

## **Experience Gained in the Research-to-Development Continuum**

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# Experience Gained in the Research-to-Development Continuum:

## Livestock Research for Sustainable Livelihoods in the East African Mountains

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The east African mountain region provides living testimony to what can go wrong when the traditional balance between people, their habitat and the socio-economic context breaks down. The problems posed by population growth, land pressure, food scarcity, and degradation of a fragile environment with finite natural resources are aggravated by insecurity, civil war and cross-border refugee camps. In the face of these odds, the CGIAR International Livestock Research Institute

(ILRI) and its predecessor, ILCA, have been working to improve people's livelihoods in Ethiopia since 1974. ILRI believes that the needs of mountain regions can be met sustainably by tapping the potentials of different ecological niches more efficiently, particularly in the area of livestock production. The present paper presents examples of ILRI's development-oriented research and evokes the challenges encountered by research that targets broad development goals.

### The east African mountains: social, economic, political and environmental “hot spots”

In many parts of Africa populations have settled in mountainous areas where the climate is mild and the environment relatively disease-free by comparison with arid or very humid lowlands. In Ethiopia, about 80% of the human and livestock populations live in areas above 1500 m (approximately 40% of the country). The 3% annual increase in the human population threatens the life-supporting natural resource base. Large-scale resource degradation is therefore common, resulting in poverty, malnutrition and low agricultural productivity. The need for food, water and social amenities in the coming decades is unlikely to be met under current land use practices. Moreover, internal and cross-border tensions are likely to grow, particularly as the demand for water is increasing in both mountain areas and downstream regions and neighboring countries.

Many complex development problems arise under such conditions. Development-oriented research is faced with the enormous challenge of finding ways to promote sustainable use of resources while satisfying the immediate basic needs of millions of people struggling for survival, for whom the health of the environment is not a primary concern. ILRI recognizes the need for a holistic understanding of the biophysical make-up of the landscape, its carrying capacity, the social needs of farmers and their interaction with the landscape, and the need for innovations and policies devised with the participation of the people. Hence it has been collaborating with many national and international institu-

tions to assemble the research and development expertise required to address these issues in a more comprehensive manner. The Ethiopian Joint Vertisol Project (JVP) consortium, established in 1986, is a case in point. It has brought together the Institute of Agricultural Research (now called Ethiopian Agricultural Research Organization, EARO), the Ministry of Agriculture, the Universities of Alamaya and Addis Ababa, ICRISAT (International Crops Research Institute for the Semi-Arid Tropics), IBSRAM (International Board for Soil Research and Management) and ILRI in order to draw on a broad basis of expertise, and has regularly adapted its research approach to accommodate new insights.

### Adapting research to development needs

#### Improving crop and livestock productivity

Livestock are important in mountain farming systems: they convert biomass unusable by humans into useful products such as milk, wool, hides, meat and draft power. They also provide people with a secure form of investment and cushion against risk (Figure 1). While livestock contribute to nutrient input and help disperse seeds in pastureland, grazing needs to be carefully managed to prevent overgrazing. Since its inception, ILRI's mountain research has therefore aimed to improve crop and livestock systems and has focused on the Ethiopian highlands as a major site that represents development problems in mountain areas.

Initially, technical solutions to problems of crop production, animal production and land degradation were addressed with reference to plots or animals. The

*“My animals are like my children, and therefore they share my house with the rest of the family. Without them we have no life.” (A Gurage farmer)*



research agenda pursued did not adequately incorporate the needs, concerns and priorities of farmers and other stakeholders (extension and development agents, etc.), and therefore compromised widespread adoption. Although systems approaches were used for problem diagnosis, only biophysical, social or economic components of the systems were addressed. Moreover, these conventional approaches did not account for the specificity of mountain areas, complementarity or competition among them, or the interaction between the different factors influencing livelihood.

#### **A new paradigm: livestock in sustainable mountain development**

The need for a special mountain development paradigm became evident as methodological extrapolations from

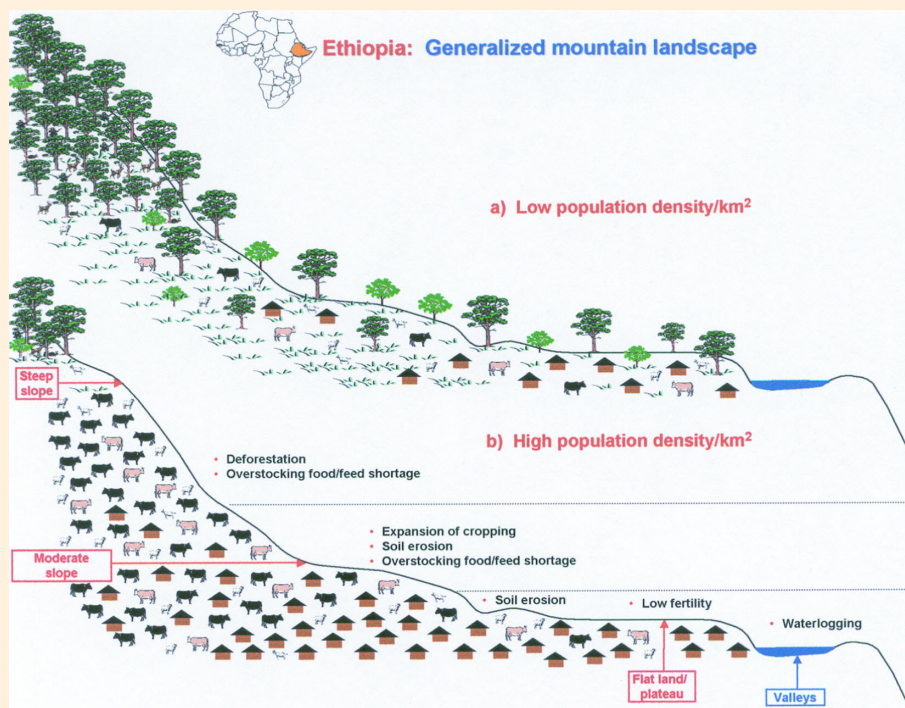
research conducted in lowland areas failed to produce the desired results. Like many other research and development institutions, ILRI recognized that because of vertical dimensions, great climatic differences and the variety of landforms found within short distances, sustainable use of any piece of land in the mountains depended to a great extent on sustainable use of the land above and below it, as much as on what happened to the land on either side. As long as the population density was low, human needs were adequately met by the ecological services of the landscape. In earlier times, vast stretches of land were still forested and natural resources supported many life forms (Figure 2a). But the situation has changed rapidly and dramatically in the past five decades (Figure 2b). How should research re-orient itself to redress this? For a start,

**FIGURE 1** Livestock are an important component of mountain agriculture in East Africa, and using children to herd them takes priority over sending them to school. (Photo by Mohamed Saleem)

regular consultations with the communities and other stakeholders were conducted. Rather than following blueprints, researchers listened to problems and possible solutions and sought the types of intervention and expertise required to deal with them.

Today most Ethiopians, like other Africans inhabiting mountainous areas, cultivate several small pieces of land that span different narrow biomes or ecobelts, topographically juxtaposed or overlapping in a landscape. From the perspective of a household, the different fields a farmer owns are not separate entities, as survival depends on exploiting all of them. Thus to support decision-making, there must be a holistic approach and a sufficient database for assessing technology and policy options for situations that range widely through space and time. Research and development in agriculture and land use in mountain regions cannot therefore be restricted to a single peak or raised area and focus on one soil type, one crop type, one farming practice, or one type of animal or community. All aspects concerned must be considered as intricately linked parts of a whole beyond the biophysical aspects of production.

**FIGURE 2** A generalized illustration of population pressure on mountain land resources over a 50-year period. (Courtesy of Kinde Engida, ILRI, Mountains Project)



In order to concurrently assess multiple criteria, an agro-ecosystem health framework, which is being tried elsewhere, was debated at an international workshop sponsored by the IDRC (International Development Research Center, Canada) and ILRI in May 1998 and adopted to guide future research. As this framework takes account of spatial, temporal and functional dimensions, it allows considerations of socio-economic, political, health-related, biological and environmental interactions that are important for assessing the health of agro-ecosystems.

### Learning to link aims, research methods and techniques

#### Example 1: A technical improvement and livestock as draft power

The black, cracking clay soils (Vertisols, close to 8 million ha in Ethiopia) commonly found at the foot of slopes are waterlogged early in the rainy season and underutilized (Figure 3). The land is commonly ploughed at the onset of the rains, using a traditional ox-drawn plough or *maresha*; the soil remains exposed to erosion until the crop is sown after two to three months. ILRI and its research partners in the JVP consortium consulted with farmers and produced some functional attachments to the *maresha*. One such attachment provided two metallic wings on each outer end of a pair of *maresha* joined by a cross-bar and a metal chain to produce a Broad Bed Maker. Use of the BBM on a plowed field produced raised, broad seedbeds and furrows that improved drainage. Moreover, the modified *maresha* was designed to suit the pulling capacity of the local farmers' oxen. The drained Vertisols opened up possibilities for multiple crops in the same year, grown in sequence or as relays or in mixtures of food and forage crops of various combinations, compared to a single low-yield cereal or pulse planted late. Sowing a crop early in the season on drained Vertisols established ground vegetative cover that reduced soil erosion, by comparison with plots ploughed and left idle until sown late in the season. If most food and fodder needs can be satisfied with Vertisols, steep slopes can be spared from cultivation.



### Example 2: Livestock, education, energy and waste recycling

Farmers have been searching for new ways to increase productivity to respond to the emerging markets for livestock products. This has led to a change in the farming system, and has implications beyond the mere production of more milk and meat through improvement of breed performance. For instance, high-value cross-bred cows require better management; stall-feeding them with cut or stored fodder and purchased supplements could reduce the negative impact of overgrazing on the land and lead to positive social change and improved use of resources:

- Children could be sent to school, since there is no need to herd the animals (see Figure 1).
- Waste (dung and urine) could easily be collected from stall-fed animals and used to generate “biogas”, as is done with the help of biodigesters in many other mountainous countries in Asia and South America.
- The slurry from biodigesters is a good fertilizer, and the spread of biogas generators in the watershed providing for domestic fuel needs could have a significant impact on forest regenera-

tion and tree cover and reduce smoke-related health hazards from burning firewood (Figure 4).

Although this technology is known and has been tried sporadically in Ethiopia, it has not been evaluated within the household economy and integrated into resource management practices. This needs to be encouraged as a development component within the general agro-ecosystem framework.

### Example 3: Research on indigenous agrobiodiversity and resource use efficiency in mountains

There is enormous diversity among livestock in the mountains. Rugged conditions have contributed to different adaptive traits among livestock in eco-niches. Phenotypic and genetic characterization of livestock underway at ILRI to determine diversity and uniqueness in indigenous populations will provide opportunities to test, evaluate and exchange genetic materials for adaptation under different production conditions. Significant variations in survival rates, feed intake, gut capacity, body weight, disease tolerance, etc. in mountain sheep breeds, for example, have been confirmed in ILRI

**FIGURE 3** A typical example of Vertisol fields in Shewa Province, Ethiopia. Improved use of these rich but difficult soils reduces the pressure on steep slopes. (Photo by Hans Hurni)

**FIGURE 4** Dung is a marketable commodity and is used domestically as a substitute for firewood instead of being spread as fertilizer to compensate for soil nutrient depletion. (Photo by Mohamed Saleem)



*“We used to have community rules that governed land use and even helped to protect trees and water resources. That was before the Derg (communist regime) and democracy.” (Abraham Eidy, an Ethiopian farmer)*

research, which proves that appropriate species can be found to suit different niches in the mountains.

In addition, diet supplements to enhance protein quality, and manipulation of livestock rumen micro-flora to increase feed digestion and microbial protein, are available now to increase livestock productivity as a result of ILRI’s research. These methods of increasing livestock productivity, and realization by the farming community of the value of keeping a smaller number of highly productive animals in place of a large herd, could potentially contribute to reducing grazing pressures and stocking rates on marginal lands.

### Policy change beyond the shift in research

Improvement of livelihoods is the ultimate indicator of successful research for development. Poverty alleviation, food security, better nutrition, health, education, income generation and other social amenities all help to improve livelihoods and must be considered comprehensively to account for their linkages. Moreover, developmental efforts must ensure

increased productivity without adverse impacts on natural resources and the environment.

The scientific community and development agencies have been blamed for trying to implement technologies irrelevant to farming conditions in the mountains. Although farmers are being increasingly integrated into the research and development agenda, there is little experience that is relevant to new projects for improving systems of production in response to various pressures such as increasing population, changing markets, etc. This is often because politicians as well as research and development agencies have yet to recognize that mountains require a different paradigm, with land use strategies adapted to niches, and consideration given to the need for complementarity. ILRI’s Mountain Project takes a broader approach to its research mission focusing on livestock. However, benefits cannot be realized and endure—and research for development cannot succeed—without policies that cater to the needs and growing confidence of mountain farmers. Such policies must promote integration of technologies and holistic land use planning.

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Mohamed Saleem, a Sri-Lankan national, has spent about 30 years in Africa. For the past 21 years he has worked with the International Livestock Centre for Africa

(ILCA), now known as ILRI. He has directed ILCA’s and ILRI’s mountain research for the past 11 years, focusing on sustainable improvement of livelihoods in mountain regions through research and conservation, in collaboration with national and international partner institutions in East Africa, the Hindu Kush Himalayas, the Andes, Central Asia and the Caucasus.