

Published in (Pages 40-46): Tibet's Biodiversity: Conservation and Management. Proceedings of a Conference, August 30-September 4, 1998. Edited by Wu Ning, D. Miller, Lhu Zhu and J. Springer. Tibet Forestry Department and World Wide Fund for Nature. China Forestry Publishing House. 188 pages.

People-Wildlife Conflict Management in the Qomolangma Nature Preserve, Tibet.

By

Rodney Jackson, Senior Associate for Ecology and Biodiversity Conservation,
The Mountain Institute, Franklin, West Virginia

And

Conservation Director, International Snow Leopard Trust, Seattle, Washington

Presented at: Tibet's Biodiversity: Conservation and Management. An International Workshop, Lhasa, August 30 - September 4, 1998.

1. INTRODUCTION

Established in March 1989, the Qomolangma Nature Preserve (QNP) occupies 33,819 square kilometers around the world's highest peak, Mt. Everest known locally as Chomolangma. QNP is located at the junction of the Palaearctic and IndoMalayan biogeographic realms, dominated by Tibetan Plateau and Himalayan Highland ecoregions. Species diversity is greatly enhanced by the extreme elevational range and topographic variation related to four major river valleys which cut through the Himalaya south into Nepal. Climatic conditions differ greatly from south to north as well as in an east to west direction, due to the combined effect of exposure to the monsoon and mountain-induced rain shadowing. Thus, southerly slopes are moist and warm while northerly slopes are cold and arid.

Li Bosheng (1994) reported on biological zonation and species richness within the QNP. Surveys since the 1970's highlight its role as China's only in-situ repository of central Himalayan ecosystems and species with Indian subcontinent affinities. Most significant are the temperate coniferous and mixed broad-leaved forests with their associated fauna that occupy the deep gorges of the Pungchu, Rongshar, Nyalam (Bhote Kosi) and Kyirong (Jilong) rivers. Mammal species of national importance to China include the Himalayan tahr (*Hemitragus jemlahicus*), langur (*Presbytis entellus*), and goral (*Naemorhedus goral goral*), as well as many locally distributed birds. Botanical surveys indicate at least 17 protected plant species and many more are likely to occur within the diverse habitats found in this part of Tibet (Yangzom 1997).

The Preserve covers four counties and is inhabited by some 68,000 people, mostly Tibetans, whose irrigated and rain-fed agriculture and sheep and yak pastoralism has evolved over the centuries since the region was first occupied at least 4-5,000 years ago. Primary threats to biodiversity include timber extraction and associated deforestation, overgrazing by livestock, harvesting of meadow sod for burning, wall construction and road repair, and the collection of shrubs and other plants for fuelwood, incense and medicinal use. While roads bring many benefits, they may also promote landsliding, illegal hunting of wildlife and the loss of natural habitat. The QNP Office of the Working Commission released a draft management plan in 1994, which was prepared based upon the findings of a specially constituted multi-disciplinary Task Force of local and international experts, funded in large part by The Mountain Institute. The plan divides QNP into three zones: Core or "key protection" zones where the protection of rare species, habitats and biodiversity is paramount. These are surrounded by Buffer Zones which are carefully managed for low impact use and participatory resource management. Finally, there is the Economic Development Zone (or Peripheral Zone) where most people live and where environmentally sensitive, sustainable economic development is encouraged. There are 7 core zones (comprising 25-30% of the total preserve area), 5 buffer zones and the large contiguous development zone stretching across the north-central portion of QNP. For more detailed information, see QNP's management plan and supporting documents prepared by the specially constituted Scientific Task Force.

The primary objective of this paper is to report on people-wildlife conflicts arising from crop damage and livestock depredation in the Qomolangma Reserve, with special reference to the management of protected and endangered mammals.

2. STATUS AND DISTRIBUTION OF LARGE UNGULATES AND CARNIVORES

Since 1991, the author and his Chinese and Tibetan associates have conducted preliminary wildlife status and distribution surveys in the QNP, with emphasis on large mammals and alpine grassland and shrubland habitats (Jackson 1991; Jackson et al. 1994). Selected areas were searched for large mammals and their sign using binoculars or a spotting scope, as well as sign transects in the case of snow leopard (Jackson et al. 1994). Local villagers and officials were interviewed whenever possible and their suggestions of wildlife-rich sites investigated by vehicle, on foot or horseback.

Surveys have not been conducted throughout all of QNP, with the far-western section being virtually unsurveyed. Wildlife populations were found to be more abundant and intact in the pastoral areas of Kyirong and Nyalam Counties, and hardly surprisingly, least abundant near permanent settlements or areas with intensive, year-round agriculture. There were significantly more sightings further than 2-3 km from well-traveled roads or settlements, suggesting hunting is a key threat (Jackson 1991). These surveys indicated that blue sheep (*Pseudois nayaur*), kiang (*Equus kiang*) and Tibetan gazelle (*Procapra pitiicaudata*) are widely distributed and occur wherever there is suitable habitat and limited human disturbance. Blue sheep populations are most dense in areas with good pasturage broken by cliffs or rocky terrain, steep drainages and ancient morainal deposits. Such habitats are well represented in the Karta, Gandun and Lapchi areas. Kiang and gazelle are most common in the plains and rolling hills of the Pegu Tso basin and the Munza valley which drains into the Yarlung Tsangpo river

in the western portion of the Preserve. By contrast, Tibetan argali (*Ovis ammon hodgsoni*) appears to be on the verge of extirpation due to past hunting: two very small populations were reported by local residents in Nyalam and Kyirong Counties, but these could not be confirmed. The best potential argali habitat occurs west of Pegu Tso and along the northwestern edge of the Preserve, but both areas are subject to almost year-round livestock grazing.

Forest ungulates of note include the Himalayan tahr (*Hemitragus jemlahicus*), serow (*Capricornis serow*), and barking deer (*Muntiacus muntjak*) with notable populations in the lower Pungchu, Zhangmu and Kyirong valleys along the Nepalese border. The QNP supports China's only populations of tahr. Reports by Li Bosheng (pers. comm.) that takin (*Budocoras taxicolor*) occur in the Pungchu gorge almost certainly confuse this species with serow, and are thus erroneous. The distribution of the East Himalayan goral (*Naemorhedeus goral goral*) and musk deer (*Moschus chyrosgaster*) are poorly documented, but both appear to be highly patchy and in the case of musk deer greatly reduced in number over historic levels. QNP does not harbor any Tibetan antelope (*Pantholops hodgsoni*), wild yak (*Bos grunniens*) or Tibet red deer (*Cervus elaphus*).

Carnivores of note include the snow leopard (*Uncia uncia*), Tibetan wolf (*Canis lupus*), lynx (*Lynx lynx*), forest leopard (*Panthera pardus*) and Asiatic black bear (*Ursus thibetanus*). Jackson et al. (1994) reported on the status, distribution and conservation of snow leopards in QNP, estimating good-quality habitat at some 8,000 km² with a potential PA population of around 100 individuals (assuming an average density of 1.25 animals per 100 km²). This estimate has not been validated by intensive ground surveys, and should therefore be taken as tentative. No population estimates are available for other carnivores, and systematic field surveys are urgently needed to determine their status and distribution within the QNP and surrounding region of Tibet. Similarly, the status of the brown bear (*Ursus arctos*) is uncertain, but a few individuals may roam remote upland areas in western Kyirong County. The distribution of small spotted cats, like leopard cat (*Felis bengalensis*), jungle cat (*F. chaus*) and golden cat (*F. temmincki*) is very poorly documented, with their presence reported from the Nepal border area (Feng et al. 1986). Forest leopards and jungle cat are said by local people to be fairly common along the lower valleys leading into Nepal. Finally, the status of Pallas's cat (*Felis manul*) is unknown.

Prior to the establishment of QNP wildlife was heavily hunted, especially where army personnel patrolled the international border with Nepal. Since the establishment of QNP and the ban on hunting, poaching has declined significantly in most areas, although blue sheep, wolves and snow leopards are still occasionally hunted for food, trophies or because of livestock depredation (see next section). The increase in the number of complaints from local people concerning crop and wildlife damage may indicate that wildlife is increasing and/or becoming more tolerant of human presence. Major threats to snow leopard are illegal poaching for bones for the traditional Chinese medicine trade, depletion of prey like blue sheep or musk deer, and habitat degradation and conflict from livestock herders. Wolves are heavily persecuted because of the perceived threat they present to livestock, with the removal of cubs from maternal dens a favorite trapping technique. Blue sheep are mostly hunted in the winter by persons from within and outside the preserve.

3. PEOPLE-WILDLIFE CONFLICTS

3.1 Crop Damage: Settlements located within or close to forested areas appear to regularly suffer from crop damage by wild boar, black bear, monkey and pheasant. Residents report that the Asiatic black bear and wild pig cause the most damage, especially in those villages which are surrounded by dense forest or located within one of QNP's low-elevation core areas. In general, fields located further from the settlement suffer more loss than fields located close to habitation. At lower elevations, most damage occurs in June and July after the maize or wheat has ripened (although some loss occurs in early spring when birds and deer feed upon seedlings). Nearly all families have to guard their fields for about 30 days per year to discourage daytime raids by monkeys and pheasants, or night-time forays from wild pig, bear and barking deer. Systematic, preserve-wide surveys of crop loss to wildlife have not been conducted, but a survey of several villages in Kyirong County's Jianguan Core Area indicated that 5-22 percent of the maize, barley and wheat production was lost to wildlife in 1990 (Jackson 1991). Economically, this loss was estimated at an average of US \$ 53 per household within the more seriously affected communities. Over the years, local residents have employed a variety of crop protection measures, but none have proven fully effective short of enclosing fields with well-constructed stone walls or metal fences of sufficient height and strength to withstand entry by wildlife. Obviously such barriers are no deterrent to birds or monkeys, and damage-prone fields can only be protected by the presence of humans and vigilant daytime guarding. Since almost all crop damage occurs at night, most households have to guard their fields from dusk to dawn during the time crops are vulnerable to damage. Prior to the establishment of the QNP, marauding animals were usually trapped, or shot and killed whenever the opportunity arose. In some places, however, hunting was prohibited on religious grounds by local institutions and revered lamas.

At higher elevation, and within the dry rain-shadow area where forage is notably scarce, blue sheep and kiang visit cropland to feed upon emerging barley shoots from late May through July. Thus, barley loss was estimated at up to 40% of the annual production in Ngora and Khoryak which are located within the Periphery Zone of Nyalam County. These 60-odd households irrigate some 400 mu of river-bottom land in which most fields are scattered widely and located far from each village. At an household level, barley losses ranged from 90 - 1,360 kg, with the total crop loss being valued at US \$ 12,200 (an average of about \$185 per household), although actual losses varied widely between the two settlements and different households (The Mountain Institute 1997). In most years the County administration is obligated to provide supplementary food for both people and livestock. In 1995/1996 the situation was greatly exacerbated by a severe winter, the worst on record since 1972, during which as much as 70% of the livestock (mostly sheep and goats) perished.

Damage prevention measures employed by these villagers have included the use of such passive deterrents as stone scarecrows, stone-pillars linked with rope, prayer flags or plastic bags, as well as more active measures such as the use of fire and smoke, shooting of guns in the air or the setting off of blasting dynamite. All guarding was done on a family-by-family basis, but since 1994, when wildlife intrusions increased significantly, the villagers resorted to community-based efforts to keep animals out of their fields. Fines were levied against those persons who failed to prevent damage, in an amount

equaling the incurred crop loss. An average of 26 persons were needed to guard the widely-spaced fields each night, thus adversely affected other labor-demanding activities.

3.2 Livestock Depredation: Conflict between livestock owners and predators dates back 9,000 years to the time when animals were first domesticated by humans -- it is not a recent phenomenon caused by the establishment of nature preserves or wildlife protection laws as commonly believed. Before modern firearms and traps were available, herders developed simple but effective traditional methods for minimizing loss of livestock to wild predators like snow leopard, wolf, wild dog, brown bear, lynx or forest leopard. These included maintaining a close watch over livestock while it was being grazed on the open range, avoiding predator-rich habitat, using good guard dogs and sheep or goat breeds with well-developed anti-predator traits, and keeping livestock in predator-proof corrals at night. While predation rarely affects the local economy, it can lead to very negative attitudes to wildlife conservation among herders (Oli et al. 1994). Erosion of traditional knowledge, reduced herder vigilance, increased livestock numbers, and changes in animal husbandry management systems have aggravated the situation. Domestic animals now far outnumber natural food items of predators like blue sheep, musk deer or even marmot, increasing the likelihood that predator and livestock will come into direct contact with each another.

Little is known about the extent, cause and distribution (geographical or seasonal) of livestock predation in QNP and elsewhere in Tibet, although some general patterns are emerging. One survey of livestock loss in eight settlements in QNP reported loss rates ranging from none to as much as 9.5% within some depredation "hot-spots," although most herders lost less than 1-2% of their livestock to predators (Jackson 1991, Table 1). In economic terms, losses amounted to an average of US \$ 25 per household for affected communities. Loss rates differed according to the kind of livestock involved, with sheep, goats, young yak and horses being most vulnerable because they are either small or are left unattended on the open range for extended periods of time. Losses are rarely, if ever, evenly distributed among the different households of a particular village.

The worst-case scenario involves "surplus killing," or catastrophic incidents involving a snow leopard or wolf that enters a poorly-made livestock pen during the night, becomes confused and then kills as many as 50-80 goats or sheep. Ironically such loss could be entirely avoided if corrals were properly constructed in the first place. Typically, the poor 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. This is a notable problem among large-bodied livestock like yak which usually put up a fight when attacked by a predator.

Although predation loss varies seasonally and year to year, winter is usually the period of greatest concern. Jackson et al. (1996) found that depredation was not evenly distributed, but rather associated the 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. Snow leopards which bring their cubs to a kill may be reinforcing the taking of livestock as prey, although the tendency of snow leopards to remain at a kill and consume all available meat increases their vulnerability to human retribution.

Achieving a balance between the needs of people and wildlife in Tibet is vital, and toward this end ways must be found for minimizing the loss of livestock to wild predators. Miller and Jackson (1994) discuss ways in which the livestock industry could be better integrated with wildlife protection and management. The snow leopard is a first-class protected species in China, as well as an internationally endangered species that occurs in 11 other Central Asian countries. The management of protected areas can only be effective and sustainable if the needs and aspirations of local people are taken into account, although park authorities will need to enhance the natural prey base or risk losing large mountain predators like the snow leopard, wolf, wild dog and lynx. Dependence upon uninhabited areas as the principal places for maintaining viable populations of snow leopards is not an effective conservation strategy for several reasons. First, there are very few places that are not used by people, especially seasonal or semi-nomadic livestock herders. Secondly all existing protected areas are far too small to support viable numbers of snow leopard. Thus, there is a critical need to establish and maintain genetically functional corridors linking the network of protected areas.

The snow leopard could possibly serve as a “barometer” for assessing mountain environmental health and biodiversity conservation. It is also seen as a “charismatic megafaunal” species about which worldwide attention can be attracted and funding solicited for promoting more positive people-wildlife attitudes. In any event, there is a critical need to better involve local residents in park management and stewardship, as discussed in the following section.

4. PEOPLE-WILDLIFE MANAGEMENT STRATEGIES AND LESSONS LEARNED

The Mountain Institute and QNP’s Management Bureau have collaborated with local government and people since 1996 to help resolve conflict due to crop and livestock damage. Using participatory training workshops as a forum, the two communities of Ngora and Khoryak served as a pilot for designing and testing a remedial program that could be applied elsewhere in QNP and Tibet. The workshop was attended by QNP staff from each of the four counties within the Preserve, selected core area village forest leaders and guards, and local officials and village leaders. Khoryak and Ngora were selected because of the high levels of damage and the willingness of residents to conserve wildlife. The primary goals of the "hands-on" training workshop and villager participation exercises were to explore ways of alleviating crop damage and improving the affected community's livelihood, as well as strengthening nature conservation. Specific objectives were to: (1) Increase crop production by identifying and implementing cost-effective ways of reducing crop damage due to kiang and blue sheep; (2) Promote environmentally responsible and socially acceptable income generation opportunities; (3) Protect wildlife in accordance with QNP’s laws and regulations; (4) Train QNP managers and villagers in participatory resource assessment, planning and management using tools like PRA (Participatory Rural Appraisal), APPA (Appreciative Participatory Planning and Action) and wildlife inventories; and (5) Prepare a funding proposal to implement, monitor and evaluate recommendations made by workshop participants.

The first few days of the workshop were devoted to learning from the villagers themselves about their concerns and how they could improve their livelihoods or increase self-reliance, while better protecting

wildlife and sustaining other natural resources of the surrounding area. Workshop participants then reviewed, discussed and evaluated this information according to QNP's laws and evolving criteria for resolving wildlife-related crop and livestock damage. This was followed by the development of a collaborative Action Plan, in which damage alleviation and income-generation plans are detailed with respect to specific activities, costs, anticipated outputs, indicators, measurement methods and allocated responsibilities. Reciprocal contributions are made by each stakeholder group (village, QNP Management Bureau, County and Shang administration, and international donor).

In the case of Ngora-Khoryak, the workshop participants and villagers decided that the best option for reducing or eliminating crop damage involved construction of a 7.6 km metal fence, while weaving training would enhance each household's ability to generate income. Total project costs were estimated at US \$ 9,000 for fencing and \$3,000 for the weaving subcomponent. The plan called for cost-sharing from all stakeholders. Ngora and Khoryak residents contributed their labor and accepted responsibility for maintaining the fence in good repair. The QNP Management Bureau provided skilled persons to supervise fence construction, while Nyalam County and Yarleb Shang transported fencing materials from Lhasa to the site and further contributed \$ 1,800 towards the project's overall cost. QNP funded some fence construction. The Mountain Institute assumed the responsibility of securing outside project funding, which was provided under the Canada Fund for Local Initiatives (Beijing) program. In addition to contributing up to \$ 5,000 to support handicrafts and ecotourism development, TMI agreed to provide technical input and assist QNP's Office of the Working Commission in Lhasa with project monitoring, reporting and financial accounting.

Among the accomplishments to date is the construction of 8 km of fencing which encloses over 80% of each village's fields. Crop production in the year following fencing increased by 61% in Khoryak and 25% in Ngora, clearly indicating the heavy loss each suffered from wildlife depredation to date. However, some of the increased barley crop was attributed to new land brought under cultivation. The more modest increase in Ngora reflects lower levels of wildlife damage and less new cultivation. Both settlements were able to increase winter forage production for livestock, which will hopefully ameliorate the effects of harsh winters, like the one they experienced in 1995-96. The increased barley and fodder production will greatly help reduce the local people's dependency on the government for annual grain supplements.

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 that they were eager "to work harder in the fields, as their efforts were no longer wasted." Feelings toward wildlife have improved markedly, as indicated by a widespread comment, "we love the wildlife." In order to retain these gains, villagers will have to ensure that the fence is properly maintained. Toward this end, they have started a small

community fund capitalized from imposed fines and income from handicrafts production. It is still too early to report on the handicrafts activities, although the community has obtained county assistance and recently opened a small production unit on the main highway, 25 km to the east. Finally, the agreement signed by the villagers with QNP 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 pending, but it is hoped that future tourism development will offer locals with the opportunity to rent pack animals and horses for special treks to the Shishapangma base camp, giving tourists the chance to view wildlife along the route.

Such “hands-on” training workshops could be easily replicated in other locations and protected areas. 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. This manual was developed as a direct output from these training workshops. Written both in Chinese and Tibetan, it describes how to undertake baseline surveys, assess and prioritize damage, and then negotiate signed reciprocal agreements with local communities to beneficially link conservation and income-generation activities so that local dependence upon and impact on marginal natural resources is progressively reduced. By involving local people in preserve management, QNP is 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.

5 Summary

Other lessons learned from the project in Nyalam and subsequent activities in Kyirong County may be briefly summarized as follows:

(1) Protected areas management is best accomplished through an iterative county and village-level “micro-planning” process, in which local resource management capacity is built using participatory tools like PRA (Participatory Rural Appraisal) and APPA (Appreciative Participatory Planning and Action). Environmental and socio-economic conditions vary widely in QNP so that locally crafted approaches and solutions are needed; these have the added benefit of encouraging and facilitating local participation at planning and implementation phases. PA management plan is a long-term, on-going process which takes time. Initial efforts should therefore focus on the key threats to biodiversity conservation, on developing co-management agreements with willing communities that could be serve as examples for others to follow, and on emphasizing the participatory management of core and buffer zones and their contained resources. By careful sharing of Preserve management with local people, the PA management authority will be better able to cost-effectively achieve biodiversity conservation and draw upon resources that would not otherwise be available;

(2) Sound baseline data are key to developing socially and ecologically effective management prescriptions that address key threats to biodiversity. Therefore, surveys and inventories must be undertaken before plans can be developed;

(3) Support for income-generation and community development must be linked to sustainable resource management actions by communities, using signed agreements as a vehicle to identify each stakeholder's contribution, responsibility and means for verifying their compliance;

(4) Projects which make outright or unilateral gifts of cash, materials or other resources have a very high failure rate. Experience shows that long-term involvement and commitment is directly related to the willingness of affected communities to equitably resolve disputes, to promote self-reliance, to share fairly in project cost and maintenance (by providing free labor or materials), and to play a leading role in project design, implementation and evaluation. The importance of building local ownership and capacity for resource protection, conservation and sustainable utilization cannot be under-emphasized.

(5) Finally, monitoring is a critical component of any successful PA management, and should be based on measurable indicators applied by all key stakeholders. Where carefully designed and implemented, monitoring allows projects to reliably measure their progress and refine specific activities as needed, in order to better meet targeted objectives.

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