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Livestock Development in Mixed Crop Farming Systems

Lessons and Research Priorities

In the past three decades or so, considerable efforts have been expended in livestock research and development in the Himalayan region of India and Nepal. Development efforts have been geared towards improving animal breeds to increase the incomes of mountain farmers. It is crucial to examine which animals are gaining economic importance and what have been the development experiences of institutional programmes. To do so, this paper reviews and analyses: 1) the temporal changes that took place over the past years in terms of livestock population and composition and 2) the institutional programmes for developing the livestock sector. Finally, it draws implications on these experiences for livestock planners and policy-makers and raises several research issues related to livestock sector development.

Livestock Population and Composition Patterns

In the Indian Himalayan region, most livestock species are raised under mixed cropping systems. In the central and eastern Himalayas cattle are most common (47.5%), followed by goats (15.8%), buffaloes (12.3%), and sheep (10.4%) (Rao and Saxena 1994). The land holdings are small and therefore livestock supplement the family income. Animal dung and bedding materials provide manure for the crops. Almost the entire energy requirements for hill agriculture are met either from bullock power or human power. Under mixed crop farming systems in the western Himalayan region of India, livestock pressure was increasing. For example, in the low hills, the average number of livestock per household was 11 animals; cattle accounting for 53 per cent and sheep and goats for 36 per cent. In the mid-hills, the numbers were eight animals in mixed farming systems and nine animals in vegetable-based farming systems (Mahendra Dev 1994).

In the north-eastern Indian Himalayas, *jhuming* (shifting cultivation) is a predominant land-use system, supporting 1.6 million tribal people over an area of 426 million hectares. The pressure of livestock population on land resources is relatively less in the eastern Himalayas than in the western Himalayas and include cattle, buffaloes, and goats with cattle and buffaloes found predominantly in the valleys and plains.

Livestock contributes 20 per cent of household cash income in the hills and mountains. On an average, a mountain/hill household raises 6 to 10 heads of animals that include large and small ruminants.

An analysis of temporal changes in livestock population and composition between 1978 and 1988 in the central Himalayas (Uttarakhand) and between 1982 and 1992 in the western Himalayas (Himachal Pradesh) shows that whereas the cattle population has declined, the buffalo population has increased significantly. Among small ruminants, the sheep population has declined (Table 1).

Under mixed crop farming systems in Nepal, the pressure from livestock is heavy. The livestock population in Nepal, in relation to the arable land per person, is one of the highest in Asia. The livestock population is estimated to be about 6.2 million cattle, 3.1 million buffaloes, 5.4 million goats, 0.9 million sheep, and 0.6 million pigs (DFAMS 1991). Under subsistence agricultural systems, 90 per cent of the population's livelihood is based on livestock rearing.

An analysis of livestock data in Nepal reveals that the most noticeable changes in the hills are the significant increases in buffalo and goat population between 1988/89 and 1996/97. This indicates their importance in the total herd composition and economy. The most noticeable change in the mountains is the considerable decline in sheep population (Table 2).

Development Experiences

So far, institutional programmes in livestock sector development have centred on improving animal breeds. In India, the 'weed' factor has been a subject of intense debate for religious reasons. This

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Comments are Welcome

Table 1: Livestock Population and Composition in the Indian Himalayas

	Central Himalayas (Uttarakhand) 1978-1988		Western Himalayas (Himachal Pradesh) 1982-1992	
Livestock species	% increase in population between 1978 and 1988	% change in composition between 1978 and 1988	% increase in population between 1982 and 1992	% change in composition between 1982 and 1992
Cattle	-5.2	-3.0	-1.06	-0.71
Buffaloes	+15.1	+2.5	+13.64	+1.62
Sheep	-9.1	-1.0	-8.15	-1.91
Goats	+7.1	+1.4	+5.25	+1.00

Source: (1) Directorate of Land Records (1992), Livestock Census, Government of H. P., Shimla. (2) Revenue Department, Livestock Census, Govt. of U.P., Lucknow, India

Table 2 : Livestock Population and Composition in the Mountains and Hills of Nepal

	Mountains	Mountains	Hills	Hills
Livestock species	%increase between 1988/89 and 1996/97	% share change in livestock composition between 1988/89 and 1996/97	% increase between 1988/89 and 1996/97	% share change in livestock composition between 1988/89 and 1996/97
Cattle	+3.17	+0.89	+5.77	-0.51
Buffalo	+0.58	0	+8.30	+0.21
Sheep	-9.59	-1.70	-2.53	-9.59
Goat	+2.87	+0.80	+9.37	+2.87

Source: Agricultural Statistics of Nepal (1990) and Statistical Information on Nepalese Agriculture (1996/97), HMG/N, Ministry of Agriculture, Department of Food and Agricultural Marketing Services, Agricultural Statistics Division, Lalitpur, Nepal

applies to Nepal also, as it is a Hindu country. The main purpose of improving animal breeds was to bring about a 'White Revolution' through livestock sector development for increased family income and to provide employment for mountain farmers. Technical innovations were geared to meet this objective, and this succeeded in some pocket areas of the foothill and mid-hill regions that were well connected with market towns through roads. Examples can be cited from Himachal Pradesh in India and Illam in Nepal. However, it did not affect the majority of rural and inaccessible mountain households with marginal and fragile resource bases.

The White Revolution, in fact mostly benefitted the comparatively well-to-do livestock rearers who happened to be located in dairy areas in the plains and had access to modern technology.

Improved Breeds and Forage Crops

The limited success in improving cattle breeds can be illustrated with the following data. In the Uttar Pradesh hills in India where such programmes have been going on for about three decades, the number of cross-bred cattle was only 28,026 (4.4%) out of a total breeding stock of 632,533. Similarly, the number of bullocks in the region was 1,277,396, of which only 66,214 were cross-bred (a little over 5%). Furthermore, the number of cross-bred cows and bullocks was not evenly distributed. Out of 28,026 breedable cross-bred cows, 11,737 (42%) were in Nainital district alone – which has a big milk market and access to a road network (SHERPA 1991).

The reason for such poor performance was that the improved breed was supplied to the weaker sections without assessing the poor and marginal farmers' means to maintain them. A large number of artificial insemination centres was opened, but these centres hardly touched the rural areas. According to recent estimates, cross-bred cattle make up less than 2% of the total cattle population in Uttarakhand in the Central Indian Himalayas (Dhar 1997).

In the Indian state of Himachal Pradesh, programmes for upgrading cattle started in the 1950s and again in the early seventies. The focus was on producing Jersey crossbreeds. This succeeded, to some extent, in areas that were accessible to milk markets through well-developed road networks. This is proven by the fact that among milch animals, the percentage share of cross-bred cows increased from 8.8 in 1982 to 22.0% in 1992.

Programmes to improve buffaloes in Himachal Pradesh were considerably successful. Until the 1980s, buffalo breeding was initiated only in a few areas. Now, artificial insemination facilities have been established in 190 extension stations in the state. The technique has gained in popularity to such an extent that demand for' Murrah' semen strains far exceeds the production. One study has revealed that, in the total milk pool of the mountain villages, the contribution of buffalo milk was as large as 98 per cent. The number of buffaloes in the herd increased significantly and that of the cattle decreased or remained stagnant.

Nevertheless, the bulk of livestock population in the Himalayan region is still largely comprised of local species – 95% of the cattle, over 70% of the sheep, and most of the goats in the Indian hill areas. This reveals the limited success of institutional policies geared towards promoting crossbreeds.

In Nepal, programmes for improving cattle started three decades ago. While these produced some visible impact in the vicinities of towns, almost 90 per cent of the countryside remained largely untouched (Joshi 1996). Private dairies with improved cows failed in the mid-hills because of lack of quality feed and proper health services. Today, most of the milk

supplied from the mid-hills is from buffaloes belonging to small farms which raise one or two milch buffaloes to supplement cash incomes. Although, the milk yield performance from cross-bred cattle was marginally better than from the native population, farmers complained that it was only at the cost of higher feed intake and health care management. Similarly, the performance of exotic or cross-bred goats has also not been any better than that of the indigenous population. Despite a 150 per cent wool increment from exotic Polwarth x native *Baruwal* cross-bred sheep, the animals did not adapt to the prevailing management conditions and were eventually rejected by farmers.

Feed shortage has been a critical problem for livestock farmers throughout the Hindu Kush-Himalayas (HKH). In Uttarakhand, the current shortage of feed and fodder is estimated to be 65% (Dhar 1997). The magnitude of the problem varies from zone to zone. Similarly, in Nepal, the shortage of animal feed is very acute during the dry period and winter and the livestock are generally underfed by one-third the required amount. The country as a whole has a feed shortage of 20 to 36%; the problem being more acute in the hills and mountains (Sherchand and Pradhan 1997).

Improved forages were introduced successfully in lowland valleys or relatively better-off areas where inputs and irrigation were available. However, they were not successful in marginal and fragile mountain areas, because of high input-dependency and high demands on scarce land and irrigation resources.

Constraints to the Adoption of Improved Breeds

Among the constraints limiting the productivity of the exotic or cross-bred population are sub-optional nutrition and management, greater susceptibility to prevailing diseases and pests, poor utilisation in other agricultural activities, and lack of an organized marketing structure. Table 3 explains the constraints in the adoption of improved cattle breeds. It illustrates that the alternative, risk-free, and low-cost option of local cattle has greater preference since they adapt easily to local resources and diverse needs.

Table 3: Advantages of Local Cattle Over Crossbreeds or Exotic Cattle in Mountain Farming Systems

Local Cattle	*Exotic Breed (or crossbreed)*
1. Adapts to local feed sources and performs well on poor quality roughage and agricultural residues - more efficient at converting roughage to body weight	1. Requires quality fodder (legumes) and concentrates for economically viable performance- uneconomical if fed on agricultural residues and roughage alone
2. Resistant to prevailing diseases unaffected by weather extremes. Well adapted to movements in rugged terrain	2. Susceptible to prevailing diseases, veterinary support services mandatory- vulnerable to weather extremes unadapted to movements in rugged terrain
3. Multipurpose - caters to diverse needs of mountain farmers- e.g., draught power, pack animal (at higher altitudes)	3. Single purpose, e.g., milk production - poor use in other diverse agricultural activities, e.g., draught power
4. Low input at low cost	4. High input at high cost
5. Reliance on externally purchased inputs and services minimal	5. High input from outside the system required - feed supplements, services need to be purchased

Source: Adapted/complied from Singh (1996), Negi (1990), and Joshi (1996).

Growing improved forages has not become feasible owing to two reasons. Firstly, farm sizes are very small and situationally fragmented. For example, a majority of farm households in both the central and western Himalayan regions are marginal with land holdings below 0.5 ha, followed by small land holders with farm sizes ranging between 0.5 to 1.0 ha (Khosla and Raina, n.d.). In Himachal Pradesh, the number of small and marginal farmers increased from 77 to 82.1% between 1976/77 and 1985/86 (Rathore 1991). In the mountains and hills of Nepal, the majority of households (67.5% and 53.6% respectively) have farm sizes between .025 and .051 ha (Munankami 1996).

Secondly, Himalayan agriculture is characterised by steep slopes, shallow fertile soils, nutrition deficiency, and terraced fields. In such conditions, growing quality forage is extremely difficult. Thus, marginal farmers depend more on Common Property Resources (CPRs), such as support lands, forests, and wastelands, to raise their livestock and derive economic benefits out of the free access to CPRs.

Lessons and Priorities

The previous narrow, technical approaches to livestock development in the hills and mountains neglected the social, cultural, and ecological specificities of livestock production (Miller 1993). Institutional programmes did not consider the development potentials and constraints of traditional farming on uplands and marginal mountain areas endowed with poor resource bases. The cross-breeding policy did not take into account the environment in which animals had to live and produce. The programmes also ignored the knowledge of livestock herders and their strategies in response to the changing biophysical and socioeconomic situations. Little attention has been given to mobilising local people and herders to strengthen their capacities to manage CPRs that are vital for livestock production systems. In addition, policy-makers have paid little attention to operationalising mountain specificities, such as inaccessibility, marginality, fragility, niche, and diversity, that characterise most mountain areas.

Research on livestock development also needs to direct its attention to conservation of biodiversity - of both the forage species and the livestock species. It has been proven that indigenous species are endowed with genetic potentials that render them far more adaptable to mountain environments than the exotic or crossbreeds.

In Nepal, women contribute 70 per cent of the labour for raising livestock. Still, women are excluded from extension, marketing, credit, and other activities that are critical for increasing livestock productivity and incomes. The heavy involvement of children of school-going age in raising livestock is given little attention. Women and children can benefit a lot from time-saving/labour-saving technologies for livestock management. Such issues are not addressed by livestock development policies and programmes.

In view of the critical role of livestock in sustainable development of mountain agriculture, ICIMOD caried out two review studies, namely, Development Experiences in the Livestock Sector in the HKH Region and Mixed Crop-Livestock Farming Systems in High Pressure Himalayan Areas. The priority research issues based on these studies are highlighted in the box below.

Research Issues

1. At the regional level, strategic studies to arrive at a better understanding of livestock development processes in relation to improving the livelihood of mountain farmers, agroecosystem health, and natural resources are essential. Such studies can focus on high pressure areas of mixed crop-livestock production systems where changes are occurring in livestock composition, forage resources, natural resource management practices, livestock management technologies, the role of gender in decision-making, marketing, farm income, and profitability. These changes have not been quantitatively assessed in a way that would enable informed decision-making.
2. At the national level, policy studies need to focus on how the present narrow sectoral approach to livestock development can be widened to accommodate the emerging socioeconomic, and natural resource management concerns and the livestock 'niche'.
3. At the local level, there are many critical questions that need to be answered in order to develop appropriate policies and strategies. Some of them are listed below.
   - What has been the impact of livestock in areas where there has been a breakdown of subsistence farming due to HYV technology? Does modern crop technology go hand in hand with modern livestock technology?
   - How is farm power being met in areas with commercial livestock production systems? What are the real issues of FYM? Is it contributing to maintaining the soil fertility?
   - What changes are taking place in farming systems in terms of cropping patterns, intensification, use of external input, farm economies and growth due to the process of commercialisation in the livestock sector ? How is this commercialisation process affected by markets and maketing arrangements?
   - What are the issues related to participatory management of common property resources for effective and productive management of livestock to benefit local farmers?

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Dr. Pradeep M. Tulachan
Farm Economist
Mountain Farming Systems
ICIMOD

e-mail:
tulachan@icimod.org.np

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Editors: **Shahid Akhtar/Archana S. Karki**
ICIMOD, P. O. Box: 3226, Kathmandu, Nepal
Tel. (977 1) 525313 or Fax (977 1) 524509, e-mail: dits@icimod.org.np

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