



# Contribution of Livestock to Mountain Livelihoods

*Research and Development Issues*



Editors

Pradeep M. Tulachan

M. A. Mohamed Saleem

Juhani Maki-Hokkonen

Tej Partap

# about the organisations

## **International Centre for Integrated Mountain Development (ICIMOD)**

The International Centre for Integrated Mountain Development (ICIMOD) is an international organisation devoted to development of the Hindu Kush-Himalayan region covering all or parts of eight sovereign states, Afghanistan , Bangladesh , Bhutan , China , India , Myanmar , Nepal , and Pakistan . The Centre is located in Kathmandu, Nepal. The primary objective of the Centre is to promote the development of an economically and environmentally sound mountain ecosystem and to improve the living standards of mountain populations. The Mountain Farming Systems' Division at ICIMOD was established to promote improvement of farm productivity on small mountain farms without degrading the resource base.

## **Systemwide Livestock Programme (SLP)**

The Systemwide Livestock Programme (SLP) is sponsored by CGIAR and convened by ILRI. It focuses on building and strengthening linkages with plant-oriented centres in order to develop integrated and coherent strategic and applied research programmes on the development of livestock feed, natural resource management, and associated policies. SLP mobilises the CGIAR resources invested in the programmes of different centres, ecoregional initiatives, and other systemwide programmes to effectively support development and natural resource management research. The SLP links the livestock-related research of CGIAR's partners worldwide and is thus a unique vehicle for enhancing the contribution of animal agriculture to CGIAR's objectives of increasing food production, eradicating poverty, and protecting the environment.

## **Food and Agriculture Organization (FAO)**

The Food and Agriculture Organization of the United Nations (FAO) was founded in 1945 with the mandate to raise levels of nutrition and standards of living, to improve agricultural productivity, and to better the condition of rural populations. FAO has its headquarters in Rome, Italy, and is the largest autonomous agency within the United Nations system with 180 member nations plus the EC (member organisation). The Animal Production and Health Division (AGA) of FAO is entrusted with clarifying and facilitating the role of global livestock production in food security and food safety, as well as in poverty alleviation, while protecting the environment. The Division has six major project areas – Global Livestock Information and Policy; Decision Support for Efficient Livestock Resource Use; Livestock and Poverty Alleviation; Animal Genetic Resources; Veterinary Public Health Management, which hosts the Programme Against African Trypanosomosis (PAAT); and Transboundary Animal Diseases (EMPRES).

## **International Potato Center (CIP)**

The Centro Internacional de la Papa (CIP), or International Potato Center, is a non-profit, scientific institution that works to bring about a sustainable increase in the production and utilisation of potato, sweet potato, and other roots and tubers in developing countries. CIP is located in Lima, Peru, and is a member of the Consultative Group on International Agricultural Research (CGIAR), an association of governments and public and private sector institutions supporting a network of 16 research centres worldwide. CIP is the convenor of the Global Mountain Program (GMP), founded by CGIAR in response to the recommendations of UNCED. The GMP links CIP, the Consortium for the Sustainable Development of the Andean Ecoregion (CONDESAN), the International Centre for Research in Agroforestry (ICRAF), ILRI, and ICIMOD. It supports cooperation and information sharing between researchers working in the Andes, the highlands of East and Central Africa, and the Himalayas in crosscutting research themes including natural resource management, biodiversity conservation, socioeconomic and policy issues, and agricultural production systems with the expectation that solutions to problems in one region may be useful in another.

# Contribution of Livestock to Mountain Livelihoods

## Research and Development Issues

### Editors

Pradeep M. Tulachan  
M. A. Mohamed Saleem  
Juhani Maki-Hokkonen  
Tej Partap

International Centre for Integrated Mountain Development (ICIMOD)  
Systemwide Livestock Programme (SLP)  
Food and Agriculture Organization (FAO)  
International Potato Center (CIP)

The views and interpretations in this paper are those of the author(s). They are not attributable to the International Centre for Integrated Mountain Development (ICIMOD), Systemwide Livestock Programme (SLP), Food and Agriculture Organization (FAO), or International Potato Center (CIP) and do not imply the expression of any opinion concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Copyright © 2000

ISBN 92 9115 264 1

#### **Published by**

International Centre for Integrated Mountain Development

G.P.O. Box 3226,

Kathmandu, Nepal

#### **Editorial Team**

Greta Mary Rana (Senior Editor)

Beatrice Shrestha (Editor)

Sushil Man Joshi (Technical Support and Layout)

#### **Cover Plates**

- Background – Steep, eroding land and land use for survival in a mountain region (M.S. Mohamed Saleem) (also b/w divider for Section 1).
- Inset (clockwise) – Alpacas contribute to the sustainable use of high mountain areas (Julio Sumar K.) (also b/w divider for Section 4).
- Threshing the crops by using livestock is a common practice in the mountains (M.S. Mohamed Saleem).
- Collecting fodder for stall-fed animals is a problem in many areas (Pradeep Tulachan) (also b/w divider for Section 3).
- Women are important players and beneficiaries in market-oriented, smallholder dairy systems (ILRI) (also b/w divider for Section 2).

#### **International Potato Center (CIP)**

The Centro Internacional de la Papa (CIP), or International Potato Center, is a non-profit, scientific institution that works to bring about a sustainable increase in the production and utilisation of potato, sweet potato, and other roots and tubers in developing countries. CIP is located in Lima, Peru, and is a member of the Consultative Group on International Agricultural Research (CGIAR), an association of governments and public and private sector institutions supporting a network of 16 research centres worldwide. CIP is the convener of the Global Mountain Program (GMP), founded by CGIAR in response to the recommendations of UNCED. The GMP links CIP the Consortium for the Sustainable Development of the Andean Ecoregion (CONDESAN); the International Centre for Research in Agroforestry (ICRAF), ILRI, and ICIMOD. It supports cooperation and information sharing between researchers working in the Andes, the highlands of East and Central Africa, and the Himalayas in crosscutting research themes including natural resource management, biodiversity conservation, socioeconomic and policy issues, and agricultural production systems with the expectation that solutions

## Foreword

The value of mountain areas is only now being recognised, although they have always been important sources of food, water, energy, and timber. Mountain resources directly contribute to the livelihoods of several hundred million people living in mountain areas and indirectly support the livelihoods of several billion people living downstream. It was only after the RIO (UNCED) endorsement of Agenda 21, Chapter 13 in 1992 that international organisations started expressing concern about mountain ecosystems and mountain inhabitants. The state and use of mountain resources constitute an issue that affects us all, and the International Centre for Integrated Mountain Development (ICIMOD) is at the forefront of efforts to help promote the development of an economically and environmentally sound mountain ecosystem and to improve the living standards of mountain populations.

Livestock are an integral, but under appreciated, component of farming in the mountains and highlands. They provide food, wool, and hides for people and draught power and fertiliser for the cultivation of crops. Livestock are the key to ensuring that farmers in remote areas, without access to outside inputs, can practise a self-sustaining and self-sufficient form of agriculture in reasonable harmony with the natural resources of the mountains. Without livestock, these farmers would be unable to survive and many nutrients would not be recycled. Despite their tremendous importance, however, livestock have been marginalised in development agendas and have received little attention in international meetings.

By 1999, a number of activities had been initiated by different organisations with the aim of filling this gap. The Food and Agriculture Organisation (FAO), as Task Manager of Agenda 21, Chapter 13, had facilitated a number of inter-agency and inter-governmental meetings on mountain issues, but still felt the need to develop a clear vision of how livestock could be used best to develop sustainable agricultural

systems. The Animal Production and Health Division of FAO was holding independent regional consultations in Asia with ICIMOD, in Africa with the International Livestock Research Institute (ILRI), and in Latin America with the Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria (CIPAV). The Consultative Group on International Agricultural Research (CGIAR) had initiated a Systemwide Livestock Programme (SLP), which is convened by ILRI, and in collaboration with ICIMOD and the Centro Internacional de la Papa (International Potato Center, CIP) set aside funds for a project development consultation with key stakeholders. ICIMOD was investigating the status of livestock in mixed farming systems and in pastoral areas in the Hindu Kush-Himalayan region. Recognising the complementary nature of these activities, four agencies – ICIMOD, ILRI (SLP), FAO, and CIP (Global Mountain Program, GMP) – decided to organise a joint symposium to discuss the issues worldwide and to develop an action plan to highlight the role and importance of livestock for highland communities.

ICIMOD was delighted to be able to host the International Symposium 'Livestock in Mountain/Highland Production Systems: Research & Development Challenges into the Next Millennium' in Pokhara, a place of immense natural beauty in western Nepal, from 7-10 December 1999. For the first time, the meeting brought together representatives of governments; local and international NGOs; research, development, donor, and funding institutions; and community leaders and farmers from the major mountain regions of the world. Sixty-eight participants from fifteen countries in six continents attended.

I am pleased to join with our partners to present this book. It is based on the papers presented and discussions from the symposium summarising the present state of knowledge about and the future possibilities for livestock in mixed farming systems in the mountains. I am sure this will prove an invaluable resource for all those working towards the sustainable development of mountain agriculture and the maintenance of fragile mountain ecosystems. I thank specially all those who contributed to making the symposium a success, the organisers, the organising committee, the participants – including those who, unable to attend in person, contributed to the e-conference – and the editors of this publication who have prepared the results in a form that all can use. Last but not least we thank the Systemwide Livestock Programme convened by ILRI for its support to the Symposium and for bearing the costs of this publication.

J. Gabriel Campbell  
Director General, ICIMOD

## Executive Summary

This book is a summary of the proceedings of the International Symposium on 'Livestock in Mountain/Highland Production Systems: Research and Development Challenges into the Next Millennium', which took place from 7-10 December 1999, in Pokhara, Nepal. The symposium was jointly sponsored by the International Centre for Integrated Development (ICIMOD), the Systemwide Livestock Programme of the Consultative Group on International Agricultural Research (CGIAR) convened by the International Livestock Research Institute (ILRI), the Food and Agriculture Organisation (FAO), and the Centro Internacional de la Papa (International Potato Center, CIP). The aim was to address the critical issues facing research and development of livestock in mixed farming systems in mountain and highland regions in Africa, the Andes, and the Hindu Kush-Himalayas and to provide a direction for future activities. The meeting highlighted the main current and future trends and constraints to livestock production systems in mountain and highland environments. It discussed participatory research and development approaches to optimising livestock production and product supply systems with the aim of achieving sustainable increases in food security, income generation, and poverty reduction whilst maintaining the natural resource base. The meeting successfully established an inter-regional framework for testing and sharing of appropriate options and experiences and prepared a joint manifesto, the 'Pokhara Call for Action', as an expression of the commitment of the participants to work towards common objectives.

Eighteen papers on livestock and livestock-related issues were presented in plenary sessions. Separate working groups discussed, and developed action plans for, four thematic areas – livestock production systems (farm level); post production processes; livestock biodiversity and conservation; and livestock policy issues. The

symposium was preceded by an electronic conference, which provided people who could not attend the Pokhara Symposium with a forum in which they could contribute to developing a comprehensive livestock research and development agenda. This electronic conference was hosted on the FAO mail-server and ran for eight weeks. Nearly 600 subscribers from Africa, Asia, Latin America, Europe, and the United States participated.

The book is divided into four sections.

Part I is an introduction and summary, with a brief account of the symposium, the main points raised in the plenary sessions and working group discussions, the issues and challenges raised during the symposium and in more detail in the papers, and the text of the 'Pokhara Call for Action'.

Part II contains papers related to the role of livestock production systems in the context of changing socioeconomic circumstances, trends in livestock production and consumption, issues related to livestock biodiversity, the effect of technological and institutional changes on smallholders, problems of and the research needed to support sustainable livestock development, and niche-based livestock products. It closes with a report of the findings of the electronic conference.

Part III describes the results of three separate regional studies sponsored by FAO, in the Hindu Kush-Himalayas, East African Highlands, and the Andean region, on livestock production systems in high pressure mountain/highland areas.

Part IV is concerned with livelihoods and sustainability issues in mountain livestock farming systems. It includes chapters on concerns about sustainability, the need to make research more relevant to individual mountain smallholders using a holistic approach on the watershed scale, issues related to draught animal power and livestock as a source of household energy, the success and failure of milk co-operatives, gender roles in livestock management, and the potential and environmentally friendly nature of llamas and alpacas.

The Symposium Agenda, list of participants, and some information on the authors of the chapters in the book are presented in three Annexes.

One significant outcome of the symposium was the declaration of the 'Pokhara Call for Action'. In this the participants agreed

- to prepare a global research and development agenda to improve livelihoods in livestock-dependent mountain and highland communities which emphasise

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 utilisation and conservation of production resources, sustainable market-oriented livestock production systems, post-production processes, and 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; and
- to encourage research and development organisations to undertake activities to improve livelihoods in livestock-dependent communities in mountain and highland eco-regions.

ICIMOD  
Sustainable

ICIMOD

# Acknowledgements

We are grateful to Mr Chakra Prasad Bastola, Minister of Agriculture of His Majesty's Government of Nepal, for graciously inaugurating the symposium and consenting to be the chief guest at the opening ceremony. We would like to express our gratitude to Mr. Egbert Pelinck, the former Director General of ICIMOD, and Dr. Mahesh Banskota, the former Deputy Director General of ICIMOD, for their inspiration, support, and guidance. We thank Dr. Hugo Li-Pun, Director of the Sustainable Production System Programme of ILRI, for delivering the keynote address; Dr. Jimmy Smith, Coordinator of the Systemwide Livestock Programme, ILRI, and Dr. Roberto Quiroz, Head of the Department of Production Systems and Natural Resources Management, CIP, for their intellectual support; and Mr. Jeroen Dijkman, FAO and ILRI, for facilitating the electronic conference that brought in inputs from a wider audience. Special thanks are due to Ms Beryl Rajbhandari for her assistance in organising the symposium and in the preparation of this book. We would also like to thank Dr. Laxman Sherchan for his review of the final draft and the entire support staff of ICIMOD for their assistance. We also thank all the people who presented the papers that enabled the meeting to highlight livestock issues and options for mountain and highland communities across the globe, the symposium participants, and the contributors to the electronic conference. Finally, we wish to thank the four institutions, ICIMOD, ILRI (SLP), FAO, and CIP, for their generous financial and logistic support, without which the symposium would not have been possible.

**CIRNMA** Centro de Investigación de Recursos Naturales y Medio Ambiente  
(Bolivia)

**CONDENSAN** Consortium for the Sustainable Development of the Andean  
Ecoregion

**CPR** common property resources

**CFA** Technical Centre for Agricultural and Rural Cooperation  
(Netherlands)

## Acronyms and Abbreviations

ADB	Asian Development Bank
AEZ	agro-ecological zones
AHI	African Highlands Initiative (convened by ICRAF)
AI	artificial insemination
ALDI	Agricultural Development Led Industrialisation
APROSC	Agricultural Projects' Services' Centre (Nepal)
AU	animal units
BBM	broad bed maker
CAC	Central Asian countries
CATIE	Tropical Agronomic Research and Training Center
CEU	cattle equivalent units
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (Colombia)
CIID	Centro Internacional de Investigaciones para el Desarrollo
CIP	Centro Internacional de la Papa (International Potato Center) (Lima, Peru)
CIPAV	Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria (Colombia)
CIRNMA	Centro de Investigación de Recursos Naturales y Medio Ambiente (Bolivia)
CONDENSAN	Consortium for the Sustainable Development of the Andean Ecoregion
CPR	common property resources
CTA	Technical Centre for Agricultural and Rural Cooperation (Netherlands)

DAH	Decentralised Animal Health Project (ITDG)
DAP	draught animal power
DDE	dairy development enterprise (Ethiopia)
DFC	dairy farmers' cooperative
DP	dual purpose dairy
DSE	Deutsche Stiftung fuer internationale Entwicklung (German Foundation for International Development)
EAH	East African Highlands
EAP	economically active population
EARO	Ethiopian Agricultural Research Organization
ESCAP	Economic and Social Commission for Asia and the Pacific
FYM	farmyard manure
FAO	Food and Agriculture Organization
FY	financial year
GDP	gross domestic product
GI	galvanised iron
GIS	geographic information system
GMP	Global Mountain Program (CIP)
GNP	gross national product
GPS	global positioning system
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
HDI	human development index
HKH	Hindu Kush-Himalayas
HMGN	His Majesty's Government of Nepal
HP	Himachal Pradesh
HYVs	high yield varieties
IAC	International Agricultural Centre (Netherlands) check with CTA
IAR	Institute of Agricultural Research (Ethiopia)
IC	internal combustion
ICA	Colombian Agriculture Institute
ICIMOD	International Centre for Integrated Mountain Development (Nepal)
ICRAF	International Centre for Research in Agroforestry (Kenya)
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics

IDRC	International Development Research Center (Canada)
IFPRI	International Food Policy Research Institute (Washington)
IICA	Instituto Interamericano de Cooperación Agrícola (Costa Rica/ Ecuador)
IIED	International Institute for Environment and Development (London)
ILCA	International Livestock Centre for Africa
ILRI	International Livestock Research Institute
INGO	international non-government organisation
INIA	Instituto Nacional de Investigaciones Agropecuarias (Puno, Peru)
IR	Indian Rupee
ISNAR	International Service for National Agricultural Research
ITDG	Intermediate Technology Development Group
IYM	International Year of the Mountains
JVP	Joint Vertisol Project (Ethiopia)
KCC	Kenya Cooperative Producers
KVIC	Khadi and Village Industries Commission
MOA	Ministry of Agriculture
MPA	Milk Producers' Association
NGO	non-government organisation
NPV	net present value
NRM	natural resource management
PISA	Proyecto de Investigacion de Sistemas Agropecuarios Andinos (INIA)
PPR	private property resources
PRA	participatory rural assessment
PRODASA	Proyecto de Desarrollo Agropecuario Sostenido en el Altiplano (convenor CIP-INIA/CONDESAN)
R&D	research and development
REPAAN	Red de Pastizales Andinos (FUNDAGRO project, Ecuador)
RET	renewable energy technologies
SAC	south Andean camelid
SD	specialised dairy

SLP	Systemwide Livestock Programme (convenor ILRI)	ILRI
SSA	Sub-Saharan Africa	IFPRI
TLU	tropical livestock units	ILCA
UNCED	United Nations Convention on Environment and Development	IED
UNFPA	United Nations Population Fund	ILCA
VDCs	village dairy cooperatives (India), Village Development Committee (Nepal)	ILRI
		INIA
		IR
		ISAR
		ITDG
		IYM
		JVP
		KCC
		KVIC
		MOA
		MPA
		NGOs
		NPV
		NRM

10

Kenya  
Arid

# Table of Contents

Foreword	
Executive Summary	
Aknowledgements	
Acronyms and Abbreviations	
<b>Part 1: Introduction</b>	<b>1</b>
1 Livestock in the Mountains and Highlands of Asia, Africa and South America: An Overview of Research and Development Issues and Challenges	3
<b>Part 2: Livestock in Mountain Livelihoods</b>	<b>33</b>
2 The Sustainable Development of Mountain Regions: A Paradigm Shift and New Considerations	35
3 Livestock in Mountain/Highland Production Systems: Challenges and Opportunities	43
4 Markets and Livestock in the Coming Decades: Implications for Smallholder Highland Producers	57
5 Livestock Biodiversity in the Mountains/Highlands – Opportunities and Threats	71
6 Technological & Institutional Changes Affecting Mixed Crop-Livestock Production Systems in the Andes	83
7 Challenges and Opportunities for Livestock Development in the Highlands of Ethiopia	95
8 Highland Livestock Production Systems—Is there a need for specialised livestock product processing and marketing?	103

9	Research and Development Challenges in Livestock Production Systems: A Report of the E-Conference	109
<b>Part 3: Livestock in High-Pressure Mountain Regions</b>		<b>121</b>
10	Livestock Production and Management Strategies in the Mixed Farming Areas of the Hindu Kush-Himalayas, Asia	123
11	Livestock Production in Areas of High Pressure Crop-Livestock Farming Systems in the East African Highlands	135
12	Systems of Milk Production in the Andean Region of Colombia: A Comparative Study	159
<b>Part 4: Livelihoods and Sustainability</b>		<b>169</b>
13	Livestock Based Livelihoods in Tibet, China, and Sustainability Concerns	171
14	Sustainability Concerns of Livestock-Based Livelihoods in the Andes	183
15	Animal Agriculture and Watershed Management: Reconciling Public and Private Good	203
16	Draught Animal Power in Mountain Highland Agriculture: Issues and Options	221
17	Livestock as a Household Energy Source in the Mountains: Traditional Practices and New Opportunities	245
18	Smallholder Livestock Farming and Milk Cooperatives in Himachal Pradesh in the Indian Himalayas	255
19	Gender Roles in Livestock Management: Experiences and Lessons from Projects in the African Highlands	275
20	Importance of Alpacas and Llamas in the Changing Context of Development Research	285
Annex 1: Programme		297
Annex 2: List of Participants		303
About the Contributors		313