Managing People-wildlife Conflict on Alpine Pastures in the Himalayas

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Abstract
Many communities in the Himalayas suffer recurrent loss of valuable livestock to wild predators like the endangered snow leopard (*Uncia uncia*), thereby presenting park managers with the need to find ecologically sound and economically sensible long-term solutions which best balance the needs of pastoralists with those of wildlife sharing the same habitat. Since 1996, the author, The Mountain Institute, and the International Snow Leopard Trust have been experimenting with new and more participatory ways of dealing with this highly contentious issue in Tibet, and to some extent in Sikkim. Community-based workshops, employing APPA (Appreciation Participatory Planning and Action) and PRA (Participatory Rural Appraisal) techniques, seek to reduce depredation loss, increase villagers' income, and protect nature, while at the same time building community self reliance for planning, resource management, and income generation within the targeted protected area. This paper summarises the methods used and results obtained thus far and includes, as appendices, a detailed 'tool-box' of simple, participatory techniques and project planning criteria that could be applied to the problem throughout the Himalayas.

Introduction

Himalayan and Tibetan Plateau rangelands provide habitat for a unique assemblage of large mammals that have adapted to the harsh climatic and environmental conditions over evolutionary time scales (Schaller 1998). Examples of carnivores are the snow leopard (*Uncia uncia*), lynx (*Lynx lynx*), brown bear (*Ursus arctos*), dhole (*Cuon alpinus*), and wolf (*Canus lupus*). Endemic ungulates range from wild sheep and goats like the bharal or blue sheep (*Pseudois nayaur*), Asiatic ibex (*Capra ibex*), argali (*Ovis ammon*), Himalayan tahr (*Hemitragus jemlahicus*), goral (*Naemorhedus goral*), and takin (*Budorcas taxicolor*), to members of the antelope family like the Tibetan antelope (*Pantholops hodgsoni*), Tibetan gazelle (*Procapra picticaudata*), and wild yak (*Bos grunniens*) or deer species, most prominently the musk deer (*Moschus chyrsogaster*), and very rare red deer (*Cervus elaphus*).

Many of these species are listed in the Red Data Book or protected under Nepal's National Parks and Wildlife Protection Act. In recent decades their numbers have declined and their distribution has become increasingly fragmented as a result of poaching, over-hunting, commercial meat harvesting, and the direct and indirect effects of increased human use of high alpine pasture habitats (Fox 1994; Nowell and Jackson 1996; Shackleton 1997). These may include grazing competition between wildlife and domestic stock, soil and pasture degradation, predation of livestock, disease transmission, depletion of

natural prey species, and disturbance to breeding or foraging wildlife, as well as marginalisation of critical wintering habitat (Fox 1997; Jackson 1990). Currently, protected areas (PAs) provide the primary habitat for harbouring vital core populations, with the surrounding unprotected buffer zone and corridors facilitating genetic exchange between increasingly isolated PAs, according to the metapopulation concept (Jackson and Fox 1997; Meffe and Carroll 1994). Using habitat modelling techniques, Jackson and Ahlborn (1990) described the importance of the Shey-Phoksundo National Park and Annapurna Conservation Area for maintaining a viable population of snow leopards in Nepal.

The high Himalayan pastures have long been used seasonally and permanently by resident or nomadic herders, whose existence depends upon finding their livestock adequate food and shelter — especially during the winter and early spring when forage is most scarce or likely snow-covered, and animals are stressed by poor nutrition and a high thermoregulatory demand. In recent decades, increasing vehicular access has led to more penetration and use of formerly uninhabited and very remote rich wildlife areas like Tibet's Chang Tang (Miller and Jackson 1994; Schaller 1998).

As native prey species' populations are reduced and depleted, so snow leopards must increasingly rely upon domestic stock for their survival. Faecal analysis indicates that livestock are an important component in the diet of the endangered snow leopard in Nepal, India, Mongolia, and parts of China (Oli *et al.* 1993; Chundawat and Rawat 1994; Schaller *et al.* 1988), so that reports of increased domestic depredation by the species is hardly surprising (Oli *et al.* 1994; Jackson *et al.* 1996). Indeed, it could be argued that pastoralists in some areas actually support or subsidise high densities of snow leopard, lynx, and wolf by ensuring that they have a ready supply of food available to them! In the Annapurna Conservation Area's Manang sector, for example, livestock biomass may be three times that of blue sheep, even although this area supports as many as 10 blue sheep per sq.km (Jackson *et al.* 1996; Oli 1994).

Protected areas and the allied welfare of contained wildlife populations will doubtless be placed at greater risk with continued loss of crops and livestock, which is rapidly emerging as the leading source of conflict between parks and local communities throughout the region (Kharel 1997; Mishra 1997; Saberwal *et al.* 1994; Sekhar 1998). For example, a comprehensive household-level survey of herders living in the Annapurna Conservation Area Project's (ACAP) Khangsar village suggested that predation accounted for 63% of all livestock mortality over an 18 to 24 month period, mostly attributed to snow leopard (Jackson *et al.* 1996). Predation rates were estimated at 21.1% for yak-*chauri* (mostly sub-adults), 0.8% for cattle, 7.1% for sheep and goats, and 19.6% for horses (with females and foals being taken more often than stallions). Predators are frequently blamed for loss actually resulting from other sources of mortality, such as disease, consumption of poisonous plants, or accidents.

Losses were not evenly distributed among the households: 37% of households suffered 50% of the total loss reported. Generally, households reporting depredation loss owned larger herds than households reporting no loss. Losses occurred throughout the year, peaking in early winter and spring. All horse and

cattle, virtually all yak-*chauri* (93%), and 78% of the goat and sheep kills reported to Jackson *et al.* (1996) were being poorly guarded at the time. Virtually all incidents occurred in cover-rich sites and many of the kills took place during daylight hours. Field checks validated predation as the probable cause of death in at least 40% of these incidents; evidence for the remaining accrued from villager reports and kill site remains, but scavenging as a cause of death could not be ruled out. Despite knowing that several snow leopards, including a female with two cubs, were active within the immediate area, Khangsar villagers allowed their livestock to graze unattended, even after several had been killed, and in spite of having alternative, 'predator-free' pastures available to them. Over a 24-day period, 17 goats and 6 yak cross-breeds were lost.

Oli *et al.* (1993) reported that the predation rate in other nearby communities totalled 2.6% of the stockholding, with the losses representing as much as 25% of the average household's per capita income. Hardly surprisingly, most local people held a strongly negative attitude towards the wolf and snow leopard. In India's Kibber Wildlife Sanctuary, Mishra (1997) reported that 18% of the livestock holding was killed over an 18-month period, amounting to 1.6 animals per household per annum with an estimated total value of US$ 128 per family per year. Villages received compensation in only 28 of 131 reported cases. According to local residents, predation rates in the area sanctuary have increased markedly since its establishment. Mishra (1997) attributes this to a dramatic increase in livestock numbers accompanying the shift from subsistence to more commercially-based animal husbandry. Surveys in Nepal, India, and Mongolia have indicated that horses are taken in significantly greater proportion than their relative abundance; their high economic value only intensifies the level of anger toward predators and feeling for retribution among affected herders (Oli *et al.* 1993). Investigators have independently concluded that retaliation may be driven more by perceived losses than actual losses; however, repeated predation almost inevitably results in some or all households seeking to hunt, trap, and kill the culprit or suspected culprits.

The available evidence indicates that all of Nepal's parks suffer from crop and livestock damage to varying degrees (Jackson 1990; Kharel 1997; Sharma 1990). Obviously, protected area management can only be effective and sustainable if the basic concerns, needs, and aspirations of local people are addressed, in parallel with those of the wildlife. Thus, park managers should place a high priority on finding acceptable and sustainable solutions to satisfy herders who have lost their stock to predators in or near a PA. Over the long term, we must ensure that the natural prey base is expanded so that predator dependency upon domestic stock is reduced, and conflicts can thereby be avoided or at least minimised. The objective of this paper is to examine the key underlying causes of livestock predation and outline, in general terms, appropriate remedial measures that could be implemented by park authorities, NGOs, and local pastoralists in a way that builds community self-reliance and strengthens their capacity for park management and wildlife stewardship.

Livestock depredation - an overview of root causes and remedial solutions

Conflict between livestock owners and predators dates back 9,000 years to the

time when animals were first domesticated by humans (Nowell and Jackson 1996): it is not a recent phenomenon caused by the establishment of nature preserves or new wildlife legislation. Before modern firearms and traps were available, herders had developed simple but effective traditional methods for minimising predation losses such as maintaining close watch over livestock while grazing on the open range, avoiding predator-rich areas, employing guard dogs, breeding sheep or goats that have well-developed anti-predator traits, and keeping livestock in predator-proof corrals at night. Erosion of traditional knowledge, reduced herder vigilance, increased livestock numbers, and changes in animal husbandry management systems have aggravated the situation. As indicated above, predation rates vary widely, differing according to the type of livestock involved: sheep, goats, young yak, and horses appear to be most at risk.

The worst-case scenario involves 'surplus killing', or catastrophic incidents involving a snow leopard which enters a poorly-made livestock pen during the night, becomes confused, and then kills as many as 50-120 goats and sheep. Ironically, such loss could be entirely avoided if corrals were properly constructed in the first place — either higher walls or wire-mesh fencing that prevents a predator from jumping into the enclosure. Typically, poor households suffer most seriously, because they cannot afford to build good corrals or pay for shepherds to look after their livestock. Some animals that escape immediate death may die later from infected wounds because of the lack of proper veterinary care — a notable problem among large-bodied livestock like yak which put up a fight when attacked, thereby repulsing the predator but escaping with deep canine punctures and claw lesions that are highly prone to septicaemia.

Although predation losses vary from site to site, year-to-year, and seasonally, winter is usually the time of greatest concern. Jackson *et al.* (1996) found that depredation was not evenly distributed, but rather associated with the nearby presence of cliffs, rocky areas, and good cover. Near protected areas, the most likely stock raiders are dispersing sub-adults seeking to establish their own home range outside already occupied areas. Snow leopards which bring their cubs to a kill may be reinforcing the taking of livestock as prey, while the tendency of snow leopards to remain at a kill and consume all available meat increases their vulnerability to human retribution.

Jackson *et al.* (1996) considered the best long-term strategy lay in combining preventative and remedial measures such as the following.

Improved guarding of livestock, especially during winter, lambing, or calving seasons and when livestock are grazing pastures with broken, cover-rich terrain at elevations in excess of 4,000m (known as depredation 'hot-spots')

Encouraging communities to hire skilled shepherds, by developing a special fund to help pay for more experienced herders and by offering subsidised veterinary care for communities which demonstrate a reduction in depredation among their holdings

Promoting the use of improved breeds of guard dogs and livestock that show a greater inclination to ward off or avoid predators

Creating core areas for snow leopard and blue sheep which are largely or entirely livestock free

Assisting herders to increase their incomes from alternative sources, such as tourism and related jobs

Offering incentives for community development projects in exchange for clearly-defined and monitored predator and wildlife protection/conservation actions by the entire community

Developing safeguards against herders or communities making fraudulent claims, killing snow leopards, or illegally poaching wildlife, particularly key prey species

Since the lack of guarding and proper supervision of herds contributes most significantly to livestock losses, herder education should be given a high priority. Much depredation could be avoided by ensuring that livestock are securely housed in predator-proof pens at night. Research into the use of guard dogs is also recommended. Programmes to provide or improve forage could help to reduce the need to graze livestock in known depredation hot spots such as areas of very broken terrain, places with an abundance of cliffs and stalking cover, and pastures located in wilderness areas.

Oli *et al.* (1994) and others have recommended the development of insurance indemnity or cash compensation schemes for compensating herders who lose livestock to snow leopards. There are many obstacles to this idea, such as fund capitalisation and herder acceptance of annual premium payments, the potentially high administrative costs, the difficulty of validating predation as a cause of death in the field, and the possibility that a high percentage of claims will be fraudulent (unless sound procedures for verifying claims are in place). Perhaps, more importantly, cash payments or replacement of lost livestock encourage even more lax guarding practices. Any programme must, therefore, incorporate species' incentives, disincentives, or restrictions to ensure that it corrects bad behaviour rather than reinforcing it.

An alternative approach

In 1996 The Mountain Institute (TMI 1997a) began to experiment with new ways of approaching people-wildlife conflict resolution in Tibet. Using participatory workshops as a forum, this approach seeks to deflect the villager's anger and desire for retribution toward a more harmonious co-existence with depredating wildlife and constructive stewardship of the land. Attended by protected area staff, villagers, and wildlife specialists, we use a highly participatory planning process called 'Appreciative Participatory Planning and Action' (APPA), that in turn draws upon traditional PRA (Participatory Rural Appraisal) tools (TMI 1997b) and a framework of Appreciative Inquiry. According to its practitioners, APPA should be "simple enough that anyone can do it, yet profound enough to change people's lives." Experience has shown

that a "problem-focused approach" (e.g., crop damage is a bad thing) often ends up with stakeholders remaining centered upon the difficulties of changing the status quo.

APPA operates on two basic complementary premises: (1) What you seek is what you find — "if you look for problems, then you will find more problems" or conversely, "if you look for successes, you will find more successes"; and (2) What you believe is what matters most — "if you have faith in your vision or ideas for the future, and if these are believable, you can achieve success without waiting for government or an outside donor to help take you there." APPA is practised through a four-phase iterative process (the Four "D's"), in which participants (1) discover their strengths and the community's valued resources and characteristics; (2) envision (dream) what could be possible within one year, 5 or 10 years, and 20 years time if their community mobilised its resources and acted in concert; (3) design an action plan for guiding development over the next 12 months or several years time, based upon what the community can do for itself; and (4) then learn how to deliver the desired objectives and meet long-term goals, starting immediately rather than waiting for some future time to take action.

The dynamic APPA process is used to mobilise villagers and to begin addressing crop or livestock depredation by building a common understanding of the project's primary objectives, which in this example may be stated as follows: (1) identify and implement ecologically sound and acceptable measures to reduce or possibly even eliminate wildlife crop and/or livestock damage, while increasing crop and animal productivity within the sustainable limits set by local environmental and pasture conditions; (2) protect wildlife and habitats in accordance with existing PA regulations; (3) promote alternative but environmentally responsible and socially acceptable forms of income generation that can be implemented and sustained through existing institutions, and which foster community pride and build greater self-reliance; and (4) train villagers and park staff in participatory resource assessment, planning, and management.

The basic steps involved in developing remedial measures for livestock (or crop) damage include the following activities: (1) verify that predators are an important threat to livestock by gathering baseline information on all sources of mortality to a particular village's livestock herd; (2) consider existing and alternative measures for reducing losses; (3) identify the environmentally, socially, and economically most appropriate control measure(s) and sign reciprocal agreements with herders and communities; and (4) implement measures according to a 'best practice' work plan that details each party's responsibilities from implementation through monitoring and evaluation phases.

The APPA process is usually initiated through a workshop with community members, leaders, and/or a particular user group which is experiencing depredation problems. Following introductions and 'ice-breaking' exercises, the facilitators provide a preliminary explanation of the purpose of the proposed workshop/project and discuss the obligations expected from each stakeholder (Table 17). They then initiate an on-going process for securing the consensus from all key stakeholders of their willingness to adopt a common set of damage

Table 17.	**Conditions governing community engagement and project initiation**

- External investment and NGO support are only made available to prospective communities *if* project activities are implicitly linked with biodiversity conservation (Sanjayan *et al.* 1997) and if the following is true.
- Each stakeholder, (whether villager, NGO, or government) is willing to make a reciprocal (co-financing) contribution, within their means, in support of the agreed-to project activities. This may be in the form of cash or in-kind services like materials and labour, which are valued using existing market rates and prices.
- There is a strong commitment to active and equitable participation from each stakeholder group throughout the project, from planning to implementation, monitoring, evaluation, and reporting.
- The beneficiary community is willing to assume all or a significant responsibility for repairing and maintaining any infrastructural improvements that may be provided by the project.
- Stakeholders agree to identify and employ simple but realistic indicators for measuring project performance and impact.

control and project design/operational criteria to help guide any agreed-to intervention (Table 18). It may be necessary to use a 'carrot and stick' approach by proposing a package of incentives, disincentives, and penalties that will better ensure stakeholder participation and compliance. Clearly, the stakeholders will need to recognise and accept the benefits and associated costs of the proposed actions, so that it is important to view the issue from a positive rather than a negative point of view.

During the 'discovery' phase, participants ask empowering and positive questions about what is best in their community and what has worked well in their lives. Facilitators probe particular community-based activities or endeavours that people see as being most successful to discover the underlying reasons of why this is so, in effect raising the self-confidence of the villagers to act in a positive and effective manner. Rather than using formal or highly structured household questionnaires, facilitators should use informal group meetings, site visits, and other group exercises to gather relevant baseline information on livestock numbers (or crop patterns) and mortality, identify animal husbandry systems and practices (including such things as pasture locations, periods of use, guarding patterns, and estimated stocking rates), or list wildlife species and map their habitat and distribution patterns. Appendix 1 indicates the range of PRA tools available to build a village resource profile and to identify patterns of crop or livestock damage. For example, pair-wise or matrix ranking is especially helpful in identifying the relative loss associated with each type of mortality or which guarding method or deterrent is seen as being most effective in the eyes of the herders. The relative vulnerability of different kinds of livestock to each predator can be ranked by giving participating herders a pile of stones, then asking them to place one for rarely depredated livestock type, sex or age classes, five for the most frequently killed types, or no stones for

Table 18. **'Best Practice' design and operational criteria** (adapted from Jackson 1998)

All agricultural and animal husbandry damage control and linked improvements must be undertaken in ways that do not adversely compromise or threaten the management goals of the PA (i.e., they must be compatible with PA regulations and/or management plans) and which are also as follow.

Environmentally sound — control measures should result in no or only very minimal harm to species, habitats, or ecosystems (for example, no overall reduction in predator numbers; no hunting, trapping or poisoning of endangered species; should lead to improvement in prey species' numbers; should avoid rangeland over-use and grazing; and should help rehabilitate disturbed areas and restore ecosystem functioning. However, it may be necessary in some situations to identify and remove or eliminate habitual livestock predators that belong to an endangered or rare species)

Economically sustainable — control actions should be affordable, contain cost-sharing mechanisms, and be capable of being sustained with minimal outside cost and technical input (communities should share in the cost of implementing and monitoring control measures; there should be minimal dependence on high-tech, expensive deterrents; control measures should be well integrated with land-use and income-generation opportunities; cost of implementation and maintenance should be reasonable, and preferably supported internally)

Socially responsible — measures should build upon proven traditional customs and 'good' animal husbandry practices (measures implemented should strengthen Buddhist precepts prohibiting the killing of wildlife; and encourage or empower local communities to act responsibly and achieve greater economic independence while operating in an environmentally responsible manner)

Embedded, with clear responsibilities and a transparent budget — Implemented based upon a signed agreement that clearly sets forth the responsibilities and contributions of each party in accordance with a mutually-agreed work-plan and budget. The work-plan should specify details such as: 'where (location); who (responsible party); what (inputs/activities); how much (quantity); when (scheduling); how implemented (method), and how monitored (indicator and process to be used)'.

those livestock that are not considered vulnerable to the particular mortality source.

These exercises are followed by frank discussions of why the various traditional guarding practices have either been abandoned or become discredited, and an evaluation of which traditional or new method could be expected to work best if properly implemented, as well as why and how closely each meets with the PA's management guidelines or promotes nature conservation. This information provides the framework upon which the team of villagers (or designated village

leaders), park manager, and NGO staff can identify and develop remedial measures that meet the criteria set forth in Table 18, and upon which reasonable consensus can be reached among the stakeholders involved. Providing details of different remedial livestock damage control measures is beyond the scope of this paper, but Appendix 2 shows some indicative interventions that were developed for the Qomolangma National Nature Preserve in Tibet.

Development of detailed action plans with a budget, monitoring indicators, and a realistic schedule takes time, in our experience a minimum of a 10 to 14-day programme is needed with a relatively high level of training and facilitation. Follow-up within a reasonable time-frame, say 3 to 9 months, is also critical. Indeed, emerging evidence indicates the need for long-term (5 to 10 years or more) commitment and involvement on the part of donors, NGOs, and park staff (Sanjayan *et al.* 1997). However, coming up with alternative means of reducing wildlife crop or livestock damage should involve considerably less time, effort, and cost, as suggested by the indicative example described in the following section.

It is important to appreciate the following assumptions, amongst others, when designing a programme for alleviating wildlife crop or livestock damage. (1) The internal and external threats to snow leopard (or any other target species) and biodiversity have been correctly identified and can be addressed using existing resources; (2) the project site is biologically significant (i.e., contains good wildlife populations, worth the investment being proposed); (3) local communities have pride in their way of life and culture, but are willing to adjust certain behaviour if it negatively affects species, habitats, or ecosystems; and (4) sufficient resources and skills are available to assist willing communities to develop, implement, and monitor plans for balancing biodiversity conservation and income generation.

Local people must appreciate and accept their responsibility to watch over their livestock properly in order to avoid giving predators the opportunity to stalk and kill unwary domestic animals. Park managers can be most effective if they educate herders and work to increase the local living standard by assisting in developing sustainable, alternative income-generating opportunities. The emerging evidence indicates that monetary compensation or poorly-defined compensatory development 'hand-outs' have not reduced depredation rates or resulted in a decline in the number of complaints filed with the relevant government agency (Saberwal *et al.* 1994; Mishra 1997). On the contrary, intermediation efforts may be doomed to fail unless the commitment shown by local people is directly linked to the responsibility they are willing to assume as well as the amount of time, energy, and materials they invest in the project. Therefore, it is imperative that the responsibility for reducing livestock depredation should be shared, at least equally, between the park authority and the local people, with short-term and medium-term support coming from national or international NGOs.

Results to date

Lessons from APPA community engagement and mobilisation in TMI activities in the Himalayas formed the basis for developing the protocols described in this

paper. APPA provided the process, while details of strategic wildlife damage evaluation and alleviation were developed over the course of two people-wildlife conflict resolution training workshops held in Tibet's Qomolangma Nature Preserve (QNP) (TMI 1997a).

The first workshop was conducted in the two villages of Ngora and Khoryak in 1996. Crop loss or damage by kiang (*Equus kiang*) amounted to nearly 40% of the annual production. Following partial fencing of the fields, barley production has increased by nearly 100%, with most villagers becoming self-sufficient in terms of food, rather than being dependent on annual government subsidies. Each settlement was able to significantly increase winter forage production for livestock, which should greatly ameliorate hardships like those experienced during the harsh winter of 1995-96, and more recently in 1998. Reduced time spent guarding the fields, especially at night, was another beneficial outcome of the project. Following fence placement, only four persons were required for patrolling, compared to a minimum of 20-26 persons previously. The fences help to keep livestock out of fields following the planting of barley, but this may turn out to be a mixed blessing should depredation incidents increase because livestock are being less closely tended than before. The time freed from guarding fields was used to build a school, repair houses, and construct several new livestock enclosures. As a result, many villagers reported their feelings towards wildlife had improved markedly.

In order to retain these gains, villagers will have to ensure that the fence is properly maintained. To this end, they have started a small community fund capitalised from imposed fines and income from handicraft production (with training in weaving and dying skills being provided by the project). It is still too early to report on the handicraft activities, although the community has obtained county assistance and recently opened a small production unit on the main highway, 25 km to the east. The agreement signed by each household with the preserve management authority called for setting aside an area where wildlife would receive special protection in the hopes of becoming more habituated to humans over time. This subcomponent is in the process of being implemented. It is hoped that future tourism development will offer locals opportunities to rent pack animals and horses to tourists making the special trek to the nearby Shishapangma mountain base camp, also giving visitors the chance to view wildlife along the route.

Other efforts by the International Snow Leopard Trust centre around making night-time livestock pens or corrals predator proof, in order to eliminate mass killing of livestock that is historically common to the Himalayan region from the Shey-Phoksundo National Park in Nepal to Ladakh and Tibet. Wherever possible, targeted communities are assisted to increase capture of income from existing tourist traffic and use of the area.

Conclusions

These kind of 'hands-on' training workshops could easily be replicated in other protected areas and locations. They help to build local capacity for habitat protection (thus strengthening biodiversity conservation), while also meeting important criteria like 'low-cost', reciprocal financing and shared responsibility,

based upon the 'best-practice' guidelines set forth in the recently completed QNP Depredation Management Handbook (Jackson 1998). This manual was developed as a direct output from the training workshops. Written in both Chinese and Tibetan, it describes how to undertake baseline surveys, assess and prioritise damage, and then negotiate signed reciprocal agreements with local communities to link conservation and income-generation activities beneficially so that local dependence upon, and impact on, marginal natural resources can be progressively reduced. By involving local people in preserve management, QNP has been able to rally new resources to supplement core government allocations for park operations. Where possible, project activities and outcomes are tracked using indicators developed by participatory means, thus building consensus and support for increased community-motivated and directed natural resource management and development initiatives.

In Nepal, there is a pressing need for researchers, development-conservation NGOs, and the Department of National Parks and Wildlife Conservation to collect reliable baseline information on crop and livestock damage sites, rates, and patterns in order to lay a sound framework for developing site-specific and locally adapted remedial measures. Research efforts in the Himalayas should focus on how herding practices could be improved, monitoring the abundance of prey species, establishing actual livestock losses to wild predators, and assessing the ecological impacts of the expanding livestock holdings (Mishra 1997). Appendix 3 summarises key information needs in this regard.

As an internationally 'charismatic' species, the snow leopard could serve as a 'barometer' for measuring mountain environmental health, and possibly even as an indicator for alpine biodiversity. It is therefore important that preserve managers work hard to maintain sufficient habitat and prey for this rapidly declining species. Parks with snow leopards may attract world-wide attention and additional funding that chould be used to promote more positive people-wildlife attitudes and to improve the involvement of local residents in park management and stewardship.

Although governments establish national parks and nature preserves, it is the local people who must live with the consequences. They bear the cost of co-existing with predators and preserving high-mountain biodiversity, often without realising any of the potential benefits. Whether affecting many or a few families, livestock depredation angers nearly everyone, especially if it occurs with regularity. It undermines the willingness of local people to protect wildlife or to tolerate the presence of a nature reserve. This highlights the importance of preserve managers implementing procedures and policies that effectively address people-wildlife conflicts in the protected areas of the Himalayas. The lessons from the programmes described above and elsewhere are vital to building up tenable strategies for addressing the legitimate concerns of pastoralists.

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APPENDICES

Appendix 1: Some common 'Participatory Rural Appraisal' (PRA) tools for assessing crop and livestock damage (adapted from the 1997 Kyirong Workshop, The Mountain Institute).

Tool and issue explored or information generated

1. Village social and resource mapping

- Crop or livestock damage—high damage areas, households that suffer from damage and relatively how much, characteristics of the most vulnerable fields or pastures
- Natural resource distribution and use—fuelwood, fodder, and timber collection areas and usage rates, NTFP collection/distribution sites; grazing pastures; water sources; wildlife 'hot-spots' and others
- Village profile—development interventions, base map, household occupations
- Cultural sites
- Wildfires

Where wildlife damage occurs — depredation 'hot-spots' and important natural resources

2. Trend lines

a) Range or forest condition
b) Economic status
c) Education
d) Trade
e) Wildlife presence
f) Crop damage/livestock loss rates
g) Cultural status
h) Health

Past, present, and potential future conditions

3. Pair-wise or matrix ranking

- Potential income generating activities/micro-enterprises
- Potential supplementary crops
- Crop and livestock protection measures or mechanisms—traditional and potential
- Importance of various crops to household income/subsistence
- Crops damaged most (part of plant, stage of plant development most vulnerable, etc)
- Kinds and ages of livestock most often killed by predators
- Wildlife species that damage crops or kill livestock
- Damage or mortality due to other factors (weather; natural disasters; poor nutrition or soil; disease; accidents; and others)

Where community energy and interventions should most profitably be focused

4. Venn diagram

- Relative amount of damage by crop or type of livestock (supplemented by records of crop losses kg/yr; or stock animals per household; describe method used to quantify)

- Local institutions, roles and relationships (who can change the situation)
- Relative importance of natural resource by quantified use (what is most important to the village)
- Key persons/institutions for developing and implementing action plans

Important institutions and persons for affecting change

5. Seasonal calendar

- Periods of crop and livestock damage (ranked or unranked)
- Occupations (men and women)
- Favourable seasons for tourism (weather, flowers, wildlife, hazards, trails)
- Cultural activities (tourist attractions and times of community celebration)
- Trade or transboundary activities: livestock herding, wildfires, trade

Times of year with most damage and highest tourism or best trade potential

6. Flow systems diagram linking Income-generating enterprises with conservation

- What if... stories, exercises to value wildlife, forest resources, cultural resources
- Exercises linking enterprise benefits with conservation

Instilling biodiversity conservation and environmental improvement as the primary objectives

7. Mobility map

- Transboundary activities
- Trade routes, import and export of materials, resources
- In and out migration
- Future mobility map: tourism (concerns?), trade, transboundary activities, handicraft/enterprise production

Important linkages with adjacent areas and communities

8. Monitoring and evaluation

- Villager sketching, note-taking, crop and livestock damage record keeping, and related monitoring of nature areas
- Development of monitoring plan, including identification of stakeholder-based indicators
- Personal, village, and PA commitments and follow-up plans

What indicators to use for measuring project performance and long-term impact. Who will do what?

9. Participatory planning, implementation and monitoring of field activities

- Identify collective crop damage and predator deterrent exercises (e.g., locally-made fencing, improved livestock pen designs; characteristics of good guard dogs or shepherds; construction of mobiles, noise-makers, and other deterrents)

- Delivery (do it!)
- Practice monitoring and evaluation while doing and after Delivery Phase

Outlining a monitoring plan and learning how to do it

10. Future desired conditions of village (via future map and trend lines) with regard to the following.

- Reduced crop damage/livestock loss (how much? where? when?)
- Benefits from micro-enterprises for compensating families and community who suffer damage
- Resource availability
- Wildlife populations and areas of conservation
- Ecotourism: where, how much, who will benefit, potential destinations/ activities, responses to expressed concerns about economic and cultural impacts of tourism
- Transboundary management (grazing, fodder collection, timber cutting, illicit trade, other)

Enhancing community capacity for planning and self-reliance

11. Action plans (see appendix 1 for example)

- Prioritised list of short, medium and long-term activities
- Detailed (2-3) action plans for selected priority/short-term activities, including micro-enterprise development by local villagers, conservation of natural resources/wildlife, crop damage protection schemes, and monitoring of crop damage reduction and other successes.
- Action plans to include: activities, sub-activities, objectives, who, when, where, cooperative body, and approximate budget with locally committed resources/funding and required outside support, and monitoring plan
- Plan for transboundary exchange, identifying objectives and expected outputs.
- Tentative action plan commitments by protected area authority and The Mountain Institute or International Snow Leopard Trust as follow-up to identified needs for outside support, management/enforcement, and monitoring.

Tools for empowerment — assuming responsibility for improving one's living conditions and the community's environmental stewardship

Appendix 2: Suggestions for ecologically-sound control measures in the Qomolangma Nature Preserve (QNP), Tibet (adapted from Jackson 1998).

Initiatives for Herders

Keep livestock in predator-proof enclosures at night-time (if necessary, improve existing corrals by raising the height of the external wall).

Avoid grazing in a known 'depredation hot-spot', especially during peak predation periods. Hot spots occur where there is plenty of cover in the form of vegetation or rocks, or where the terrain is strongly broken by gullies and ridges and interspersed with cliffs and large rock outcrops.

Encourage herders to guard their livestock conscientiously, especially during winter, lambing, calving season, or other periods of maximum depredation risk. For example, it may be possible to adjust the birth season of some livestock to decrease their vulnerability, although this option is usually limited by climatic conditions and the need for animals to grow quickly and put on weight before the onset of winter.

Try to ensure that livestock are clumped in a relatively small area at any one time, thereby it is hoped reducing the encounter rate between predators and livestock. Herds should also be rotated between pastures to avoid over-utilising fodder.

Most village dogs are very poor at guarding livestock — train them to do true guarding.

Remove carcasses of animals dead from disease or snowfall-induced mortality to avoid attracting scavenging carnivores.

Help QNP officials to ensure that prey species are protected by reporting all incidents of poaching, whether by outsiders or other villagers.

Initiatives for QNP management authority

Train herders in improved animal husbandry techniques, including daytime guarding measures and designs for improving corrals; identification and avoidance of depredation 'hot-spots'; and the means of detecting and verifying if livestock were killed or only scavenged by predators.

Find ways of reducing contact between people and snow leopard, including husbandry practices that make livestock harder to approach and stalk.

Create core areas for snow leopard and blue sheep which are largely or entirely livestock free.

Encourage communities to share in livestock guarding responsibilities, if necessary by hiring skilled shepherds paid from a special fund.

Promote the use of improved breeds of guard dogs and livestock showing greater instinct and ability to ward off predators.

Encourage herders to ensure lambing and calving occurs under confinement, since new-born animals are very vulnerable to attack

Offer communities economic and resource management incentives in exchange for tolerating some loss. For example, provide partially subsidised veterinary care for those families who demonstrate a reduction in depredation rates. Core area households willing to reduce the number of domestic animals could be provided with alternative sources of income, including sales of handicrafts, employment as wildlife guides or forest guards, and other jobs related to tourism.

QNP could establish a special fund to compensate those poor households that are especially impacted by depredation through no fault of their own. Alternatively, such a fund could be used to establish a small livestock herd owned by the preserve from which animals could be drawn to replace livestock that are killed.

Establish village-based wildlife conservation committees to assist in preserve management and monitor damage control measures.

Implement standardised procedures for recording and documenting livestock mortality due to predation and other causes, especially in or near QNP's core zones.

Develop safeguards against herders or communities making fraudulent claims, killing snow leopards, or poaching wildlife.

Do not permit foals to range freely for days. Store grass to feed them over the critical period.

Disincentives should be applied against herders who break rules or fail to protect their livestock adequately from predators. For example, offenders could pay a fine which would be deposited in a fund used for community development or resource management.

Appendix 3: Basic information requirements for developing depredation alleviation action-plans.

Knowledgeable herders, village leaders, and heads of households should be interviewed and questioned on the following items, using fully participatory techniques and the more widely accepted PRA tools.

Number of animals lost to disease and predators during the past 12 months (previous year) by each household. What was the age class, sex, and type of livestock lost to each kind of mortality (predators, disease, poisoned plant consumption, accident, theft)? How many animals succumbed to poor fodder or excessive winter snowfall last year or the year(s) before?

What is the current size and composition (number, type, sex, and age-class) of the livestock herd owned by the person being interviewed? The objective is to develop an unbiased profile of stockholding in the target community to serve as a basis for computing percentage lost or predation rates, birth and herd growth rates (trend), and economic value with respect to the various kinds of livestock and their productivity from interviews of different households and knowledgeable persons. Government records or statistics can be used to supplement these data on the livestock population of the particular community or village.

Identify during which season (month or months) most losses occur due to disease, predators, snowfall, and other factors. This is best done by asking herders to prepare a ranked matrix showing month and relative loss rate due to each major mortality factor. During which months are losses lowest or highest? Interventions should concentrate on the times of greatest loss or vulnerability for each major source of mortality.

Ask herders if they know during what time of night or day (dawn, midday, dusk) predators usually kill livestock. Determine the relative proportion of losses that result while animals are out grazing on the open range versus being housed in a corral (i.e., number of kills due to a predator entering into the corral). This will help determine if and when guarding by shepherds is most appropriate.

Determine the locations (in or near the village, summer or winter pasture) where losses occur and if possible identify the name and geographic location of all known depredation "hot-spots." Maintain maps of kill sites by each major predator species. Where possible, these areas should be avoided during periods of known depredation.

Identify each species that is causing damage, and which predators are the most destructive in this regard. During which months are predators closest to the village? Try to determine if villagers think that a particular individual is responsible for the spate of killings, based on some identifiable feature like physical distinctiveness, or track size and characteristics. Depredating species often vary from one locality to another, and one year to the next.

Ask local residents about wildlife population trends in the targeted area (while realising that such information may not be especially accurate or reliable, but it is nevertheless useful for park management and for involving people in conservation activities). What is the status of natural prey species in the area? Have they decreased or increased since establishment of the particular park, and what evidence do local people have for these trends?

What are the current and traditional practices used by villagers to prevent or reduce depredation loss? How effective are these, and how can such measures be improved upon? Have local herders become lax due to a change in attitude from one generation to the next, or the lack of manpower? Which of the techniques described in Appendix 2 would work best and do these comply with the PA's laws and regulations or management plan?

What is the cost of preferred preventative measures in terms of materials, labour, and maintenance? Would there be any negative impacts on the environment or community if these measures were to be implemented?

What matching or reciprocal arrangements and responsibilities would villagers, government, and other donors be willing to commit to?

Identify and discuss what indicators may best be used to measure the effectiveness of the project from an impact viewpoint. Obtain suggestions from the villagers for indicators that they would consider useful in determining the effectiveness of a particular invention (e.g., 50% reduction in number of livestock killed by predators; 'observable' increase in the number of blue sheep, no livestock killed in night-time corrals over a five-year period, etc). Try to use several indicators. For example, a reduction in the depredation rate may be balanced with monitoring of snow leopard or natural prey species' numbers or relative abundance (such as number, frequency, and location of sightings of animals or their signs). Determine how monitoring can be made as participatory as possible and how it can be accomplished on a regular basis at low cost.