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Sunil Nautiyal, K. S. Rao, Rakesh K. Maikhuri, and Krishna Gopal Saxena

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A Case Study in the Buffer Zone

In the past, transhumant pastoralists in the Indian Himalaya used resources available in various subsystems for their livelihoods. Recent sedentarization of a section of the transhumant pastoralist population resulted in competition with the existing sedentary population for resources in some areas. Resources such as grazing areas and forests are becoming less productive and can no longer cover growing demand (both human and livestock). In the Niti valley (Nanda Devi Biosphere Reserve [NDBR] buffer zone), changes in government policies during the past 50 years have produced a land-use system that is not conducive to traditional transhumant pastoralism. The present article analyzes the impact of loss of grazing area on transhumant pastoralism, the current state of monetary return from livestock rearing, and the output–input ratio in terms of energy currencies in villages inhabited by transhumant pastoralist populations and villages now practicing sedentarized lifestyles. Although small ruminant-dominated animal husbandry is providing monetary benefits to local populations, the system is consuming more resources than it produces in terms of energy currencies. The prospects for transhumant pastoralism in the buffer zone villages of NDBR are discussed.

Keywords: *Biosphere Reserve; land-use change; mountain rural economy; transhumant pastoralism; Nanda Devi; Himalaya; India.*

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Introduction

All societies use animals as providers of food, protein, draught power, etc. But nomadic, seminomadic, and transhumant pastoralist societies have lifestyles that revolve mainly around their livestock (Brower 1991; Kuznar 1991; Cincotta et al 1992; Farooquee 1998; Rao et al 2000). The transhumant pastoralist societies inhabiting the high Indian Himalaya exploit the seasonal abundance of grazing resources. The Tolchha subcommunity of Bhotiyas (an Indomongoloid ethnic group), who inhabit the settlements forming the buffer zone villages of the Chamoli part of the Nanda Devi Biosphere Reserve (NDBR) (Figure 1), are undergoing rapid assimilation into the sedentary population (Khasa ethnic group, Garhwali population). Although such changes are also reported for other

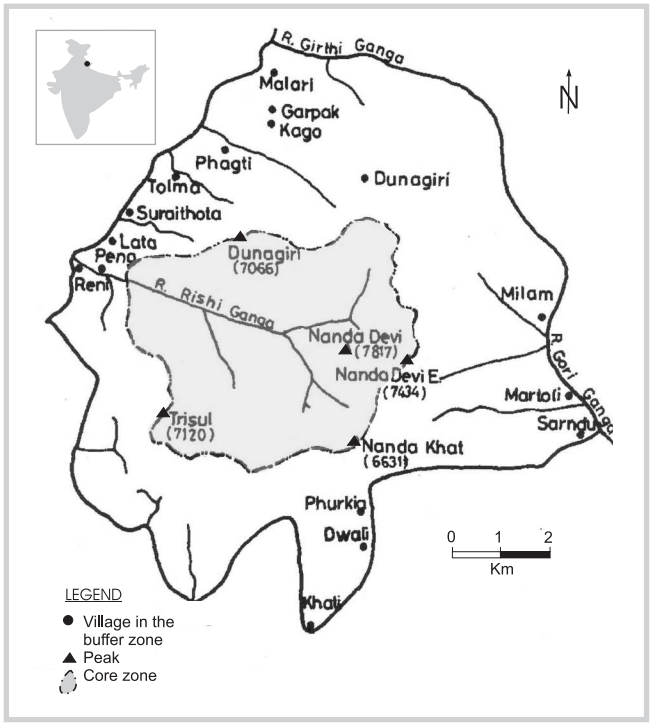


FIGURE 1 Sketch of the NDBR in Uttaranchal, India. (Sketch by authors)

transhumant communities in the region (Shashi 1979; Brower 1991; Farooquee and Nautiyal 1996; Farooquee 1998; Saberwal 1999) and elsewhere (Meir 1987; Casimir 1991; Kuznar 1991; Cincotta et al 1992), the impact of changing land-use policies on livestock populations and the transhumant way of life has not been fully assessed.

Nomadic pastoralism and transhumance are based on efficient use of seasonally abundant resources in marginal environments without degradation. They thus require the support of local policies to continue within carrying-capacity limits. The present article examines the impact of conservation policies on livestock husbandry, population fluctuations over a period of 3 decades, and changes in ownership structures in a representative high-altitude village with transhumant pastoralist households (Dronagiri) and a representative low-altitude village where households are undergoing rapid sedentarization (Lata), in the Chamoli part of the buffer zone of the NDBR. It also attempts to analyze the monetary returns and output–input ratio in terms of energy currencies for various categories of animals and the current contribution of livestock rearing to the livelihoods of local inhabitants.

The study area

The NDBR extends across 3 administrative districts (Chamoli, Bageshwar, and Pithoragarh) of Uttar

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Pradesh State (UP) (now Uttaranchal). The area was declared a National Park in 1982 and a Biosphere Reserve in 1988, including buffer zones. The area has a unique combination of ecosystems, including mixed temperate forests, alpine meadows, glaciers, and high mountain peaks. It consists of a core zone of 624.62 km^2 surrounded by a buffer zone of 1612.12 km^2.

Land-use pattern

A total of 17 villages are situated in the NDBR buffer zone. The Tolchha subcommunity of the Bhotiya group inhabits 10 villages of Chamoli district in Garhwal region, which are included in the present study. The other villages are inhabited by the Joharia and Nakuria subcommunities of Bhotiyas and form the buffer zone villages of Pithoragarh and Bageshwar districts in Uttaranchal State. The population of the 10 villages studied was 2253 in the 1991 census. The villages of Reni, Peng, Lata, Phagti, Laung, and Tolma are now permanent settlements, and the 1299 people in these villages only send their livestock to the alpine pastures during the summer under the supervision of a few shepherds (nomadic pastoralists). The other 4 villages (Dronagiri, Kaga, Garpak, and Malari) are summer settlements only, and their 954 inhabitants move to settlements in the lower valleys away from the buffer zone in winter. These people practice traditional transhumance, with entire households migrating to lower valleys in winter and to summer settlements in summer. The livestock in these villages also move with the family. Rainfed agriculture is practiced, with 3 crops in 2 years in villages now settled and 1 crop during summer in villages practicing transhumance. In addition to agriculture and livestock rearing, economic activities such as medicinal plant cultivation have also been taken up recently (Maikhuri et al 1998; Silori and Badola 2000). The main features of representative villages are given in Table 1.

Changes in land rights and policies

Most of the areas inhabited by the Bhotiya communities were peripheral to existing political entities before and during British rule in India. After Independence the situation did not change until 1960, when abolition of the UP Zamindari Act of 1947 was implemented in the region, and cultivators of the land were given ownership rights. Implementation of this policy left the transhumant pastoralist population without land in their winter settlements and with some permanent holdings only in their summer settlements (Rawat 1991). In transhumant pastoralist summer settlements, people adopted a sedentary lifestyle where climatic conditions permitted it. But the transhumant pastoralist populations of other villages continued to practice traditional transhumance as best as they could. Because transhu-

TABLE 1 Main characteristic features and livestock population for the 2 villages representing the lower- and higher-elevation regions in the NDBR buffer zone.

Parameters	Lata	Dronagiri
Number of households	86	43
Area (hectares)[a]		
VanPanchayat	1994.00	—
Agriculture	59.7	16.2
Community land	90.5	—
Barren	—	10,621.2
Government forestland	89.0	12.8
Government land	79.3	26.88
Pasture	94.0	—
Population		
Total	457	247
Adult male	150	102
Adult female	141	80
Children below 14 years	166	65
Altitude (m)	2400	3600
Transhumance	Not practiced	Practiced
Cropping pattern	3 crops every 2 years	1 crop per year
Main occupation	Agriculture	Agriculture
Subsidiary occupation	Animal husbandry	Animal husbandry
Number of cultivated agricultural crops per year	14	10
Livestock type		
Bullocks	105	40
Cows	63	33
Calves		
Male	32	0
Female	48	19
Goats		
He-goat	8	441[b]
She-goat	102	263
Kid	36	132
Sheep		
Ewes	270	490
Rams	8	40
Lambs	79	284
Horses	1	31
Mules	2	0
Dogs	9	4
Poultry	16	16

[a]Area as per Revenue Department.
[b]Three hundred ninety-eight goats are used as pack animals.

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mant pastoralist populations had no land rights in the lower valleys, they began to stay the entire winter in one of the villages where they had only camped in earlier times. Thus, some transhumant pastoralist households from Dronagiri village now inhabit Maithana, Pursani, Ghat, and Birhi villages rather than collectively going to Chor Pani (grazing lands and forest near Rishikesh), where they used to camp in earlier days. These villages inhabited by the Garhwali population face a scarcity of fuel, fodder, and other subsistence resources, and the influx of a transhumant pastoralist population puts additional stress on dwindling resources. Although the small ruminants of transhumant pastoralist households are sent to grazing areas and forests in the Terai (eg Chor Pani) under the supervision of shepherds, their cattle stay in villages and graze in village commons and forests with the livestock of the sedentary Garhwali population. The annexation of Tibet by China in 1959 and the Indo-China war of 1962 closed transborder trade and transhumance to Tibet, and people adopted a lifestyle exclusively dependent on livestock, which now provides about 60–80% of the total household income (Rao et al 2000; Silori and Badola 2000) in the buffer zone villages of the NDBR.

Methodology

Data collection

A detailed review of land-use policies applicable in the region was carried out from available records and government documents. Next, a detailed questionnaire was developed for a complete survey of the 10 study villages to assess the livestock holding systems (numbers of animals in each category), source of fodder, grazing area available or used, annual livestock management practices, etc. Data were collected over a period of 2 years (1994–1996) by conducting door-to-door surveys. Although information was available for all 10 villages, data from only 2 representative villages (Dronagiri, a high-altitude village with transhumant pastoralists, and Lata, a low-altitude village with sedentarizing pastoralists) were used to depict the trends in the buffer zone villages of the NDBR. Government records were consulted to assess livestock population changes in the past 3 decades and verified with the data recorded from the households.

Calculation of energy requirements

Feed requirements were assessed based on values given by Ranjhan (1977) of standard food energy requirements for each animal category in the Indian mountains. The amount of feed or fodder collected and used for stall-feeding was estimated from stocks in each household, from information supplied on feeding practices, and from actual field sampling on community lands and agricultural lands. Human energy invested in livestock management was estimated based on the actual time spent for each activity (logged by a research team working for their doctoral degrees during the 2-year period in households selected to represent those still practicing transhumant pastoralism and those now practicing sedentarized lifestyles) by adult males and females, and children. Time was converted to energy using standard values given by Gopalan et al (1978). For meat-producing animals (sheep and goats), the weight gained by each category of animal at the time of slaughter was used to calculate annual meat production, and the values thus obtained were corrected using dressing percentages of 75% and 70% for goats and sheep, respectively. This value was converted to an energy value using the standard values (Gopalan et al 1978). For draught power, the standard value of 3.03 MJ per bullock hour was used, as suggested by Mitchell (1979). The quantity of dung or manure production per animal in each category was based on actual observations and converted to an energy value using the standard values (Mitchell 1979).

Calculation of monetary values

The values of inputs and outputs were converted to monetary terms to estimate the output–input ratio using prevailing wage rates for human and animal labor and commodity prices for manure, feed, meat, etc. To estimate the grazing intensity on alpine grazing lands, data on all animals from the buffer zone villages and those from villages outside the buffer zone were collected from the registration records maintained by the forest checkposts at the entry points of the Biosphere Reserve. Because shepherds graze their animals only in areas identified by a specific name, where they have grazing rights, segregation of data was possible. Grazing rights in each alpine pasture were also verified from the records of villages with these rights. The grazing intensity was estimated using a formula suggested by Bjonness (1980). Management costs of rearing small ruminants were based on a standard flock of 200 ruminants under the charge of 1 shepherd (this is the standard unit used by the local shepherds to fix rates).

Results

The population of livestock reared by the inhabitants of the NDBR buffer zone villages showed a drastic decline in the periods 1970–1975 and 1990–1995. This was due to sharp reductions in the sheep and goat populations and near extinction of yak breeds in the area (Figure 2). However, other animal populations such as dairy cattle, horses, and mules, although reduced, did not show drastic change. Analysis of data for the entire buffer zone indicated a marginal increase in the num-

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FIGURE 2 Status of livestock population at 3 points in time in the buffer zone of the NDBR.

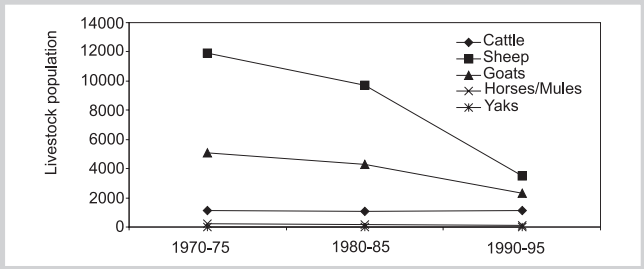
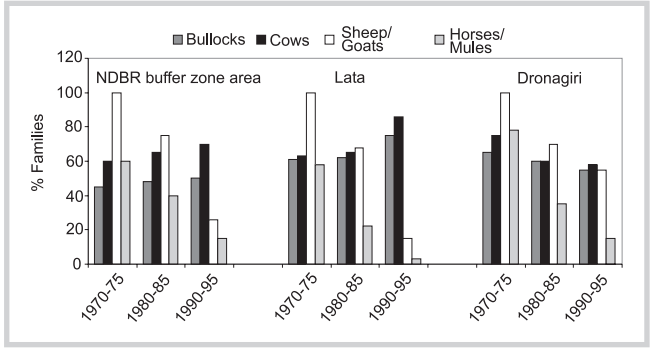


FIGURE 3 Changing livestock ownership patterns in the entire NDBR buffer zone and the representative villages of Lata (low altitude, sedentarized) and Dronagiri (high altitude, transhumant).



ber of families owning or rearing bullocks and cows, whereas those owning or rearing sheep and goats showed a drastic decline. In the village of Dronagiri the number of families owning or rearing cows and bullocks declined substantially, whereas in the village of Lata the number of families owning or rearing these animals showed a marginal increase during this period. However, both villages showed a decline in the number of families owning or rearing sheep or goats and horses or mules (Figure 3). These trends were found to be common in all buffer zone villages.

The annual livestock management in the buffer zone villages is presented in Figure 4. Sheep and goats are left in open areas and forests under the supervision of shepherds (*anwals*) for grazing throughout the year. They are moved from alpine pastures to lower valleys during winter and back to the alpine pastures during summer. The shepherds feel that fodder availability, both in quantity and quality, is currently poor in the lower valleys, and thus mortality rates for animals increase during their stay in lower valleys in winters. This poor nutrition is said to be the reason for the poor quality and quantity of wool produced during shearing in March. The bovines and equines of settled villages are taken to common lands for grazing during the spring, summer, and rainy seasons and stall-fed in winter (December–February). However, the bovines and equines of villages practicing transhumant pastoralism are stall-fed from November to April at their lower-valley settlements and taken to nearby common lands and forests for grazing at summer settlements in high elevations during the rest of the year.

Before the area was brought under conservation in 1982, all 15 pastures of the region, with an area of about 6188 hectares, were available to about 21,000 animal units (1 animal unit is equal to 1 head of cattle, which is equivalent to 0.10 goats or sheep, 1.26 buffalo or yak, and 2.67 horses or mules) grazing in the area. After the area was declared a National Park and then a Biosphere Reserve, only 7 pastures with a total area of 2433 hectares remained available to about 14,500 animal units. This is equal to a stocking density of 6 animal units per hectare of pastureland, as against about 3 animal units per hectare of pastureland before 1982.

Managing the numbers of sheep and goats is essential for managing stock densities. Local people manage the animals by reducing their numbers, either by selling them to other consumers for meat production or by using them for local meat production. The number of animals reduced per year is about 35% of initial stock in Lata and about 15% of initial stock in Dronagiri village. However, the number of animals sold accounted for only 20% and 11% of initial stock in Lata and Dronagiri villages, respectively. The average kid and lamb production from 100 she-goats and ewes was recorded at about 91 and 84, respectively.

Local inhabitants report that effective management of an average herd of about 400 animals, consisting of about 200 goats and 200 sheep and about 4–6 horses or mules, requires a 2-member shepherd team. The costs involved for such a herd are given in Table 2. If we exclude the uncertainties of livestock rearing, about Rs 300 is the net benefit for each goat or sheep. Because of the availability of grazing area and the requirement of wool for woolen handlooms, the numbers of small ruminants are high in villages practicing transhumant pastoralism, by comparison with villages now sedentarizing. Input costs (monetary and energy) and returns are depicted in Figure 5. Although sheep and goats show a high output–input ratio in monetary terms, they have a low output–input ratio in terms of energy currency. Similarly, pack animals (horses or mules) and dairy cattle also showed a low output–input ratio in terms of energy and a high output-input ratio in monetary terms. Bullocks had the lowest monetary output–input ratio but a high energy output–input ratio.

Discussion

Transhumant pastoralism in the NDBR buffer zone has undergone change: improved access and services to previously remote areas; disruption of the traditional trans-Himalayan trade network; an increase in tourism and alternative employment opportunities for local inhabitants; and a general settling down of many transhumant pastoralists, with a corresponding reduction in spatial mobility for livestock herds. Similar scenarios are also reported from Tibet (Goldstein and Beall 1989;

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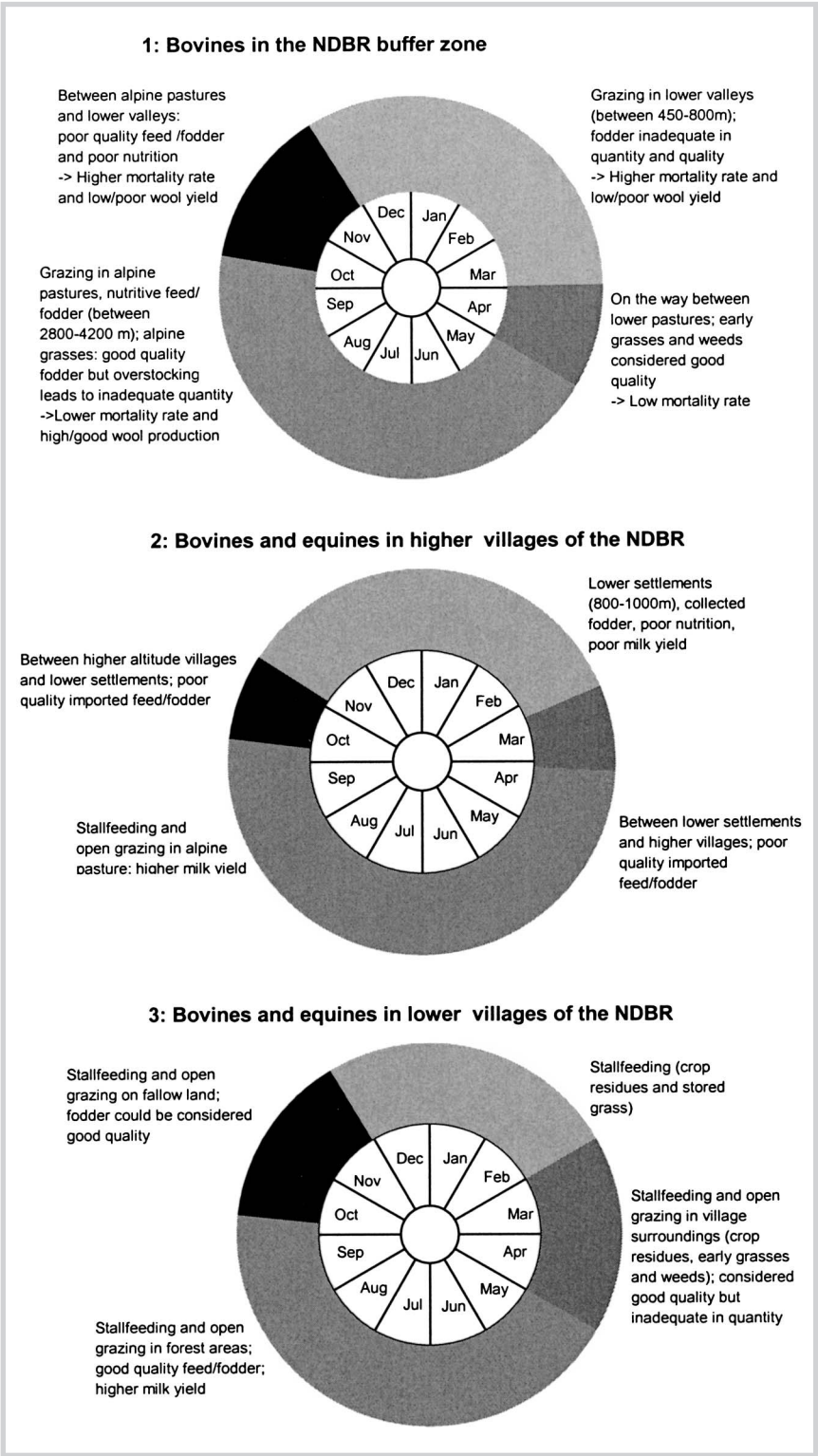


FIGURE 4 Annual calendar for livestock grazing in the NDBR buffer zone.

Miller 1993) and elsewhere in the study region (Hoon 1996; Saberwal 1999).

In general, the livestock population showed a decreasing trend. Yak and yak breeds disappeared from households in the region and were seen only on government farms. This is due to the nonavailability of yak for procreation after trans-Himalayan trade was halted and the loss of utility that came with limited spatial mobility in the post-1962 period. The increased emphasis on livestock resulted in diversification of sheep breeds through introduction of Tibetan varieties, mainly between 1950 and 1960, and Himachal varieties after 1962. This has resulted in the erosion of traditional breeding knowledge in the region (Farooquee and Rao 1999).

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TABLE 2 Management costs (Rs per year) of rearing a standard-size flock using the services of shepherds. Values in parentheses are profit per sheep or goat. US$1 = Rs 42 in 1996.

Particulars	Lata	Dronagiri
Costs involved		
Cereals (750 g per day)	4485.00	4485.00
Salt, spices, oil, etc	425.00	425.00
2 sheep as gift (Rs 1100 per sheep)	2200.00	2200.00
2 pairs of shoes	250.00	250.00
2 blankets and 2 pairs of woolen dresses	1250.00	1250.00
Smoke (Rs 70 per shepherd per month)	840.00	840.00
Salt for sheep (2 kg per sheep or goat)	600.00	600.00
Tax (Rs 3 per sheep and Rs 6 per goat)	600.00	1200.00
Total	**10,650.00**	**11,250.00**
Returns		
Sale of sheep or goat	60,500.00 (@ Rs 1100.00)	78,000.00 (@ Rs 1200.00)
Wool	14,400.00	—
Total income	**74,900.00**	**78,000.00**
Total profit from 200 ruminants	64,250.00 (321.25)	66,750.00 (333.75)

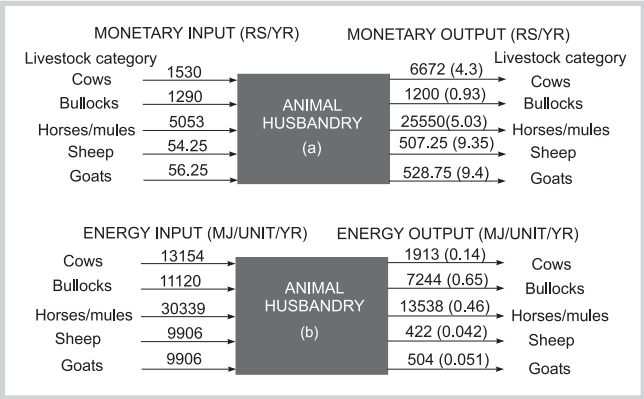


FIGURE 5 Monetary (Rs) and energy (MJ) inputs, outputs, and output–input ratios (values in parentheses) for various types of livestock rearing in the NDBR buffer zone.

As a system of land use, pastoralism requires access to a variety of different ecological niches. Loss of only a small but vital resource such as alpine grazing lands or village commons in the lower valleys can upset the delicate balance on which survival depends. As a result of conservation of land use in the alpine area and intensified production in the lower valleys, transhumant pastoralists lost most of the available grazing areas. To adjust to this situation, the livestock population was also reduced. However, the reductions were not sufficient to keep grazing intensity at the required optimum of about 0.3 hectare per animal unit (Negi et al 1993). Livestock population reduction has also been reported in pastoral societies of the Kyrgyz Republic (Anonymous 1995) for similar reasons. Hoon (1996) records that grazing intensities of transhumant pastoralists in the Kumaon part of the NDBR are between 5 and 7 animal units per hectare.

The human population in the buffer zone villages has grown by about 37% per decade. The subsequent rise in demand for animal products has not been met; thus per capita consumption has dropped. It is important that the rising demand for animal products be met through improved productivity rather than increased numbers. This could be done by introduction of better breeds, revitalizing traditional knowledge in breeding technology (Farooquee and Rao 1999), and managing feed and fodder availability. The implementation of conservation in the region accentuated management problems such as livestock depredation by wildlife. Competition for resources between wildlife and traditional pastoralism is also reported from Africa (Prins 1992) and the Himalaya (Rao et al 2000). Management options in the conservation area are not simple. Suggestions include reducing the numbers of domestic stock (Brown 1971), improving the carrying capacity of the area (Semple 1971), and exploring alternate livelihood options (Maikhuri et al 2000).

Livestock care includes the provision of pastures, protection (shepherding and fencing), and veterinary care. Each task makes special demands on pastoralist households, which respond with different actions (Ekvall 1968). Because herding requires constant attention throughout the year, transhumant pastoralists cannot leave their flocks or herds even for a few hours. The time, energy, and attention required vary greatly. Studies indicate that maximum energy and attention are required to manage livestock during migration, followed by winter management at settlements and then manage-

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ment at summer settlements (Hoon 1996). These production systems are energy intensive, but little commercial energy (kerosene, fertilizers, etc) is used in the region. Human energy is an important part of the production system. All the energy needed for transport is provided by animals, which provide a significant supplement to human dietary energy requirements. Sheep play an important role in both energy and monetary flows in the region because of their numbers. They are suited for a transhumant lifestyle that exploits seasonal resources. However, little research has been done on the environmental cost of small ruminant populations in settled villages in the region. Environmental degradation may be linked to this factor. Although the inhabitants of settlements practicing sedentary lifestyles are aware of environmental problems caused by overgrazing, they have few opportunities to reduce the density of livestock, ie, mainly cattle required for draught power, manure production, and milk production needed to serve the growing human population.

Bullocks, which are also needed for agriculture, have the greatest energy output–input ratio of all animals reared. Thus, reducing their numbers may not be acceptable to the inhabitants of NDBR buffer zone villages. However, cows, which are kept mainly for manure production, require more energy input than the output they provide and need to be reduced, with alternatives for manure production. Ives and Messerli (1989) argue that increase in the number of animals and maintenance of infertile and moribund animals occur because farmers incur no costs under the present systems of unrestricted grazing on village common land or government land. However, in the case of the NDBR buffer zone, extensive open grazing may increase degradation around habitations that are now settled and may lead to further conflicts between local inhabitants and management authorities. The villages with transhumant pastoralist populations have few options except to continue transhumance with reduced stocking density because they cannot settle in their summer settlements. However, their future will depend on the way they manage their stay and livestock grazing in winter outside the Biosphere Reserve, where they are facing conflicts with settled inhabitants.

The traditional transhumant Bhotiya (Tolchha) management of livestock gives minimal importance to energy output–input ratios because priority is given to the use of seasonally abundant grazing resources in alpine pastures. However, the settling of transhumant pastoralist households requires more animals, which could be managed by stall-feeding with manure production (for crop production). Although fodder production could be considered a possible option for meeting increased demand, limited land availability (most of the available land is already under crop production to meet the needs of the growing human populations in these villages), human labor, and manure in these households make implementation of such an option unacceptable to local inhabitants.

The NDBR management authority needs reduced livestock densities in the region to allow the area under conservation to regenerate naturally and meet the growing demand for wildlife fodder. Although villages with transhumant pastoralist populations are reducing livestock holdings because of nonavailability of grazing resources in winter, the villages that are now settled continue to show increases in the numbers of cattle, which are required for draught power and manure. In addition, the keeping of small ruminants by these people for economic benefits is adding to the growing pressure on village commons and surrounding forests. For effective management of available resources in the region, continuance of transhumance by villages within the limits of carrying capacity is required, as is reduction of cattle populations and replacement of small ruminants with alternative options such as medicinal plant cultivation and organic food production in settled villages. This strategy could provide the required economic benefits to both settled and transhumant populations and also support conservation goals by reducing the overall pressure.

Conclusions

Development concerns in the Himalaya revolve around managing local resources in such a way as to conserve and enhance environmental values and promote socioeconomic development. Linkages between ecological and socioeconomic approaches ensure that development is location specific. Although conservation of natural resources figures at the top of the environmentalist agenda, possible ways of building upon the economic potential linked to infrastructure development and increased cash flow through a well-developed market economy are the primary concerns of the local people. The lifestyles of transhumant pastoralist populations (Tolchhas) are undergoing changes to adjust to growing employment opportunities under government sponsorship and increasing constraints on traditional transhumant pastoralism. The small ruminant-based production systems developed after curtailment of trans-Himalayan trade need to be diversified to provide opportunities for people to operate traditional woolen handlooms, grow organic produce, and cultivate medicinal plants. Revitalizing the production system and reducing unproductive animals among sedentary populations to reduce grazing pressure in winter settlements would provide opportunities to continue the sustainable livelihood of transhumant pastoralists in the buffer zone villages of the NDBR, a World Heritage Site.

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