nature Conservation Foundation agreed to pay the council a yearly sum of Rs 20,000 (or US\$425), which is being met by a grant from the Van Tienhoven Foundation in the Netherlands. This money is used by the council for collective work and village development schemes. Three villagers are employed as guards to prevent free-ranging animals from entering the area, and the council itself ensures that herded livestock are not taken in.

The rangeland comprising the set-aside was used to graze livestock during summer and autumn, with the grazing pressures being especially high in autumn. Our surveys indicated that, prior to protection, bharal used the area only in summer at a maximum density of about 4 animals per km<sup>2</sup>. We have continued to conduct annual bharal censuses (Mishra 2001) in the grazing set-aside. After 4 years of protection, there was a threefold increase in use by bharal. In 2001–2002, we recorded evidence that bharal used the area in winter also. These trends are in line with our objective of enhancing wild prey density by restricting grazing of local livestock.

We started the livestock insurance program in 2002. As in the case of the grazing set-aside, the village council appointed a committee of four villagers that would supervise its implementation. Regulations of the program were arrived at through mutual discussions between us and the village council. Villagers contribute monthly premiums toward insuring livestock (yaks, horses, cattle, cattle-yak hybrids, and donkeys). The International Snow Leopard Trust is helping strengthen the corpus of this cooperative fund until it becomes self-sustaining (expected to take 2–3 years). We have also provided incentives for better antipredatory herding, with biannual monetary rewards for safe herding (least number of livestock predation cases) being paid to the herders from the insurance fund. The regulations include clauses that safeguard wildlife and large carnivores from persecution and prohibit the collection of carcasses when livestock do get killed by carnivores (earlier, carcasses were retrieved, often by driving away the predator; Mishra 1997). The program offers more realistic rates of compensation (up to 100% of the livestock's value, but it varies depending on the total number of livestock killed and the total size of the insurance fund during a given year) for livestock losses to carnivores and discourages false compensation claims. It is presumably helping to reduce levels of livestock predation.

We are also working with the villagers to develop programs to achieve sustainability of the grazing set-aside by phasing out external subsidies. This includes a program to develop and market handicrafts. We are also facilitating a project on wildlife tourism to be linked directly with the grazing set-aside. This is expected to make it beneficial for

the villagers to maintain the set-aside for posterity, even after the agreement runs out.

Since 1999, this incentive program has managed to accomplish more than the protection of a small pasture and assist in recovery of bharal. It has conveyed to villagers the message that safeguarding the conservation interests of wild carnivores and their prey need not proceed at the expense of the local community. It has helped bring changes in deep-rooted local attitudes toward wildlife. This is evidenced by the fact that no large carnivores have been persecuted in the last 4 years and by villagers having twice turned away army personnel intending to hunt bharal and ibex (*Capra ibex*), warning them that such activities would not be tolerated.

## Snow Leopard Enterprises: an Incentive Program in Mongolia

### Landscape, Ecology, and Society in Snow Leopard Habitat of Mongolia

Snow leopard habitat in Mongolia is restricted to the Altai Mountains, the Khangai Mountains, the Hanhoohy Uul and Harkhyra ranges, and isolated mountainous sections of the Trans-Altai Gobi, with a total area of perhaps 100,000 km<sup>2</sup> (McCarthy 2000). Despite the snow leopard's affinity for steep and rugged terrain, much of its range in Mongolia is heavily used for livestock grazing. As in India, our conservation program in Mongolia started with a research project on snow leopard ecology that identified the important conservation concerns, quantified human-wildlife conflicts, and generated an understanding of the socioeconomic context of conservation (McCarthy 2000; Allen et al. 2002). After obtaining insights into the area's ecology and society and realizing the need for community-based conservation, we devised an incentive program for conservation of the snow leopard and other wildlife.

The results of our snow leopard study had disturbing implications for estimates of snow leopard populations (McCarthy 2000). Prior to our work, the estimates of snow leopard home range came from four studies (two in Nepal, one in India, and one in Mongolia), in which ground-based VHF radiotracking in extremely difficult terrain left the authors suspecting their home range estimates to be too low (11–36 km<sup>2</sup>, mean 19 km<sup>2</sup>; Chundawat 1990; Schaller et al. 1994; Jackson 1996; Oli 1997). In the only snow leopard study so far to use a combination of VHF and satellite radiocollars, our research not only confirmed this but suggested that snow leopard home ranges might be several times greater than previously believed (14 km<sup>2</sup> to >1500 km<sup>2</sup>, mean 429 km<sup>2</sup>, and 72 km<sup>2</sup> after the unusually large sample was excluded; McCarthy 2000). Because estimates of the global snow leopard population are largely based on home range size,

the total estimated snow leopard population was potentially highly inflated. In Mongolia, large home ranges and associated long-distance movement necessitated by low prey density made the snow leopard more vulnerable to persecution (McCarthy 2000).

Nearly one-third of Mongolia's 2.3 million people practice a seminomadic pastoral lifestyle, and those numbers have increased since the collapse of the communist system and shift to a market economy. Livestock constitute the wealth of most herding families. The sale of wool from livestock is one of the most important sources of cash income in this subsistence economy. We found that herders were largely dependent on passing traders to sell wool and had little control over prices. Since the breakdown of the collective economy during the early 1990s and the privatization of livestock ownership, there has also been a breakdown in collective decision-making structures. Herder households now operate as independent economic units and are wary of any structure that resembles collectivism.

Losses to large predators (wolves and snow leopards) were common and economically serious. We found evidence of high levels of retaliatory killing of the snow leopard. Of the 116 herders we interviewed, 14% had hunted snow leopards (Allen et al. 2002). Our interviews also revealed a deep-rooted negative attitude toward wolves, which apparently were responsible for greater livestock losses, making it clear to us that the herders would not be immediately open to a conservation program that included wolves. With this background knowledge about the small snow leopard population, its continued persecution (even after the complete official ban on hunting in 1994), the economic hardship faced by the herders due to the large carnivores, and their attitude toward wolves, we decided to work with them to set up a conservation program focusing on the snow leopard.

### Incentive Program in Mongolia

Snow Leopard Enterprises was initiated in 1998 in response to an expressed need on the part of herders for improved access to markets, in exchange for a conservation commitment from them. The program runs under the International Snow Leopard Trust and has been financially supported by The David Shepherd Conservation Foundation, the World Wildlife Fund–Mongolia, the Canada Fund, and the British Embassy in Mongolia. The incentive program focuses on value addition to wool. The hand-crafted products that herders are encouraged and trained to produce are about 15–20 times more valuable than the raw wool they usually sell.

Our study of snow leopard ecology was based in the Great Gobi Protected Area. Informal discussions with neighboring herders about the need for snow leopard conservation led us to conduct a more formal survey regarding their relationship with snow leopards and other

wildlife (Allen et al. 2002). The survey included questions about what conservation agencies could do to provide incentives to protect wildlife, particularly snow leopards. A majority of respondents requested help in getting the wool (from sheep, goats, and camels) to markets in order to get better prices. Given peoples' attitudes about collective work, we opted to initiate the program on an individual basis with the herder families. Discussions with families led to the idea of adding value to raw wool by manufacturing handicrafts rather than selling the wool wholesale.

We developed the structure of the incentive program through discussions with herders who utilized snow leopard habitat and the protected-area administration or local government wildlife-management agency. A conservation contract is drawn up, in which each party commits to specific actions. Because the field conditions and stakeholders vary, separate contracts with varying clauses are developed for each site. Snow Leopard Enterprises guarantees that it will purchase a certain number of specially designed handicrafts. Herders sign a contract committing to specific conservation actions, such as a complete ban on poaching of snow leopards and their prey. Contracts are signed and orders placed each autumn. The following spring, Snow Leopard Enterprises purchases the products at the agreed base price. If, by the end of the contract period, all herders have honored their conservation commitment, producers receive an additional 20% bonus. Any violation in the project area, either by persons from within the community or by outsiders, results in loss of the bonus for all participants. If the person involved is a member of the conservation program, the family loses its membership. This provides an incentive for herders to refrain from poaching and to protect the wildlife from poachers coming from outside.

Compliance with the conservation contract is monitored by the protected-area administration in sites where the project falls within buffer zones of protected areas. Elsewhere, environmental officers of the local government monitor compliance. Although these agencies play a policing role, they also provide logistical support and are visibly associated with a program that is valued by the local community. This allows wildlife managers and administrators to communicate a positive image to the community. We also provide an incentive to these administrative agencies by assuring them 10% of the sales income from the project site.

The program is growing in popularity throughout the range of snow leopards in Mongolia. We started in 1998 with 80 families. Over 200 families are now taking part, and we expect to reach 400 families within the next five years. Since the program started, herders have begun to organize themselves into collective groups, greatly facilitating logistics and presumably increasing the conservation impact through collective implementation. By creating handicrafts from a small portion of the raw wool they

produce, families on average are able to increase their per capita income by 25% (US\$50). This can be substantial in a country where government workers earn only the equivalent of US\$35 a month. The money is paid to the women of the family. The program is expected to grow rapidly over the next 5 years as marketing opportunities open up, with the additional income generated per household projected to increase to US\$150.

Attitudinal shifts are more difficult to measure than economic impact, but we are seeing increased awareness among herders of the value of protecting snow leopards and their prey. There have been no reports of snow leopards being killed in any of the project sites since the program was initiated (in two of the sites, three cases of snow leopards being poached were recorded between 1994 and 1998). In one site, two ibex were poached, following which all participants in that area were not paid their bonus. Although people were upset, they accepted the loss as it had been stated in the conservation contract. They expressed a determination not to allow this to happen again, with peer pressure rising against poaching in the project site. With the payment of a bonus dependent on contract compliance, a positive incentive is achieved rather than punitive action. The program has presumably also helped improve the relations between local authorities, protected areas, and local people.

## Discussion

### Incentive Programs: Preservationism or Sustainable Use

Given the reality of a growing interface between humans and wildlife, conservation efforts worldwide have been guided broadly by two influential but contrasting approaches, preservationism and sustainable use. The preservationist approach has placed the aesthetic and ethical values of wildlife (and their habitats) above utilitarian values, recognized the vulnerability of certain species and ecosystems to human pressures, and supported the use of coercion by the state to curtail land use that is detrimental to wildlife conservation (Kramer et al. 1997). Although this approach has succeeded in arresting declines of many species and ecosystems vulnerable to human pressures, these successes have usually come at the cost of alienating and antagonizing local users of natural resources (Terborgh et al. 2002).

The sustainable-use approach, on the other hand, is founded on the premise that local users of natural resources have the greatest appreciation of the value of those resources, are negatively affected by their degradation, and can therefore be motivated to conserve them, provided the authority to regulate resource use is devolved to them (World Conservation Union et al. 1991; Secretariat of the Convention on Biological Diversity 2001). By supporting extractive human use of natural

resources, the sustainable-use approach has succeeded in mobilizing greater local participation and support for conservation. However, it has often failed to demonstrate the ability to conserve species and ecosystems that are particularly vulnerable to extractive pressures (Terborgh & Van Schaik 1997; Madhusudan & Karanth 2000). This raises important questions about the wider applicability of the two approaches. Does preservationism and associated curtailment of extractive use of natural resources always need to be imposed by the state? Is conflict between local people and the state inevitable in the pursuit of a preservationist agenda? On the other hand, does local participation in conservation have to be contingent upon extractive resource-use privileges for the community?

In both our field sites in India and Mongolia, the snow leopard and its prey have faced serious problems related to anthropogenic resource use. In Spiti, although the prey was being out-competed by livestock (Mishra 2001; Mishra et al. 2001), poaching for meat and trophies was causing prey declines in Mongolia (Anonymous 2000; McCarthy 2000). Carnivores in both areas were persecuted in retaliation for livestock predation, the persecution being much more intense in Mongolia. For the snow leopard and its prey, conservation needs—such as enhancing prey density and cessation of retaliatory killing of carnivores and poaching of prey—necessitated a curtailment of extractive resource use, which has commonly been associated with the state-imposed preservationist approach. Nonetheless, the economic incentives employed in these regions enabled the pursuit of preservationist actions with complete local support and participation. The ability of incentive programs to provide monetary returns to local people also suggests that local subsistence may be safeguarded without necessarily involving the extractive use of natural resources.

Recognizing that people and wildlife will continue to live together in snow leopard habitat, our incentive programs are designed to promote coexistence. In different social and conservation contexts, incentive programs have been used to reduce the interface between people and wildlife. For instance, in the Nagarhole National Park in the south of India, an incentive program for large-carnivore conservation has addressed the problems of hunting and habitat degradation caused by the resident people, who faced a serious lack of civic and social amenities (Karanth 2002). Here, incentives—monetary compensation, arable land, education, access to amenities and employment—are being used to promote voluntary resettlement of people outside the park boundary. There are still other situations where a certain amount of interaction between humans and carnivores may even promote the conservation of large carnivores. In Khasan in the Russian Far East, access to farm deer has perhaps saved the Amur leopards (*Panthera pardus*) from extinction, and incentives are being used to facilitate the access of predators such as the leopard and the

Siberian tiger (*Panthera tigris*) to farmed animals (Hötte & Bereznuik 2001).

### Limitations and Costs of Conservation

The results of our work thus far indicate that incentive programs can potentially strengthen conservation efforts, as reflected in changes in people's attitudes toward wildlife and in the response of wildlife to conservation efforts. However, successful examples of incentive programs remain heavily subsidized by conservation funds (e.g., Szapary 2000). It is also important to recognize that the availability of a strong baseline of ecological and socioeconomic research in both Spiti and Mongolia enabled the design of suitable incentives and the identification of appropriate local institutions to administer them. Factoring in the research funding that enabled the generation of scientific information implies a further escalation in the costs of conservation. This perhaps warrants a greater recognition that conservation funds need to be made available not only for implementation of conservation programs but also for the research that informs the design of effective programs.

In a recent review, Ferraro (2001) makes a distinction between incentive programs involving "development interventions" and those paying the local communities directly for conservation. Criticizing the former approach for generating ambiguous conservation incentives, being unable to produce short-term conservation benefits, and being complex in implementation, Ferraro advocates systems involving direct payments. Some of the initiatives in our programs could qualify as development interventions and others as direct payments. Although limited in their spatial scale, our programs have produced conservation benefits in the short term, and, with a comprehensive understanding of ecology and society, have not been complex to implement. It is important to recognize that conservation issues are usually specific to an area and context and merit well-designed and area-specific conservation action, some of which may be direct payments and some development interventions. Still other action may be benefit sharing, in which, in exchange for conservation commitments, local people share revenues derived from wildlife (Davies 2000; Hearne & McKenzie 2000).

Ferraro's analysis provides valuable insights into why development interventions could fail and should serve as a guideline for improving their design. We believe, however, that making a necessary distinction between the two approaches and denigrating one in favor of the other may be a luxury conservationists cannot afford.

Perhaps the most important concern about our incentive programs is that they represent small and isolated efforts. Our project in India, for instance, involves about 80 families, whose direct resource catchment and area of influence comprises about 30 km<sup>2</sup> of rangelands. In Mongolia, Snow Leopard Enterprises is now active in all

the provinces with snow leopards, but it still touches only a fraction of the people affecting wildlife. Expanding the spatial coverage of these programs while internalizing their costs will remain the biggest challenges to conserving the snow leopard.

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