Rangeland, Animal Husbandry and Wildlife in Annapurna, Nepal: A Case Study from Manang Valley

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Abstract
Like many traditional pastoral societies in the Himalayas, the traditional pastoral systems in the upper Manang (Nyeshang) Valley are currently undergoing substantial change as a result of external influences related to modern development activities, and this is affecting the age-old balance between herbivores and plants. The changing patterns of land use in the valley have led to a fluctuation in livestock and wildlife numbers over the past several decades. At present, local elimination of the wolf and an almost complete cessation of hunting of blue sheep have led to an increase in the number of blue sheep. It would be of interest to monitor the impact of the changing numbers of wildlife and livestock on the vegetation composition and productivity of these remote wild lands, and thereby on the whole functioning of the ecosystem. Recently, the King Mahendra Trust for Nature Conservation's Annapurna Conservation Area Project (ACAP) has focused on the collection of multiyear data on rangeland, livestock, and wildlife. These data will be used to identify the patterns of dynamics of the wild and domestic animal population, and will allow the project to correlate fluctuations with predator (e.g., snow leopard) abundance and or other ecological parameters (e.g., rangeland quality). This long-term research and monitoring approach, designed as an essential part of the array of ongoing conservation and development activities, is expected to enable assessment of the impact of the project in the region, and provide sufficient feedback to make corrections and refinements.

Background

In the high mountains of the Himalayas, the continued presence of an assortment of wild ungulates, their domestic relatives (the livestock), and their mammalian predators, is a clear indication that wild animals and livestock can co-exist (Fox *et al.* 1994, Miller and Jackson 1994, Schaller 1998). For the past several centuries, grazing of livestock has been the dominant human land use in these remote high altitude valleys. However, many of the traditional pastoralist systems are currently undergoing substantial change as a result of external influences related to modern development activities, and this is affecting the age-old balance between herbivores and plants (Miller 1987), and thereby the whole predator-prey system. To date, only a few studies have been made on the ecological interactions between the region's pastures and wildlife in the light of changing land use and modern development activities, although interest has already begun to grow (Miller and Bedunah 1993, Fox *et al.* 1994, Fox 1998).

The upper Manang Valley is a dry alpine landscape, and is a transition zone between the moist southern Himalayan slopes and the high desert steppes of Tibet. This valley is also known as Nyeshang and comprises the villages of

Khangsar, Manang, Brahka, Ghyaru/Ngawal, and Pisang (Pohle 1990).[18] The abundant pastures of upper Manang have long supported the traditional herding of yaks, yak-cow crosses, cattle, and sheep and goats. Thus, livestock are and continue to be the major source of livelihood for the agro-pastoral communities of Manang. Unlike other settlements along the northern fringe of Nepal, Manang has never been a major trading link between Tibet and Nepal. Even so the inhabitants of Manang have been active in trading abroad for a long time. By 1940, most traders were able to invest in their homeland, especially after retirement. Traditionally-minded traders spent their entire capital establishing yak herds and flocks of sheep and goats bought from nearby Mustang and Dolpa districts. Livestock numbers rose between 1940 and 1960, and the pressure on the habitats of blue sheep may also have increased. This was followed by the decimation of blue sheep populations by Khampas, the freedom fighters who fled Tibet following the Chinese exertion of full control over Tibet in 1959. Hence, during the 1960s and early 1970s, there was a drastic decrease in blue sheep numbers in the entire Manang and Mustang trans-Himalayan areas, as well as of the large wild predators such as wolves and snow leopards. The Nyeshang Valley, for example, now has no resident wolves (Fox and Ale unpublished). The Nepalese government in 1973 eventually stopped the activities of Khampas.

The period between the 1960s and the early 80s was a period of mass migration. Almost two-thirds of the population migrated out of the valley to Kathmandu, the capital, and other urban areas. The livestock numbers subsequently decreased dramatically, thus the pressure on the pastures and wild ungulates. The traditional village committees also banned the hunting of blue sheep during this period. The combination of a reduction in livestock numbers, elimination of wolves, and an almost complete cessation of hunting, has apparently led to an increase in the blue sheep population within upper Manang in recent years (Fox and Ale unpublished).

For the past two decades, the Nyeshang Valley has been developing as one of the most popular trekking routes in Nepal, because of its spectacular scenery and culture, attracting some 15,000 trekkers annually. Since the 1990s, the valley has drawn the attention of government and non-government projects, e.g., Ghenjyang Irrigation Project, a multi-million rupees government project that is trying to bring a massive portion of abandoned lands under irrigation particularly in Manang village, and construction of a huge Buddhist monastery in Ngawal, being some of the examples. The ACAP has also been actively involved in community-based conservation and development work since 1993.

All these development activities have made the valley once more attractive, and, as a result, several households have now returned to Manang, raising the spectre of an increasing livestock population. There is concern that the pressure on wildlife habitat may once again be increasing. Clearly, over the past several

[18] Nyeshang Valley is culturally distinct from other regions of Manang District such as the Nar region to the north and Gyasumdo region to the east (Pohle 1990). This paper addresses trends in Nyeshang Valley only and does not reflect the situation in the remote northern portion of Manang District, comprising the villages of Nar and Phu, which have not been subject to the same pace of socioeconomic change evident in Nyeshang.

decades these major changes have affected the traditional lifestyle, land-use practices, and the array of wildlife occurring there (Fox and Ale unpublished). There is a need to substantiate these socioeconomic changes and the impacts they have had or continue to have on the rangelands and on the whole functioning of the ecosystem.

Rangelands and Traditional Pastoralism

Rangelands comprise approximately 12% of the total 1,914 sq.km. area of Manang district; a further 80% of the district is barren rocks and snow-covered mountains. The upper Manang rangelands consist of scrubland vegetation at an average altitude of 4,039masl, and alpine grasslands, at an average altitude of 4,563 masl. The vegetation cover for grasslands ranges from 51-100%, more than for shrublands. Sedges like *Carex* and *Kobresia* and grasses such as *Calamagrostis* and *Stipa* dominate the alpine grasslands. These grasses/sedges comprise two-thirds (66%) of the total species' composition. The remaining vegetation cover (34%) of the grasslands is comprised of herbs and forbs, the five most dominant species being *Bistorta macrophylum, Cortia depressa, Tanacetum nubiganum, Potentilla* sp, and *Leontopodium himalayanum.* The four most dominant genera of the scrublands are *Juniperus (J. indica and J. squamata), Rosa (R. sericea), Berberis,* and *Lonicera.* The vegetation cover of the shrublands ranges from 26-50%. Herbaceous cover is low for shrublands. However, one can notice some grasses (dominant being *Calamagrostis* sp, *Danthonia cumunsii,* and *Koeleria cristata*), but only among dense thorny bushes and on steep rocky terrain; and hence inaccessible to livestock. Scattered throughout the open areas of the shrublands are less palatable herbs and forbs. Among them *Cremanthodium arnicoides, Tanacetum nubiganum, Aster* sp, *Ajuga bracteosa,* and *Thalictrum elegans* are the most dominant species (Ale 1993).

These grasslands and shrublands support livestock and an array of wildlife that characterise the upper Manang trans-Himalayan ecosystem. The shrublands are clearly more grazed/browsed than the alpine grasslands because of their closer proximity to villages and the possibility of access during winter months. However, these lands may not be overgrazed. One way of determining whether rangelands are overgrazed is to look at the health of the livestock and large wild herbivores (in this case blue sheep) that graze and browse there. The blue sheep and livestock in upper Manang are healthy and robust, at least during the summer months.

Knowledge about land use and the impact of different land-use practices is of fundamental importance to Manang's livestock, wildlife, rangelands, and agriculture. Grazing is an important land use and has a functional relationship with the agricultural, economic, social, and religious activities; it also influences the survival of the region's wildlife (Miller 1987; Brower 1991; Fox *et al.* 1994; Fox 1998). The abundant pastures of upper Manang have long supported the traditional herding of livestock. Traditional animal husbandry practices illustrate the operation of land-use controls that permit sustained livestock production in constrained conditions.

The most important constraint to keeping livestock in these semi-desert lands is the availability of winter forage. In a landscape of marked relief, where

cultivable ground is scarce, cropping for direct human consumption certainly takes precedence over cultivation of fodder. Nevertheless, hay fields are maintained throughout the valley. Even so supplementary feeding in the form of hay and crop residues is small and not generally enough to last the winter, so livestock must depend on what the land offers in terms of grazing resources. Although summer grazing is luxuriant, it is only possible for a few short months, and then begins a long harsh winter that almost always exhausts the stored supplementary feed. This essentially means that animal numbers must be in balance with winter feed limits. In Manang the response of farmers and pastoralists to this has been to create a detailed set of social rules and regulations for grazing. The mechanism for regulation of grazing is operated through land tenure arrangements and communal controls over common land resources. Seeking to limit risks, the pastoral production system is based on flexible strategies which allow people to take advantage of the seasonal rangeland condition.

Community-imposed restriction of access to common lands is an important strategy which has played a crucial role in maintaining sustainable use of the available forage resources. One such rule forbids cutting premature wild grasses on communal lands. Such rules are so firm that they have become social lore. The community schedules the livestock movement in such a way that critical winter grazing lands are protected for the duration of the growing season. The key to this control is the '*Tohsom*' system. *Tohsom* literally means field-watcher. The *Tohsom* committee consists of a varying number of members depending on the size of the village and the lands under cultivation. Every year, before the onset of growing season, this committee is organized by the village committee and is automatically dissolved at the end of the growing season. Livestock must leave the village by the date set by the committee members. The livestock are thus pushed higher with the onset of the rains and the first green, thereby protecting forage around the village for the winter. This thus ensures rotational grazing between the high pastures located between 4,000 to 5,000 m and the fields around the villages (3,500 m), thereby maintaining the balance between existing, but scarce, resources in both high and low areas. Such complex, but flexible animal husbandry practices, which mediate the effects of grazing animals on the rangelands, have helped to maintain the equilibrium between livestock, landscape, and wildlife.

Such indigenous practices may explain the continued existence of large herds of blue sheep on high pastures in many areas of the Himalayas (see also Brower 1990, 1991; Furer-Haimendorf 1983). Also, the biomass of livestock in some parts of Manang Valley has been reported to be three times that of blue sheep (Jackson *et al.* 1994), suggesting unavoidable livestock depredation (Oli 1992; Ale 1994). At the same time, livestock may be helping to sustain the population of predators, such as the snow leopard, in the valley (Jackson *et al.* 1994).

Today traditional land-use patterns are constantly changing in the face of increasing economic, social, and political forces, thus clearly affecting the balance between resource users and the limited resources available. Trade and tourism are the two factors that have affected the traditional lifestyle of inhabitants of upper Manang. Their involvement in international trade affected

their traditional lifestyle and subsistence occupations, particularly livestock husbandry, which in turn affected their ability to invest in the tourism industry. Contrary to the popular opinion that increasing prosperity leads to an increase in livestock holdings, these socioeconomic changes have led to a steady decline in livestock numbers. In 1994, the population estimate was only around 5,400 head of livestock (62% small ruminants) for the entire upper Manang Valley. Prior to the 1960s, Manang village alone had approximately 500 cattle and more than 3,000 sheep and goats. By 1996, sheep and goat numbers decreased by 25%. Yaks also declined in number by 1996 in comparison to the 1960 figure, for instance, Khangsar (500 vs. 100), Brahka (200 vs. none), Ghyaru/ Ngawal (200 vs. 80), and Manang (700 vs. 300). A change in livestock ownership pattern has also occurred. In the past many owned a few livestock; the present trend is for a few to own many livestock. Along with these changes has been a decline in importance of social systems such as the *Tohsom* practice in smaller villages such as Ghyaru and Pisang, although still functional in the larger villages such as Manang proper.

Research and Monitoring

No attempt has yet been made to collect any systematic data on the region's wildlife and other natural elements. An initial inventory of all the mammalian species in the region is a prerequisite if we are to address the relevant issues raised above. The ACAP has recently started a research and monitoring scheme in Manang Valley on rangeland condition and wildlife status to keep track of changes and their possible impacts on predator and prey population dynamics. The long-term goal of this research and monitoring aspect of the project is to support ACAP's database and thus help to conserve and manage the region's wildlife and the rangelands. The major objectives over the years are as follow.

- Monitor blue sheep numbers and snow leopard abundance
- Study the prey-predator relationship
- Conduct field experiments to study forage competition, behavioural interactions, and the various effects of grazing in different micro-habitats
- Monitor livestock number
- Examine trends in the vegetation composition and productivity of the rangelands

The research and monitoring work is designed as a joint venture between the ACAP and the Earthwatch project, USA. Experts from the University of Chicago at Illinois, USA, are involved in designing the project by means of which in-country expertise is being developed for the sustainability of the monitoring scheme.

Starting in 1999, an initial inventory of the mammalian species in the region was initiated with the Earthwatch Project. Since direct observation of larger species such as blue sheep and livestock (e.g., yak, cattle, sheep, and goats) in open valleys such as Manang is not a problem, the research team used direct visual observation (cf. Sinclair 1985, Fox *et al.* 1994). They also used standard indirect methods (trapping, sign search) for elusive species (e.g., snow leopard, rodent), followed by intensive visual observation for recording spatial distribution, habitat selection of blue sheep and livestock using categorical

habitat types, and other behavioural patterns (e.g., vigilance). Future methods used to address the questions of competition will include assessments of habitat partitioning, resource partitioning, and behavioural patterns in various habitats. Although some visual techniques for food selection are possible, scientifically sound faecal/pellet analysis for both blue sheep and livestock will be done. This will also be done to see the diet composition, primarily of snow leopards, over the years (see Oli 1991). Grazing enclosures will also be constructed in places to document the influence of different domestic and/or wild species on vegetation productivity and composition. To study the behavioural interaction of predator-prey, we will conduct vigilance observations and manipulative foraging experiments for the prey community. This will require constant monitoring of blue sheep, livestock distribution through direct observation, and of snow leopards through indirect methods during the research period.

The preliminary 1999 Manang data revealed a mean density of 5.9 blue sheep per sq.km in a total study area of 61.2 sq.km, which is comparable to the figures from earlier studies (Fox and Ale, unpublished).

Previously, the ecosystem theory related to food chain dynamics suggested that carnivores generally regulate herbivores (Hairston *et al.* 1960). However, more recent revision of this theory (Oksanen *et al.* 1981) in relation to productivity of environments suggests that in areas of low productivity, the predator component may not be abundant enough to regulate herbivore populations. This leaves the natural system dominated by an essentially plant-herbivore (two link) trophic relationship (Fox 1995). Strong evidence for just such a two-way link relationship in low productivity areas has been provided by Messier (1995). Within the context of Manang Valley, the predator (snow leopard) may play a tracking, not a regulatory, role in ungulate (blue sheep) population dynamics, which would mean that the natural ecosystem of Manang could be a two-trophic system. Whether snow leopards regulate the prey population has yet to be addressed.

Over the past several decades, the livestock number in this valley has fluctuated (see above). The actual effects of these changes on the dynamics of the blue sheep, their habitat, and wild populations of snow leopard in the long run are important, and it is important to understand these in order to formulate proper policies for sustainable biodiversity conservation in the region. More extensive studies have been done in African ecosystems than anywhere else (Jarman 1974; Sinclair 1985; Sinclair and Arcese 1995). The basic ecological questions, such as range-use patterns by wild and domestic ungulates, selection of grazing habitats, and anti-predator behaviour addressed by the proposed project, will definitely enhance our understanding of the natural systems.

Multi-year data are expected to reveal patterns in wild and domestic animal population dynamics, allowing researchers to correlate fluctuations with predator abundance or other ecological parameters (e.g., rangeland quality), thus showing the status of the ecosystem in general. It will not be possible to include all species in management plans; management for biodiversity may be achieved by focusing on indicator species that can act as surrogates for the larger community. This strategy requires the monitoring of populations and

development of long-term habitat suitability indices for species that are known to be sensitive to stresses like habitat fragmentation, overgrazing, or other kinds of degradation (Meffe and Carroll 1994, Morrison *et al.* 1992). Selecting indicator species is a difficult task because the population dynamics of the indicator species chosen is usually 'noisy'. For example, long-lived species may persist in altered or sink habitats for decades but not reproduce, thus falsely indicating habitat quality. The population of indicator species should be relatively easy to observe and monitor to track the species' population dynamics. An animal with the ideal combination of characteristics may be hard to find. Given the constraints, I suggest that blue sheep may be a possible indicator species for the trans-Himalayan ecosystem. This choice is mainly based on the fact that they are relatively large and conspicuous and hence their population dynamics can be examined in detail without much difficulty.

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