

# Livestock in the Mountains and Highlands of Asia, Africa and South America: An Overview of Research and Development Issues and Challenges

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## The Context

Most mountain and highland areas in the tropics and sub-tropics are particularly suitable for rearing livestock as a result of their ecology, climate, and the relative absence of disease. Production trends, however, have not been able to keep pace with the increase in human population. Although changes in world production and consumption patterns have opened up favourable new opportunities for smallholder livestock producers, the absence of appropriate infrastructure, technologies, support services, and enabling domestic policies has impeded the expected production increases in many developing nations. With both rural and urban populations expected to maintain their growth, constraints related to the intensification and commercialisation of animal agriculture, such as conservation of the natural resource base and changes in the requirements for infrastructure and livestock-related services, are likely to increase. Nevertheless, there is evidence that increased integration of livestock production into highland crop farming systems could have significant beneficial effects on the sustainability of these systems as well as on the conservation of natural resources. Livestock research and development initiatives in these regions must address the identification, testing, and implementation of options and strategies that optimise livestock production and crop/livestock integration with the aim of achieving a sustainable increase in household food security, income generation, and poverty reduction while maintaining the natural resource base.

Although mountain areas have always been important sources of food, water, energy, and timber, this fact has only been recognised recently. It was only after endorsement

of the United Nations Convention on Environment and Development (UNCED) of Agenda 21, Chapter 13 in 1992 that international organisations started expressing concern about mountain ecosystems and mountain inhabitants. As the Task Manager of Chapter 13, the Food and Agriculture Organisation (FAO) has facilitated a number of inter-agency and inter-governmental meetings. Although these meetings recognised the importance of livestock in highland farming systems, they did not develop a clear vision of how livestock could be best utilised to develop sustainable agricultural systems. It was in this context that the international symposium on 'Livestock in Mountain/Highland Production Systems' was organised in Pokhara, Nepal, in December 1999.

The symposium focused on issues related to livestock in mixed farming systems, that is farming systems in which crop production is combined with keeping of livestock, in highland and mountainous regions. The symposium provided a forum at which the participants could discuss and share experiences related to the use of livestock as a valuable natural resource to improve people's livelihoods, particularly in the mountain and highland regions of the Hindu Kush-Himalayas, Africa, and South America. These regions are characterised by a predominance of subsistence rather than commercial farming, unlike similar regions in North America, Australia, and Europe. In the following pages, the term 'mixed farming systems' is used to denote the major agricultural systems addressed in the regions as given. The terms mountain/highland or 'mountains and highlands' are used interchangeably to avoid the problems that arise from the lack of a common definition of the two terms in different regions (see the discussion at Forum Mondial de la Montagne (2000), International Mountain Research Workshop on *Mountain Regions: A Research Subject?* 4-7th June 2000, Autrans/Grenoble, France). Some of the chapters refer to 'mountains' or 'highlands' only according to the author's preference; the reader should understand these as essentially referring to the same thing.

Studies presented during this symposium from the Hindu Kush-Himalayas (HKH), Andes, and African highlands show that, despite their geographical separation, these areas have many similarities in terms of the role of livestock in production systems, environmental and sustainability concerns, gender issues, and the constraints and challenges stemming from the technological, institutional, and economic situations.

In this first chapter we attempt to provide an overview of the main points raised in the papers presented at the workshop and during the discussions that followed; the details can be found in the chapters that follow. The issues raised are summarised from all three regions under different thematic headings.

## **The Major Issues Raised**

### ***Livestock in mountain and highland economies***

Livestock play an important role in mountain economies. In the HKH, livestock contribute 20-40% or more to the income of mixed farming households (Tulachan, Chapter 10). Overall livestock contribute 36 to 47% of the total agricultural income in the mountains and hills of Nepal. In Tibet, they account for more than 50% of the total gross production value of agriculture (Tashi, Chapter 13). Livestock play an equally important role in the agricultural economy of the African highlands. In Ethiopia, animals and their products account for 30% of agricultural GDP and 12% of total GDP, excluding the value of draught and manure (Sileshi and Tegegne, Chapter 7).

The income-generating functions of livestock vary from livestock being the main cash crop, as in smallholder dairy systems, to the occasional chicken or goat sold to cover sporadic or emergency expenses. The range and the amount of products sold depend on the different systems but they can vary from meat to manure, eggs to fibre, milk to work (Dijkman, Chapter 11). Livestock are one of the common ways in which the poor build their assets and are able to finance their children's education and other important requirements (Li Pun and Mares, Chapter 2).

Livestock are critical in maintaining soil fertility. They allow land-use intensification through the concentration of nutrients and the acceleration of nutrient cycling. In the majority of mountain areas, chemical fertilisers are still unavailable or beyond farmers' means. In such cases manure serves as the fertiliser. Unfortunately, significant amounts of nutrients are often lost as the result of poor collection and storage methods for manure and the exposure of livestock excreta (Dijkman, Chapter 11; Tulachan, Chapter 10).

Various attributes of draught animals – energy for agricultural operations, physical products, income and employment gains, and sociocultural and ecological services – are vital for the sustainable development of mountain highland agriculture in the HKH (Singh and Partap, Chapter 16; Tulachan, Chapter 10). In Ethiopia, animal power is used for 15 different types of farm operation; more than 90% of the crops are cultivated using about 6 million draught animals, mainly oxen (Zinash Sileshi and Azage Tegegne, Chapter 7).

Complementary links between livestock and other factors such as environment, socioeconomic conditions, land-use changes, and technological innovations are recognised by Jodha (Chapter 3) and in the Andean context by Estrada and Quiroz (Chapter 6). In the livestock-crop mixed farming situation, understanding of

complementary links between the activities in livestock production systems helps understanding of the multiple complementary links that are crucial to environmental stability and the security of people's livelihoods in mountain areas.

### ***Trends and management strategies in livestock production systems***

Over the past years, considerable changes have taken place in populations of livestock and the composition of livestock holdings, as well as in management strategies, as a result of population growth and land-use intensification. In mixed farming systems in the HKH there has been a decline in the populations of cattle and sheep and an increase in the populations of buffalo and goats, indicating a growing importance of buffaloes and goats in the livestock economy (Tulachan, Chapter 10).

In the HKH, accessibility and development of road networks has played a crucial role in the development of smallholder dairies as an integral part of mountain farming systems. There has been a considerable shift in the management strategies of smallholder dairy farmers; from extensive grazing to intensive stall feeding, from use of public land to use of private land for growing fodder and forage crops, and from feeding crop-residues to increasing use of purchased feeds (Tulachan, Chapter 10). According to Singh et al. (Chapter 18) there is a growing trend in Himachal Pradesh towards keeping buffaloes and cross-bred cows for milk production – reflecting a shift from low-producing indigenous animals to dairy animals with higher milk yields.

Analysis of the livestock production trends in high-pressure areas across the East African region indicate that there is an increasing trend towards smallholder crop-livestock production. Smallholder dairies have flourished better in Kenya than in Ethiopia, partly because of the better market infrastructure in Kenya and partly as a result of differences in the types of animals raised in the two countries. In Kenya, dairy development has been based on the use of cross-bred animals, whereas in Ethiopia the numbers of these animals are negligible (Dijkman, Chapter 11).

An interesting trend is emerging in livestock production systems in Tibet, especially in the lower altitude areas, with a transition from animal husbandry based on rangelands to a mixed crop-livestock system, i.e., from the extensive traditional system to an intensified system. Commercialised livestock production is increasing as a result of both state and private investment. In the future it is likely that mixed crop-livestock production systems will be promoted, whereas pastoral livestock production systems will focus on rehabilitation and conservation (Tashi, Chapter 13).

### ***Smallholder dairies and factors affecting their success***

In the HKH, smallholder dairy farming has been gaining in importance (Tulachan, Chapter 10). There is an emerging trend towards the introduction of new dairy



livestock species for better milk yields. Certain preconditions must be fulfilled to ensure the success of introducing such species, and the approach used must be appropriate for local conditions. Tulachan cites two examples; one each from Nepal and India. In the hills of Nepal, veterinary health support services are limited and supplies of quality feed inadequate, thus outright adoption of improved cattle is not possible. Under these circumstances it is more appropriate to introduce improved buffaloes, which adapt better to the locally available feed resources while giving better milk yields than local cows – and this is what is happening. In Himachal Pradesh in India the necessary conditions for rearing improved dairy cattle exist, and introduction of improved cattle should be encouraged – as in fact it is.

Singh et al. (Chapter 18) examine the operation of dairy cooperatives in Himachal Pradesh and outline the factors determining their success and failure. These cooperatives were introduced as a management strategy for milk producers under the 'Operation Flood' programme and were intended to act as reliable market outlets for milk producers and as regular suppliers of milk at reasonable prices to consumers. A total of 250 dairy cooperatives was set up of which a quarter are now defunct. At present only 7.7% of the milk produced in the state is being collected through these cooperatives, so there is considerable scope for expansion provided they are conducted professionally. The failures resulted from inefficient management and the problem of vested interests, with people using the cooperatives as a way of gaining power and prestige.

The keys to the success of dairy cooperatives are sound business practices, competent managerial personnel, and systematic training of members and office bearers. Other factors such as favourable government policies and presence of a competitive environment are also critical. The most important variable observed related to success or failure is accountability. To whom is the dairy cooperative accountable? Are its decisions made mostly in the interests of its members or are they shaped in response to government objectives and policies? Do cooperative officials mostly look 'downward' to members or 'upward' to higher officials? Do members see the dairy cooperative as belonging to themselves or to the government? (Singh et al., Chapter 18)

Kenya in East Africa is one of the few success stories for smallholder dairy development on the African continent. The success mainly resulted from the introduction of exotic and crossbred cattle by Europeans. A profit analysis of the adoption of dairy cattle in the Kenyan highlands indicated that household characteristics, local area characteristics, availability of veterinarians, the agro-climate, and formal markets are the important factors affecting the successful adoption of crossbred cattle. An increase of one per cent in the proportion of local sales to formal

markets is associated with a more than three per cent increase in the probability of adoption. This can be attributed to the greater reliability and lower risks in milk marketing which reduce the risks associated with adoption. The availability of a veterinarian also reduces risks and has a large positive effect. The distance by road to an urban centre also has a significant impact (Staal and Jabbar, Chapter 4).

Zapata Cadavid (Chapter 12) examines the systems of dairy production practised in two areas of the Andean region of Colombia; the North High Plateau of Antioquia and Quindio Department, both located in the central range of the mountains. Specialised dairy is the common system in Antioquia, whereas both specialised and dual purpose dairy is practised in Quindio. The most popular breed of cattle is Holstein and the most popular grass is *Pennisetum clandestinum*. Feeding is based on pasture. Lactating cows are supplemented with concentrate. In the North High Plateau of Antioquia the system called 'pigs-pasture-milk' is popular: pigs are penned in a high part of the farm, their manure is used as fertiliser to increase grass production, and the grass is fed to the cattle.

### ***Natural resource management (NRM), environment and sustainability concerns***

Livestock production is intrinsically associated with environmental quality. When there is good grass cover, soil erosion is less than in areas with crops alone. Crop and pasture productivity on hillsides is directly associated with soil erosion, which also affects the supply and quality of water downstream (Leon-Velarde et al., Chapter 14). Equally, population increases and the expansion of tourism mean that some of the main grazing areas formerly used for ruminant livestock are no longer available for grazing (e-conference, Chapter 9).

Use of environmentally friendly technology in farming practices is critical for minimising environmental degradation. This approach is based on maintaining soil fertility by recycling livestock waste as organic fertiliser, rather than by application of chemical fertilisers (Zapata Cadavid, Chapter 12). Many people have a narrow view of mountain rangelands. They regard mountain grassland simply as feed for livestock and ignore the important role it plays in carbon sequestration, nutrient cycling, water capture, soil conservation, and conservation of biodiversity (Li Pun and Mares, Chapter 2).

In the Andes, rangelands constitute the main feed resource for ruminant species. Grazing of native pasture is complemented with crop residues like stovers and introduced improved feed resources. The extent to which livestock on aggregate degrade or upgrade soil is a matter of debate. In the high pressure areas of the HKH, pressure on the environment and common property resources is declining as a result

of the trends towards smaller herd sizes, use of private land to plant fodder resources, stall-feeding, and use of external inputs such as purchased feed (Tulachan, Chapter 10). Use of manure to produce biogas, as practised in the mid-hills of Nepal, is a further benefit from livestock that has a positive effect on the environment, especially on forests (Rijal, Chapter 17). Likewise, intensification of some highland production systems in Latin America is based on the use of concentrates, which means less pressure on local natural resources (e-conference, Chapter 9).

Kaufmann and Saleem (Chapter 15), in a paper based mainly on collaborative research in one of the watersheds in Ethiopia involving the Ethiopian Agricultural Research Organisation (EARO), the International Crops Research Institute for Semi-Arid Tropics (ICRISAT), and the International Livestock Research Institute (ILRI), draw attention to concerns about the sustainability of natural resource bases in the African Highlands. Improving the welfare of smallholders involves developing land-use systems that meet both the socioeconomic needs and the requirements for sustainable use of the production resources; the reconciliation of public and private goods is important for achieving these goals. Kaufmann and Saleem argue that the conventional approach to development focuses primarily on policy interventions and technology components and their interactions at the household/farm level. To have a sustainable impact on human welfare in terms of poverty alleviation, food security, better nutrition, and human and environmental health it is necessary to go beyond household profitability, resource productivity, and resource requirements. Technologies and policies and their interactions have to be integrated at both the community and the household levels. Unless common and private interests are reconciled, the conflict between them will be detrimental to both. The authors suggest mechanisms for mobilising community action to reconcile these using an example of water management in the landscape.

In East Africa the problems of concentration of people, a fragile environment, and deterioration of natural resources form a vicious cycle. At present agricultural production is decreasing by three per cent per annum, whereas the population is increasing at close to the same rate. In Ethiopia, loss of soil is aggravated by removal of manure which people use as fuel for cooking as a result of lack of other sources of fuel (Li Pun and Mares, Chapter 2).

Although many local systems of resource management have a proven record in protecting communal areas, these systems have not functioned well in protecting and ensuring the judicious use of forest and pasture areas because of the high population pressure. Tree lopping and grazing of forests in some pocket areas of Nepal have become so intense that trees are degraded and there is no forest regeneration. Even where collective forest management is being tried, there are significant problems with



what has been called the 'free-rider' effect, in which the benefits that people obtain are not commensurate with their contribution. Nevertheless, the community forestry programme has been successful where local people were genuinely given the ownership of forests to manage by themselves. Leasehold forestry is another successful example. In the leasehold project, blocks of degraded forest are leased to the poorest farmers and assistance provided to help them regenerate the land for the households' exclusive use. In these areas the number of less productive animals has decreased, and income from livestock products and livestock related products such as fodder has increased. There has been a massive regeneration of forest species at most of the sites, with a positive influence on adjacent forest areas and reputed aversion of forest encroachment and shifting cultivation (e-conference, Chapter 9).

### *Livestock biodiversity and other production resources*

The introduction of exotic species has often been associated with problems like resource and climate mismatches. When improved animals from lowland areas are introduced into highland areas they can encounter specific health problems, not to mention problems related to services and feed resources. One such example was observed in the Andes. When exotic broilers and dairy grade cattle were introduced in the Colombian highlands, difficulties were experienced as a result of the sudden and large diurnal variation in ambient temperatures. Exotic species should be introduced with caution to avoid high mortality (e-conference, Chapter 9). Careful consideration of technologically narrow and short-term approaches, and conducting genetic impact analyses prior to the introduction of exotics, might help mitigate such risks (Valle Zarate, Chapter 5).

A study conducted in the Andean Valley of Bolivia in which breeding groups held under different ecological and socioeconomic conditions were compared, showed the clear superiority of pure-bred, local animals in harsh environments, crossbreeds in improved environments, and pure-bred exotics under conditions of intensive feeding and husbandry. Crossbred and pure-bred animals are not available to most farmers in mountainous areas, however. The results show that local genetic resources play an important role in producing optimised breeding stock (Valle Zarate, Chapter 5).

Camino and Sumar (Chapter 20) examine the scope for introducing South American lamoids – llamas and alpacas – in other mountain/highland regions. Native to the fragile Andean ecosystem, these animals can survive cold, heat, and intense solar radiation (ultraviolet) and can also survive on a dry coarse diet with very little water. Their ability to survive in harsh conditions and their productive superiority give them a clear advantage over other animals like sheep, goats, and cattle, thus they can be termed 'super species'. Recent introductions of alpacas and llamas into the



United States, Israel, Canada, and New Zealand, have shown that they can be reared successfully outside the Andes for commercial purposes.

Biologically, lamoids are among the most environmentally gentle ruminants. With their soft-padded feet, they do not scour steep hillsides. With their sharp front teeth, they clip off grass rather than tear it off like sheep and cattle. Moreover, with their efficient digestive system alpacas and llamas can survive on coarse native grasses. Thus in contrast to sheep and cattle they require no pasture improvement or other modification of the unique, high-altitude environment. Lamoids can easily be integrated into the farming systems and economies of mountain/highland areas because rearing them involves only a very small investment in terms of labour and technology. Lamoids have several economically beneficial characteristics. The animals have multiple uses: the medium to fine quality llama wool can be used in making tapestries and garments; they can be used as beasts of burden to transport goods over rugged mountains; and they can also be a source of meat. When animals are introduced into new surroundings, however, special care must be taken to prevent transmission of infectious diseases from local livestock and consumption of toxic plants.

### *Gender concerns in livestock management*

Gender is a vital issue for the sustainable management of livestock in mixed crop-livestock farming systems because of the substantial role women play in livestock management. Men and women have different domains of activity and different knowledge and skills. In some areas the knowledge and skills of women are considerably greater than those of men, but in general this does not receive due recognition. Women also face barriers related to access to and control of essential items (Njiro, Chapter 19) and still have very limited access to all types of services from credit to veterinary services (e-conference, Chapter 9).

Two communities of Turkana were studied in Kenya. In these communities, male elders have a strong authority and make the major decisions on family issues and herding groups. Women do have a voice within the society, however, they are free to talk in the presence of men and to be represented at the community 'tree'. The Turkana women play a key role in maintaining household food security. A married woman is responsible for feeding the members of her household (children, husband, and dependants); she prepares, stores, cooks, and serves all food, whether it consists of animal products or purchased or aid-food (Njiro, Chapter 19).

Amongst the Sambura People at Baragoi in Kenya, women are believed to be incapable of the strenuous tasks involved in treating animals, like carrying cattle to the treatment centre. But in fact in the absence of male household members they do

perform such tasks. Overall women were found to be more concerned about the health of their livestock than were men. They purchased drugs more often and noticed sickness first. Some women were acknowledged as experts in certain specific areas like birthing or retained placenta, and with small stock or cattle (Njiro, Chapter 19).

Women in general have been marginalised in research and development programmes in the African Highlands (Dijkman, Chapter 11). A similar marginalisation and disregard for women's knowledge, skills, and contribution in raising livestock is common in the HKH (Tulachan, Chapter 10). However, changes have been taking place in the HKH with regard to women's access to cash and decision-making in livestock management. Women are increasingly taking control of the cash earned by raising livestock and spending it on the household, and they play a more active role than men in goat, poultry, and pig farming (Tulachan, Chapter 10).

In the Andes, too, women play an important role in livestock production systems. It is estimated that women produce, process, or sell up to 80% of the food in the Andean countries (Li Pun and Mares, Chapter 2).

### *Technological and institutional issues*

Despite an array of scientific innovations, science and technology have had little impact on livestock development or improvement in developing countries. Sound policy backing is crucial for the dissemination of technology. Having policies to promote credit is a key element in the adoption of improved technologies. Credit must be made available to farmers, so that they can make use of new technologies (Li Pun and Mares, Chapter 2).

Estrada and Quiroz (Chapter 6) discuss the technological and institutional changes affecting mixed crop-livestock production systems in the Andean countries of Colombia, Ecuador, Peru, and Bolivia. At the beginning of the 1990s, changes in government policies substantially modified the mixed crop-livestock production systems of small producers in the mountain regions. Many of the basic crops like corn, wheat, and barley went out of production as a result of increasing imports. In addition to the land-use changes, state power became greatly reduced, limiting to a great extent the ability of the state to support research, extension, and credit activities.

Zapata Cadavid (Chapter 12) discusses two productive technologies aimed at increasing farm production: a conventional and a new approach. The conventional technical approach tries to increase milk yields using imported concentrates, improved breeds such as Holsteins, and vast amounts of chemical fertilisers. This approach has drawbacks such as the need for large amounts of capital, dependency

on imported inputs, and deterioration of the environment. The new approach is an integrated and environmentally-friendly technology. It uses crossbred cattle and pigs, biodigesters to produce energy, and earthworms for composting solid wastes which, combined with the effluent from the biodigesters, provide organic fertiliser. Some of the numerous advantages of this technology are a feed supply for cattle and pigs, food for humans, pest-free and healthy pastures, natural regeneration of fragile areas, maintenance of soil fertility, a supply of biogas for cooking, and the availability of high quality fertiliser. The extent to which this new technology can be transferred to other areas still needs to be investigated. The heterogeneity of mountain regions in terms of factors like altitude, climate, soils, quality and quantity of feed resources, and ethnic background poses a great challenge to the transfer of technologies like this from one region to another (Leon Velarde et al., Chapter 14).

In Africa some technologies, like the introduction of cross breeds, have brought households additional income. In Kenya, a recent study showed that farmers with crossbred cows had an additional income of 50 dollars per cow per month without the need for additional labour. There was no significant increase in household milk consumption, however. When evaluating the net benefit of new technologies like this, improved nutrition of the household (direct, or indirect through use of the cash income) should be considered (Li Pun and Mares, Chapter 2).

ILRI and its collaborators studied dairy-draught technology (using cows for the dual purposes of milk production and draught power) in the Ethiopian highlands with the aim of determining whether the crossbred cows could provide draught power and replace oxen. The replacement of ox power with dairy draught power proved feasible, as long as the farmers had good access to milk markets, and animal health care and breeding services. Road quality and distance from urban markets were some of the major factors determining the sales' price and thus the feasibility of adoption of the technology (Kaufmann and Saleem, Chapter 15). Dairy-draught technology is attractive because it enables the reduction of animal numbers, and in fragile areas this supports efforts to improve vegetative cover and protect soil. The advantages are best recognised, and the technology most accepted, in those situations in which farmers collectively recognise the limits to the stock-carrying capacity of their watersheds. The feed released by the displaced oxen can be used more profitably by the dual-purpose cows, and as the cows are stall-fed the manure and urine can be more readily collected for use as organic fertiliser. An unexpected benefit observed in Ethiopia was that more children were able to attend school because the need for herding was eliminated (Kaufmann and Saleem, Chapter 15).

In Nepal, manure is used for generating 'biogas', with the slurry used as fertiliser. This reduces the use of wood as a fuel for cooking and heating and has had a



significant impact on forest regeneration and tree cover (Kaufmann and Saleem, Chapter 15). Data from Nepal show that 25% of the country's total energy requirement could be met by biogas technology, without losing the fertiliser value of dung. In many cases it has been reported that the slurry coming out of the biogas digester is of better quality than raw farmyard manure. Decomposition of dung and agricultural residues can also be enhanced by mixing slurry with them. Use of biogas technology minimises the risk of competing use of animal dung for fuel (Rijal, Chapter 17).

Before introducing new technologies, it is important to predict the impact on the economy and the environment. Bioeconomic models can be used to assess the combined impact of a number of technologies in space and time. Such models show, for example, that implementation of some of the present technologies without any constraints can increase farmers' incomes by 50%, but will at the same time increase soil erosion by 34%. Simulation studies recommend stratification to manage watersheds, increase income, and reduce soil erosion. Such stratification would involve agroforestry in the upper hills, zero grazing livestock production in the mid-hills, and intensive cereal production in the flat areas (Li-Pun and Mares, Chapter 2).

### *Policy issues for livestock development*

In the HKH, past livestock policies were supply-driven with little consideration of the socioeconomic and resource-base conditions of the mountains. This resulted in many failures (Tulachan, Chapter 10). Li Pun and Mares (Chapter 2), Zinash Sileshi and Azage Tegegne (Chapter 7), Leon-Velarde et al. (Chapter 14), and Kaufmann and Mohamed Saleem (Chapter 15) all draw attention to the marginalisation of mountain livestock development policies. In all regions, governments have extrapolated the research and development strategies used in the lowlands to the mountains without due consideration of the mountain specificities. These policies were generally sectorally based and inadequate, and in many instances aggravated the production problems faced by smallholders. Thus all authors call for policies that will unleash participatory, inter-sectoral, and holistic approaches in the context of mountain/highland environments.

For the HKH, Jodha (Chapter 3) suggests a number of policy and programme interventions to avoid a backlash from unequal highland-lowland economic links. He suggests a number of policy options that will trigger creation of the necessary physical infrastructure and capacity building of the local communities, as well as institutional arrangements and federating arrangements for input disposal and output supplies (including price support). These changes would also help in reducing the marginality and vulnerability of mountain communities while enabling their participation in competitive markets.



The new policies in the East African Highlands (EAH) lean towards increased market orientation, privatisation or dismantling of state-owned interests in production and distribution, liberalisation of markets and trade, and an increased emphasis on issues of poverty alleviation and social needs. Nevertheless, they have still not been able to overcome major hurdles like problems related to access to credit services. In addition, in many of the EAH countries, such policies have only been partially implemented, and this has caused market distortions and created disincentives (Dijkman, Chapter 11).

Global trends in livestock demand and production point clearly to a strong potential for growth, especially in the developing countries. The questions are whether smallholder mixed farmers will be able to compete with growing industrial systems and participate in the domestic and global market, and what the particular constraints are facing those in the highlands. Policy-makers need to address small-scale production and marketing, poor access to livestock services and credit, policies that favour capital-intensive livestock production, and the growing commercialisation of livestock production (Staal and Jabbar, Chapter 4).

A sound policy backing is of utmost importance for any technology to be effective. For example, the benefits of dairy-draught technology cannot be realised unless the technology is supported by enabling policies that encourage farmers to invest in innovations. One example of such a policy is the promotion of biogas by subsidy schemes, which is justified by balancing the environmental benefits of biogas against the cost of environmental rehabilitation (Kaufmann and Saleem, Chapter 15).

The draught animal power (DAP) system has an essential role to play in the sustainable development of agriculture in mountain regions. In the HKH region, the policies related to DAP are inadequate. A sound ecozone specific DAP policy is necessary to support, promote, augment, and develop the DAP system (Singh and Partap, Chapter 16).

As mentioned above, the move towards economic liberalisation at the onset of the 1990s transformed many government policies in the Andean countries. As a result, many basic crops went out of production, land-use patterns were changed, and needed government activities were reduced (Estrada and Quiroz, Chapter 6).

One of the keys to effective policy-making is understanding the rationality of farming practices. Policy-makers trained in developed countries often overlook the value of farmers' practices. Policies are required that will empower mountain communities through participation, education, and information (Li Pun and Mares, Chapter 2).

### *Constraints to livestock production systems*

The inaccessibility and ruggedness of mountain areas are well recognised as physical constraints, but there are other less well-understood constraints. Human disregard for mountain specificities results in a blanket approach to providing solutions which does not meet the need to improve farmers' welfare. One of the characteristics of the mountain region that enriches its diversity but is a constraint to livestock production systems is its heterogeneity. The heterogeneity of mountain regions impedes the transfer of technology from one region to another (Leon Velarde et al., Chapter 14).

Shortage of animal feed and the lack of adoption of technologies to improve feed production in monocultures or in association with other crops is seen by some as one of the key constraints in the livestock sector (Dijkman, Chapter 11; Tulachan, Chapter 10). Although local agricultural research institutes and universities have a history of research into feed resources, most investigations have been conducted at localised sites and the impact of this research on feed resources in general has been limited.

E-conference contributors draw attention to the presence of anti-nutritional factors in highland vegetation as a fodder problem. Specific reference is made to the tannins present in many trees that have a negative influence on protein digestion. Tree fodder is an integral part of feed in many highland/mountain areas.

The low returns that farmers receive from investments on livestock are another constraint to the development of livestock production systems. The low price of milk has been seen as a disincentive for smallholder dairy farmers in the HKH (Tulachan, Chapter 10).

Broad regional studies and case studies in East Africa show that livestock production is particularly constrained by market and spatial factors. These constraints are likely to become even greater as a result of the high costs of infrastructure and risks of disruption. Selected case studies show that the primary constraints to livestock production in highland and mountain areas are remnants of restrictive policies and regulations, high transaction costs as a result of poor infrastructure and information systems, and poorly developed markets for inputs and outputs. These case studies also show that recent reforms have eased some of these constraints with good results for both producers and consumers. Further reform and investment in supporting infrastructure, including farmer group development, can help provide good growing opportunities for smallholder livestock producers in highland systems (Staal and Jabbar, Chapter 4).

Inadequate veterinary services and health care are a general and serious problem for the development of the livestock sector (Dijkman Chapter 11; Tulachan Chapter

10). In the highlands of South Africa, the withdrawal of subsidised extension and veterinary services has not only affected animal health but also the adoption of technologies (e-conference, Chapter 9).

Efficient use of DAP needs to be supported by developing suitable implements. Lack of new, efficient, and site-specific equipment can be a constraint to realising the full benefits of DAP (Singh and Partap, Chapter 16).

Other constraints include lack of methodologies for integrating research results into technological alternatives, inappropriate incorporation of socioeconomic aspects into the technology development and transfer process (Leon Velarde et al., Chapter 14), and irrelevance of technological innovations to farmers' needs (Kaufman and Saleem, Chapter 15).

### *Livestock research and development issues*

Mountain areas are characterised by some specific features that distinguish them from the plains; we call them 'mountain specificities'. They include limited accessibility, a high degree of biophysical (and social) fragility, marginality, and diversity, and specific niche opportunities—including human adaptation mechanisms. These mountain specificities and their implications for livestock production systems need to be taken into consideration when addressing livestock issues in mountain areas, in particular the potential for development (Jodha, Chapter 3; Tulachan, Chapter 10). The main challenges to livestock research and development (R&D), however, result not from these specificities but from shortcomings in government policies related to institutional and environmental undertakings to market economic technological changes.

Successful development of the livestock sector, particularly market-oriented livestock production systems, requires that everyone involved is aware of mountain specificities, gender issues, and the marginality of farms and livestock farming (Jodha, Chapter 3; Tulachan, Chapter 10). Whereas the socioeconomic circumstances in mountain areas (demographic and institutional) are changing rapidly, the key biophysical condition of these areas has remained broadly unchanged. New developments must be sensitive to these unchanged conditions or they may not prove environmentally and economically sustainable in mountain areas. The complexity and heterogeneity of the different agro-ecological zones need to be recognised and taken into consideration when formulating policies. This heterogeneity is the prime obstacle to the transfer of technologies from one region to another. It is also important to recognise that diversified and inter-linked resource-based activities are a key attribute of sustainable production systems in mountain areas and that R&D has an important role to play in ensuring the continued success



of such systems (Jodha, Chapter 3). If all these constraints are taken into account during the initial design of an R&D programme, there is considerable potential for increasing the sustainability of crop-livestock productivity and household income (Leon Velarde et al., Chapter 14).

Agricultural research previously focused on improving animal and crop productivity independently; in the seventies and eighties it was recognised that crops and livestock interact and must be considered jointly to optimise overall farm performance (Kaufman and Saleem, Chapter 15). More recently it has been recognised that research has to go well beyond farm boundaries to ensure positive impacts on poverty alleviation, natural resource management, and protecting the environment. Developing new holistic initiatives is a challenge for the people working in R&D, however. It not only requires changes in the training of such people around the world, it also requires a clear understanding of the external forces prompting the change (e-conference, Chapter 9).

Scientific communities also need to make research more relevant to the problems of smallholders (Kaufmann and Saleem, Chapter 15). One way of addressing these problems would be through farmer organisations that create better bargaining power and allow the vertical integration of activities (Staal and Jabbar, Chapter 4).

Notwithstanding improved accessibility and market links, the dependence of livestock on local resources will continue to be an important factor. Hence, conservation and efficient use of these resources, including such things as recycling and reprocessing, needs to be an integral part of the management of livestock production systems. R&D efforts should be focused on these aspects and on improving upon traditional methods. With support from institutions, R&D can play an important role in ensuring the efficient use of scarce resources, the quality of animals, and the most effective composition of animal holdings (Jodha, Chapter 3; Staal and Jabbar, Chapter 4).

There is a need to formulate simple and integrated programmes that have multiple functions (from extension to the effective marketing of products) and emphasise the use of local resources to decrease reliance on imports. For example, full utilisation of the genetic variation of local animals needs to be considered in multipurpose production systems before resorting to introductions (e-conference, Chapter 9). Also, research and development programmes should be directed to encouraging and empowering local people to retain their unique genetic livestock resources in these ecologically fragile but globally important mountainous environments (Valle Zarate, Chapter 5).



Zinash Sileshi and Azage Tegegne (Chapter 7) describe three broad themes important for future research in the African highlands: sustainability of the crop-livestock production system, which includes improvement of feed resources, animal traction, nutrient cycling and management, health management at the farm level, and options for diversification of animal power; improvement of market-oriented smallholder production, which includes development of a feeding package, appropriate breeding schemes and recording systems, efficient processing and handling methods, health management and delivery services, health standards for export of meat and animals, policy and institutional adjustment, and marketing; and conservation and utilisation of animal and forage genetic resources, which includes characterisation and evaluation of genetic resources and selection of animals for resistance to diseases and parasites.

Leon Velarde et al. (Chapter 14) point to the need to develop methodologies for integrating research results into technological alternatives to solve the different problems encountered in the Andean region. Characterisation of agro-ecosystems across the region is needed, rather than a localised analysis, to support the sustainable use of the natural resources. There is a need to shift to a holistic approach in research and development activities with participation by a group or consortium of institutions. In one such existing consortium, the Consortium for Sustainable Development of the Andean Region (CONDENSAN), institutions from both the government and private sectors work together to promote sustainable food production without a concomitant deterioration in natural resources and sufficient to cope with population growth (Leon-Velarde et al., Chapter 14; Li Pun and Mares, Chapter 2).

The prerequisite to the successful introduction of new approaches is to ensure participation of local communities from the very beginning. This means participatory planning, community participation with all stakeholders involved from the start. It is particularly important that women are fully included in these planning exercises, and that their unique skills and knowledge are recognised. For effective community development, it may be necessary to show the obvious benefits of what is proposed before people are convinced. This requires specific strategies that need to be worked out well in advance. Future generations should also be involved; one way of realising this could be through educational and curricular changes (e-conference, Chapter 9).

Dijkman (Chapter 11) stresses the need to generate information that can be turned into simple messages for easy communication between extension services and farmers and in a form that allows farmers to take a more active part in the evaluation of alternative strategies. Dairy production messages can be a useful entry point because of the many advantages that dairy has, including a means of constant income for farmers (Li Pun and Mares, Chapter 2).

In the HKH region, the best approach to improving milk production in smallholder dairies is thought to be through reducing the actual numbers of animals whilst improving the quality of the remaining animals and of the feed supply. The major challenge is to increase production whilst avoiding environmental and natural resource degradation (Singh et al., Chapter 18). Leasehold forestry in areas between 500 and 2000 masl, possibly integrated with community forestry programmes, has been suggested as a potential means of improving feed supplies. In both Ethiopia and Bolivia some farmers have developed an integrated food/feed system to improve feed supplies in which weed species are allowed to grow with cereal crops to increase biomass production (e-conference, Chapter 9). Research is needed to facilitate transferral of this system to other regions. Tashi (Chapter 13) calls for improved forage production technologies associated with marginal cropland to increase the feed production in Tibet, and the introduction and expansion of forage crops such as oats, peas, and alfalfa.

There is a need to promote private sector involvement to improve animal health services (Tulachan, Chapter 10) as already practised in countries like Kenya and Tanzania (Dijkman, Chapter 11). There is also a need to preserve and promote ethno-veterinary practices so that farmers are less dependent on conventional veterinary services (e-conference, Chapter 9). Tapping of tannin and other toxins contained in fodder is another challenge for researchers (e-conference, Chapter 9).

Attention should be paid to creating the necessary physical infrastructure, including processing and marketing facilities. Institutional arrangements like local ownership of local commons, group action, arrangements for input disposal and output supplies (including price support), and capacity building of local communities will help in reducing the marginality and vulnerability of mountain communities while facilitating their participation in competitive markets (Jodha, Chapter 3).

Economic liberalisation in the Andes has not produced the desired effects. Estrada and Quiroz (Chapter 6) outline some options for identifying production niches where mixed crop-livestock production systems are the best means of generating employment. Mere assessment of biological, economic, and environmental efficiency may be insufficient. Formation of strategic alliances with the private sector is a possible mechanism to help government and producers finance system changes. Consumers should be encouraged to pay for environmental damage.

At the onset of the new millennium, R&D should focus on the use of information systems to facilitate extrapolation of knowledge from one region to another. Tools such as geographic information systems (GIS), modelling, and information and communication technologies, as well as methods such as participatory research and development, should be used to make assessments and recommend solutions for many problems. Building

partnerships among the different institutions working in the field of livestock is critical to addressing regional and global issues (Li Pun and Mares, Chapter 2).

Prospective studies need to be conducted to support sustainable mountain development. The studies should develop scenarios, and also indicate the consequences, for both mountain and lowland people, of a failure to implement. Researchers and development agents should aim for a win-win solution (increased household income and improved human welfare in mountain/highland areas whilst ensuring the sustainability of common property resources) through raising public awareness about costs and benefits in social, economic, and environmental terms. This is the major challenge for research and development in the livestock sector.

## **Working Group Sessions and Recommendations**

Four parallel working group sessions were held on the third day of the symposium covering four thematic areas related to livestock R&D (see Annex for details of the participants). Participants were asked to put their ideas in writing as well as making contributions to the discussion and both verbal and written contributions were collated by the facilitators. Each group identified the primary issues in its thematic area and made recommendations for future action. The results were presented and discussed at a plenary presentation session. The main points from each group are summarised below.

### ***Topic 1: Livestock production systems and participatory approaches to natural resource management – R&D challenges***

The major issues related to this theme were identified as conservation of the natural resource base, poverty alleviation, food and economic security, and gender and equity. Livestock can make a considerable contribution to improving food security and generating income. To safeguard this potential, livestock R&D should focus on understanding the vulnerability of livestock production systems and the external forces that impinge on these systems. Making R&D services more effective and efficient is crucial to livestock development. The group developed suggested action plans and identified desirable activities related to three priority issues.

#### **Priority Issue 1: Rationale and social, economic, and environmental vulnerability of livestock production systems**

##### ***Objectives***

- 1 To identify key social, economic, and environmental indicators related to livestock production systems and the external forces affecting them
- 2 To identify any interaction between these indicators in order to assess the social implications of environmental change and the 'trade-offs' involved



### *Activities*

- 1.1 Selection (random) of a mountain/highland area to be surveyed
- 1.2 Conduct survey in the area using questionnaire and PRA techniques to identify indicators of social, economic, and environmental change.
- 1.3&2 Process and analyse the data from the survey of social, economic, or environmental importance.

## Priority Issue 2: Generation of socially equitable and environmentally sustainable technologies and strategies

### *Objectives*

1. To generate appropriate technology packages to increase the livestock productivity in specific regions
2. To increase the food and economic security of mountain people

### *Activities*

- 1.1 Identify the key problems that affect livestock production systems
- 1.2 Review research findings that address these problems
- 1.3 Call for necessary research to be performed within a clear time frame into the diversification of livestock resources, feed resources and feeding strategies, animal diseases and strategies to control them, diversification of the use and management of animals (including creation of appropriate harnessing implements), the environment and the effects of global warming
- 1.4 Test technology packages at the farmers' field level and make recommendations
- 1.5 Perform simulations of the package for different locations to cover all ecozones
- 2.1 Create awareness of the new technological packages among rural people
- 2.2 Support empowerment of farming communities through in situ and ex situ training and visits with emphasis on involving women
- 2.3 Timely delivery of technical input and services

## Priority Issue 3: Improvement of linkages between farm research and livestock services

### *Objective*

1. To make research and development services more output oriented



### *Activities*

- 1.1 Joint planning, execution, and evaluation of research and development programmes by all stakeholders
- 1.2 Identification of the appropriate roles of different stakeholders (private and public sectors) to avoid duplication of activities
- 1.3 Capacity building for sustainable mountain development through empowerment of all stakeholders including farmers
- 1.4 Identification of most effective and efficient livestock services and their delivery systems

### ***Topic 2: Post production processes (processing, marketing, and consumption) – R&D challenges.***

The group identified two essentially different approaches to the improvement of post-production processes: improvement based on realistic practices built on existing knowledge and technology; and improvement based on understanding the role of structural and institutional factors and policies. Product diversification, market development, appropriate policies and planning, and human resource development are the key areas that livestock R&D needs to address to enhance post-production processes. The suggested action plans are summarised below.

#### **Issue 1: Processing and product diversification (technology and economics)**

- Appropriate processing technologies and local products at local and community level
- Diversification and value addition on various scales and through packaging

### *Objectives*

1. To promote production diversification
2. To identify, improve, and promote local processing technologies appropriate to indigenous products
3. To establish the scope of diversification and value-added production

### *Activities*

- 1.1 Identification and refining of processing technologies
- 2.1 Develop inventory of available, local processing technologies and products
- 2.2 Assess appropriateness, economic viability, and need for improvement
- 2.3 Select most promising and adapt or improve technologies

- 2.4 Promote and popularise through training, workshops, seminars, and similar
- 2.5 Conduct activities related to monitoring, evaluation, and feedback
- 3.1 Develop inventory of value-added livestock products in markets and assess supply and demand
- 3.2 Assess economic viability of selected products
- 3.3 Disseminate information to entrepreneurs and manufacturers

## Issue 2: Market development

- Cooperatives and support services
- Market promotion
- School milk production schemes
- Market information services
- Infrastructure: processing, transport, storage, and others

### *Objectives*

- 1 To identify and understand the existing marketing system(s)
- 2 To develop a market infrastructure: processing, transport, storage, and information services
- 3 To encourage cooperatives and farmers' associations
- 4 To promote consumption of livestock products

### *Activities*

- 1.1 Studies/surveys on existing dairy marketing
- 1.2 Identification of gaps
- 1.3 Development of strategies to address the information gaps
- 1.4 Based on findings and results, identify needs and opportunities
- 1.5 Conduct socioeconomic survey to understand feeding habits, affordability, health consciousness, and other factors in the communities
- 2.1 Develop inventory of existing marketing infrastructures; identify needs and opportunities
- 2.2 Establish sustainable interventions in livestock market infrastructures with donors, governments, and the private sector
- 2.3 Establish livestock marketing information systems and a monitoring database and disseminate
- 3.1 Identify cooperatives and farmers' groups and associations involved in livestock marketing; identify needs and opportunities

- 3.2 Assist and promote institutional development of cooperatives and farmers' groups and associations (training needs)
- 3.3 Provide logistical support to cooperatives and farmers' groups and associations
- 3.4 Study consumption patterns and preferences
- 4.1 Promote livestock products through generic campaigns
- 4.2 Assess the market for product diversification possibilities, e.g., mid-day milk with flavour for school children

### Issue 3: Policy and Planning

- Regulation of quality and standards of products
- Animal waste management
- Policy support for local processors/markets
- Prices
- Incentives and subsidies

#### *Objectives*

- 1. To review and provide recommendations on policies for regulation of quality and standards, and to extend policy support to
  - local processors and markets
  - price incentives and subsidies
  - animal waste: utilisation and disposal

#### *Activities*

- 1.1 Policy on regulation of quality and standards
  - Review policies on regulation of quality and standards
  - Provide recommendations with an action plan to enforce implementation
- 1.2 Policy on markets
  - Study the effects of existing and alternative policy options (price incentives, licensing, import duties, subsidies, animal waste, and others)
  - Recommend policy options that support local processors and markets

### Issue 4: Training and human resources

Improving capacity for assimilating and disseminating technology

- Quality management
- Marketing and promotion

### *Objective*

To provide need-based training programmes on

- processing and technology development
- ensuring quality management
- marketing and promotion
- developing sound research and development plans

### *Activities*

- 1.1 Assess human resource development systems and facilities; identify needs and opportunities
- 1.2 Develop sound human resource development plans (training and facilities)
- 1.3 Strengthen institutions and facilities
- 1.4 Provide need-based training at multiple levels
- 1.5 Create awareness about quality management and its importance

### ***Topic 3: Livestock biodiversity and conservation***

Protecting genetic diversity was agreed to be an important task for the sustainability of ecosystems. Conservation of the indigenous knowledge base is equally important for the preservation of livestock diversity. Thus the foremost task for researchers is to assemble knowledge, including indigenous knowledge, on the livestock diversity in different agro-ecological regions. The suggested action plan on livestock biodiversity and conservation is summarised below.

### Research Theme: Livestock biodiversity and conservation

#### **Objectives**

1. To identify livestock diversity in mountain/highland regions in relation to plants, ecosystems, and people
2. To conserve and use livestock diversity by matching it with agro-ecosystems using an interdisciplinary, hierarchical, and holistic approach

#### **Activities**

- 1.1 Synthesise the state of available knowledge about livestock diversity in different ecosystems and establish an inventory of livestock diversity in the regions
- 1.2 Carry out a survey of the characterisation and population status of each livestock genotype through participatory action research based



on four hierarchical components (genetic, ecological, socio-cultural-economic, and policy)

- 2.1 Formulate and execute a conservation policy act and regulations on livestock diversity related to livestock breeding and selection and mobility
- 2.2 Implement conservation and utilisation programmes for indigenous animal genetic resources that are at risk or on the verge of extinction in specific pocket areas using a participatory farmers' group approach with selective breeding schemes
- 2.3 Evaluate the influence of land-use trends on livestock diversity (locally and comparing across regions) by remote sensing/GIS, PRA, ecological assessment, and a description of resource use efficiency (commonly called the 'agro-ecosystem approach')
- 2.4 Analyse the sociocultural-economic aspects of livestock breeding to look at the demographic pressures resulting from market, transportation, and settlement policies

#### ***Topic 4: Livestock policy issues***

Sound policies are the key instrument needed to further livestock development efforts and are vital for the improvement of livestock-based livelihoods. Sound policies are needed in the areas of marketing of livestock and livestock products, credit services, and institutional strengthening and other capacity building. Consultation with farmers and local communities is indispensable for the formulation of sound policy. The suggested action plans for the development of sound policies are summarised below.

#### **Issue 1: Market-oriented livestock production**

##### ***Objectives***

1. To assess the environmental impact of livestock intensification
2. To develop and promote sustainable market-oriented livestock production systems

##### ***Activities***

- 1.1 Select representative sites in mountain regions in the Andes, Africa, and HKH
- 1.2 Quantify the bioeconomic, social (including human drudgery), and environmental impacts of livestock maintained in pastoral, crop-livestock, and more intensive management systems

- 1.3 Assess the bioeconomic, social, and environmental impacts of alternative market-oriented systems
- 2.1 Design and validate alternative market-oriented systems
- 2.2 Develop policy options to promote the conservation of existing, sustainable production systems
- 2.3 Promote the use of improved livestock-based systems
- 2.4 Monitor and evaluate the improved livestock market-oriented systems
- 2.5 Promote the exchange of experiences and lessons across different mountain/highland regions

## Issue 2: Credit and investment

### *Objectives*

1. To promote cottage, small, and medium-scale industries in the livestock sector and diversify sources of income
2. To promote diversified and intensified livestock production systems
3. To create sources of employment and alternative livelihood possibilities
4. To compensate mountain communities for their role in conserving the environment

### *Activities*

- 1.1 Form credit groups
- 1.2 Mobilise rural savings
- 1.3 Simplify credit delivery systems
- 1.4 Formulate policies for the promotion of livestock industries
- 1.5 Create more favourable credit and investment policies for smallholders
- 2.1 Develop inter-linkages between the crop, livestock, forestry/agro-forestry, silvipastoral, and horticultural sectors
- 2.2 Explore possibilities for integration within the livestock sector like poultry-pigs-fish and pigs-pasture-cattle/buffalo
- 2.3 Encourage use of terraces, terrace risers, and bunds to produce additional forage
- 3.1 Explore location-specific alternative sources (other than livestock) of household income like papermaking and plantation or collection and marketing of herbal and medicinal plants that can employ inefficiently used labour

- 3.2 Provide additional information on hotel management and tourism
- 4.1 Allocate some portion of earnings from tourism and the hotel business exclusively to the mountain/highland region as a substitute for compensation (policy strategy)
- 4.2 Although headwater resources are maintained by highland/mountain people, the greater part is normally harvested by lowland people. Earnings from water tax could be shared by the highland/mountain region (policy strategy).
- 4.3 Promote investment support for strategic partnerships between the private sector and small farmers
- 4.4 Ensure the equitable sharing of the benefits from such partnerships

### Theme 3: Trade and regional integration

#### *Objective*

- 1. To augment trade and regional integration

#### *Activities*

- 1.1 Assess the status and emerging trends in the livestock sector and formulate policy options
- 1.2 Study the local impacts of global trade
- 1.3 Develop policies for strengthening highland-lowland integration
- 1.4 Promote understanding of the impact of present trade policies on smallholders to enable them to be more competitive

### Theme 4: Institutional strengthening and capacity building

#### *Objective*

- 1. To enhance institutional strengthening and capacity building

#### *Activities*

- 1.1 Strengthen livestock development institutions such as the International Potato Center (CIP) and CONDENSAN in the Andes, ICIMOD in the HKH, and ILRI and the African Highlands Initiative (AHI) in the African highlands, and NGOs, farmers' associations, and local communities so that they are better equipped to support participatory, equitable, and gender sensitive smallholder activities
- 1.2 Promote private sector participation in livestock R&D
- 1.3 Officially exchange information with governments, and promote activities to locate and mobilise funds for development projects



## **Pokhara Call for Action**

The three days of discussions and deliberations culminated in the formulation of the 'Pokhara Call for Action'. This declaration is intended to form the basis for livestock research and development in the early years of the new millennium. The text is shown in the box. The Pokhara Call for Action was approved by the plenary.

### **POKHARA CALL FOR ACTION ON THE ROLE OF LIVESTOCK IN SUSTAINABLE LIVELIHOODS IN MOUNTAIN AND HIGHLAND AREAS**

Mountain and highland ecosystems are found on every continent and sustain an estimated ten per cent of the world's population. In addition, several billion people living in the lowlands depend on these ecosystems for food and other resources such as water, raw materials, and energy. These areas are also important sources of plant and animal diversity, both wild and domestic. In the past few decades, environmental changes and rapid increases in population density in these highland and mountain areas have meant increased problems for planning effective resource management strategies. Despite the increased importance of these areas and the global recognition they received after UNCED in 1992, many highland/mountain communities continue to live in poverty, and in many countries they are still socially, economically, and politically marginalised.

Livestock are of particular importance in highland/mountain farming systems. They provide direct tangible benefits such as food, fibre, and draught power, as well as the indirect benefit of converting crop residues and other plant biomass into useable nutrients, the key to sustaining smallholder mixed farming systems. They also provide people with a secure form of investment, assets, and a protection against risk. In addition, livestock can enhance biodiversity across the landscape, and can help to balance social inequities, especially for women and the landless.

Changes in world food production and consumption patterns have opened up favourable new opportunities for livestock-dependent people. However, the absence of appropriate infrastructure, technologies, support services, and enabling domestic policies has impeded the expected production increases in many nations.

Rural and particularly urban populations are expected to maintain their growth, thus constraints directly related to the intensification and commercialisation of animal agriculture are likely to increase. Strategies are therefore required to ensure food security for a growing population, to increase income, to promote social equity, to support economic development, and to protect the environment.

Representatives of research, development and donor institutions from the major mountain regions of the world participated in an International Symposium on

"Livestock in Mountain/Highland Production Systems: Research and Development Challenges into the Next Millennium", held from 7 to 10 December 1999, in Pokhara, Nepal.

After four days of deliberations, participants agreed upon the following.

- To prepare a global research and development agenda to improve livelihoods in livestock-dependent mountain and highland communities which emphasises the understanding of the dynamics of evolving livestock production systems, the strengthening of appropriate technologies and strategies, and the contribution of policies and capacity building that link R&D, and focuses on:
  - a. utilisation and conservation of production resources,
  - b. sustainable market-oriented livestock production systems,
  - c. post-production processes, and
  - d. trade and regional integration.
- To prepare a livestock agenda for incorporation into the framework for the International Year of the Mountains in 2002
- To encourage collaboration across the different mountain/highland eco-regions
- To encourage governments, and donor and funding agencies to give higher priority in national and international development agendas to the gender-balanced participation, empowerment, and property rights of livestock-dependent mountain and highland populations
- To encourage research and development organisations to undertake activities to improve livelihoods in livestock-dependent communities in mountain and highland eco-regions