

Investing in the Future

Agricultural Research and Education
for Sustainable Mountain Agriculture -
Report of a Regional Consultation

Editors
Mahesh Banskota
Tej Partap



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Kathmandu, Nepal
January 23-26, 1996

Editors
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Foreword

Thousands and thousands of mountain people, both men and women, are responding in a myriad ways to the daily challenges of survival in a difficult environment. In the past, the principal part of this response has been to improve mountain agriculture. Indigenous wisdom played a singular role in bringing about the needed changes and mostly its workings were slow, small-scale, and evolutionary, rather than revolutionary. As the pace of change in mountain agriculture is significantly outpaced by more drastic changes from other forces, such as population growth, deforestation, expanding commercialisation, and so on, mountain agriculture is in dire need of becoming more sustainable in the future.

For the majority of the 125 million mountain people currently living in the HKH region and their children and grandchildren, these mountains will continue to be their home even in the 21st century, and mountain agriculture will still be a way of life for substantial numbers of them. Apart from this direct concern for mountain people, the failure of mountain agriculture and the resulting deterioration of mountain environments will have far-reaching downstream effects. Improving mountain agriculture in any way we can is therefore a challenge, and we need to find out what we can really do here.

One critical lacuna in the past has been the relatively gross neglect of attention to specificities of mountain agricultural education and research systems in the region. Realising this, ICIMOD proceeded to contact the different agricultural education and research organisations that could play an important role in future in improving the productivity and sustainability of mountain agriculture. The response has been overwhelming, as is evident from the contents of this monograph, "Investing in the Future." There is unanimous concern about the future of mountain farm households and about mountain agriculture in general. However, the approaches proposed for dealing with different aspects were, quite rightly, very different, reflecting different agroclimatic belts and different socioeconomic, cultural, and institutional conditions. Besides the identification of many beneficial activities for strengthening mountain agricultural education and research, there also emerged a new fraternity of mountain agricultural universities, professionals, and researchers, all unanimous in their call for ICIMOD to play a major facilitating role. ICIMOD will carefully study many of the issues and recommendations identified and select those to which we can make a meaningful contribution, and in particular those for which we have the specific mandate and comparative advantages, i.e., a mountain-specific focus, multidisciplinary, and regional collaboration. I also hope others will,

125 million mountain people currently living in the HKH region... and mountain agriculture will still be a way of life for substantial numbers of them

E. Pelinck

at least, find a few innovative ideas and activities for implementation in this very critical area of mountain agricultural education and research. Our contribution today can make a significant impact tomorrow on the sustainability of mountain agriculture.

In closing, I would like to thank all the Vice Chancellors, Secretaries, Director Generals, Professors, and Researchers who worked hard to make a contribution during the Regional Consultation on Research and Education for Sustainable Mountain Agriculture held in Kathmandu, Nepal, from January 23-26, 1996. Organising this Regional Consultation was made possible through generous financial support provided by the Government of the Netherlands for a large programme on Institutional Strengthening for Sustainable Mountain Agriculture implemented by the Mountain Farming Systems' Division of ICIMOD. I take this opportunity to express our great appreciation of the Government of the Netherlands for this generous support to ICIMOD. I would also like to express appreciation of the efforts of Dr. M. Banskota and Dr. Tej Partap as editors of this important monograph. Thanks are also due to Greta Rana and her colleagues for preparing this manuscript for publication.

Egbert Pelinck
Director General

Preface

The Mountain Farming Systems' Division of ICIMOD is engaged in a long-term programme of strategies for sustainable mountain agriculture. Identifying and promoting ways of improving institutional capacities with respect to agricultural research and education was one of principal objectives of this programme.

To initiate a dialogue on regional cooperation among educational and research institutions in the Hindu Kush-Himalayas, a 'Regional Consultation on Education and Research for Sustainable Mountain Agriculture' was organised by the Mountain Farming Systems' Division of ICIMOD from January 23-26, 1996, in Kathmandu, Nepal. The participants at the conference included, Vice Chancellors of the Universities of the HKH, Heads of Agricultural Research Institutions and Extension Agencies, representatives of NGOs in the region and International Agricultural Research Centres.

The main objective behind the meeting was to provide an opportunity to institutions to share their experiences and vision on mountain agricultural research and development processes within the region. It was expected that such interactions will lead to a better understanding of the need for regional cooperation in respect of mountain agricultural research and education. The meeting was a great success and ended up making several recommendations for and promises of follow-up action at national and regional levels.

This report presents a complete account of the issues concerning mountain agricultural research and education presented, highlighted, and deliberated upon during the consultation. The report starts with a brief background to this meeting, and then highlights the overall concerns of agricultural research and education raised by the distinguished speakers at the inaugural session. The following chapters are devoted to the key issues of the state of education and research in the HKH, soil fertility and water management challenges, the food security and livelihood concerns of the mountain farmer, institutional innovations in and micro-level evidence of sustainable mountain agricultural development approaches.

A considerable amount of deliberation took place on the perspectives, role, and responsibilities of the national agricultural research and education systems. Several experienced representatives from many institutions shared their vision and experiences. Keeping the essence of the points speakers made, we have tried to summarise their statements as concisely as possible.

a 'Regional Consultation on Education and Research for Sustainable Mountain Agriculture' was organised by the Mountain Farming Systems' Division of ICIMOD from January 23-26, 1996, in Kathmandu, Nepal

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The chapter on recommendations sums up the participants' suggestions for improving education in and research on mountain agriculture. The final chapter mainly consists of the closing remarks made by selected participants and their views on the achievements of the consultation as a whole.

In writing this report, we were faced with the challenge of putting the diversity of visions and experiences shared by the participants into a concise and readable framework. We have tried hard to do so with as much representation of the facts as narrated by participants themselves as possible. Responsibility for any mistakes and misquoting of facts attributed to others in this report is ours alone.

Editors

Acronyms

AKRSP	Aga Khan Rural Support Programme
AZRI	Arid Zone Research Institute
CAFA	Commission for Agriculture, Forestry and Animal Husbandry
CGIAR	Consultative Group on International Agricultural Research
CHT	Chittagong Hill Tracts
CIMMYT	Centro Internationale de Mejoramiento de Miaz y Trigo
CRMT	Central Research Management Team
CIP	Centro International de la Papa
FAO	Food and Agriculture Organisation
HKH	Hindu Kush-Himalayas
HP	Himachal Pradesh
ICAR	Indian Council for Agricultural Research
ICARs	International Agricultural Research Centres
ICARDA	International Centre for Agricultural Research in Dry Areas
ICIMOD	International Centre for Integrated Mountain Development
IMF	International Monetary Fund
IRRI	International Rice Research Institute
LAC	Lumle Agricultural Centre
masl	metres above sea level
NARS	National Agricultural Research Systems
NARC	National Agricultural Research Council, Nepal
NE	North East (Indian Himalayas)
NGO	Non-Government Organisation
GDP	Gross Domestic Product
PAC	Pakribas Agricultural Centre
PARC	Pakistan Agricultural Research Council
RNR	Renewable Natural Resources
R&D	Research and Development

SNV Netherlands' Development Organisation

TA Transformed Area

TV Television

UP Uttar Pradesh (India)

UNDP United Nations' Development Programme

VHF Very High Frequency

Executive Summary

Sustainable mountain development emphasises the need for some fundamental changes in agricultural research and education. Starting by overcoming the neglect and isolation of mountain agriculture and its farming women and other household members, the focus of education and research should not simply be on maximising productivity, but more on the sustainable use of fragile resources. ICMOD's initiative in bringing together the agricultural education and research organisations active in the Hindu Kush-Himalayas was motivated by the need to assess the current state of mountain agricultural education and research and to identify future research and educational priorities for the region.

The Prime Minister of Nepal, in his inaugural address, made a very strong plea by saying that *"...while a progressive rise in the standard of living is a legitimate aspiration of the people of mountain areas, this does not mean that we should lead a wasteful and polluting lifestyle."* This can be seen as the major challenge for the agricultural research and educational systems in the region. Dr. Amir Mohammed, in his keynote speech, pointed out that without improvements in many social, legal, and resource access conditions, *"mere availability of improved technology cannot achieve the desired end result of a healthy, vibrant agriculture at the grass roots."*

The theme papers presented at the conference touched upon a number of critical dimensions of agricultural research and education in the region. Banskota and Partap pointed out that mountain farmers could no longer afford to think too far into the future, referring to the practical problems of resources' conservation. In spite of many critical areas requiring systematic research and integration with the educational system, agricultural research and education lacked the needed resources and were not preferred areas of work. Partap and Shah discussed the deteriorating soil and water resource base in mountain areas and argued that natural factors had been as important, if not more so, than mountain farmers in this process of change. They outlined some of the new, promising areas of research and learning in the management of soil and water resources. A number of contributions focussed on institutional issues. Dr. Zafar Altaf pointed out that, in the ongoing agricultural institutional adjustments generated by liberalisation and structural adjustments, it is not clear who would focus on the problems of the small farmers as the priorities focussed not on what one produced, but on what the markets wanted. Anupam Bhatia pointed out that change was always painful but it was *"going to be a*

*...A
Progressive
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areas.*

**Hon'ble Prime
Minister, S. B.
Deuba**

**...the need to
Integrate
farmers'
preferences
and
knowledge
with scientific
knowledge
and
technology**

Editors

common thread and the ability of institutions to adopt and to meet the challenges of the future are going to be critical for sustainable mountain agriculture." There were many strong points to traditional systems, but these alone were insufficient to cope with new challenges. New capabilities need to be developed. Dr. Liu Yan Hua discussed the changes in institutional fortunes following market-oriented policies in China. Many institutions could not afford good people and without good people many organisations had no future in the market place. Paul Harding discussed the innovations being introduced at Lumle Agricultural Centre in Nepal where the institution was going through many different changes-the most important being the transformation from a donor managed, agricultural research and extension centre to being a part of the national agricultural research system.

A number of other presentations touched upon the issue of farmers' perspectives. Ram Yadav referred to the Chinese saying about walking on two legs while emphasising the need to integrate farmers' preferences and knowledge with scientific knowledge and technology. He cited an interesting example in which VHF telephone connections had helped farmers locate markets for their produce. Trilok Papola made a number of provocative suggestions when he argued that food security questions should be turned away from food self-sufficiency questions and furthermore that mountain agriculture as a sustainable source of livelihood in the mountains would remain a question mark. Jose Luis Reuda noted the need for different agencies to work together by contributing from their respective strengths or comparative advantages.

Presentations of micro-level experiences from different countries emphasised the overall role of infrastructure, service, and processing in order for subsistence agriculture to move towards high-value activities. Contributions from the different national agricultural research systems highlighted the experiences of the Arid Zone Agricultural Research Institute (AZRI) in Pakistan, the changing nature of pastoral areas in China, mixed farming systems in the middle hills of Nepal, and shifting cultivation in India and Myanmar. One interesting observation from Nepal was that many of the problems farmers were facing were not agricultural research issues *per se* but issues concerning other sectors such as roads, electricity, education, health, and drinking water.

Many Vice-Chancellors made presentations on the status of agricultural research and education in their respective universities, focussing on the needs of sustainable mountain agriculture and the underlying problems and weaknesses in the measures taken to respond to some of these challenges.

Recommendations focussed on four major areas - transforming education systems, redefining research priorities, internalising gender, and creating regional and international partnerships and alliances for sustainable mountain agriculture.

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Background and Objectives of the Workshop

Present policies, investments, research, and technology development have only a limited focus on mountain problems. Even if there have been efforts towards crisis management, most interventions have been undertaken with a predominately plains' bias. These are significant lacunae in our understanding of the interventions that should be undertaken in future to render mountain agriculture sustainable. The alleviation of poverty and the extent to which we can improve mountain environmental conditions will greatly depend upon a comprehensive understanding of the constraints and opportunities prevailing in this extremely challenging environment.

Under these circumstances, the daunting task of sustainable mountain development emphasises the need for fundamental changes in agricultural research and education. First, there are relatively few universities in the Hindu Kush-Himalayan Region. Second, most of the existing universities suffer from the same type of neglect and isolation that mountain populations and areas have experienced in the past. Thirdly, mountain institutions have also overlooked their immediate envi-

ronment in their research and teaching activities and focussed more on non-mountain and lowland concerns. Fourthly, because of the problems of access and communications prevailing in mountain areas, professionals there have always found it easier to liaise with their counterparts in the plains than with those in mountain areas, reinforcing the plains' bias in teaching and research activities.

With this in mind, ICIMOD carried out a comprehensive review of the existing institutional systems in the Hindu Kush-Himalayan Region to assess the existing institutional capacities for sustainable development of mountain agriculture*. A number of issues emerged from this exercise.

These issues were as follow.

- i. Most institutions have been greatly influenced by plains' based research. Only some institutions have been able to incorporate the mountain perspective into their mandates and functioning.
- ii. R & D institutions for mountain agricultural development are still

* For further details see ICIMOD 1995, *International Workshop on Institutional Strengthening for Sustainable Mountain Agriculture. Report of the International Workshop on Institutional Strengthening for Sustainable Mountain Agriculture Kathmandu: ICIMOD.*

I

....Mountain institutions have also overlooked their immediate environment in their research and teaching activities....

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.... Many institutions are increasingly being criticised, for research activities that appear to have little relevance to the problems of their surrounding environment...

Editors

very sectorally oriented and continue to focus primarily on maximising yields rather than on the sustainable use of fragile resources.

- iii. Incorporation of indigenous knowledge in formal agricultural research systems has received very low priority, thus leading to limited adoption of modern technologies by mountain farmers.
- iv. Wherever agricultural research institutions have been able to make a significant impact, the key factor behind this was their ability to understand and harness the comparative advantages of mountain areas.

At a time when more questions are being raised than answers provided in every aspect of development, the present role of agricultural research and educational institutions in mountain areas in generating appropriate knowledge, technologies, and human resources; in promoting

relevant research; and in providing answers to complex economic and environmental issues appears to be fairly limited, sporadic, and far fetched. Many institutions are being increasingly criticised for research activities that appear to have little relevance to the problems of their surrounding environment.

The strange anomaly is that while much of the present development discussion emphasises the need for greater familiarity and understanding of the local environment, local resources, local knowledge base, local cultures, and local adaptation mechanisms, most of the teaching and research institutions in mountain areas do not focus on the problems of their local environment. A great effort is needed to integrate modern science and technology with the conditions of the local environment in the academic and research activities of most of the teaching and research institutions working in mountain areas.

As mountain areas open up and come into contact with the wider market

Expansion of horticulture on to sloping marginal lands and forest areas: economically beneficial and ecologically viable - Himachal Pradesh, India
T. Partap



economy, and governments seek to launch an increasing number of development activities, balancing environmental damage with conservation and sustainable use is becoming both an intellectual as well as a practical challenge for these institutions. Research centres and institutions of higher learning in mountain areas should begin to focus on some of these critical issues.

Objectives of the Regional Consultation

ICIMOD organised this consultation as a first step towards fostering REGIONAL COOPERATION for sustainable development of mountain agriculture among the agricultural research and educational institutions located in or concerned with mountain agriculture in the HKH. The consultation was intended to provide a platform for sharing experiences, discussing issues of common concern, and identifying areas for joint activities among the research and educational institutions in the HKH Region.

The consultation also provided a forum for discussing priority areas and activities for ICIMOD, in general, and for its Mountain Farming Systems' Division in particular.

More specifically the consultation attempted to address the following.

- i. To assess the extent to which the mountain focus is being taken into consideration in agricultural research, education, and training within academic and research institutions.
- ii. To identify the gaps in the roles required of agricultural universities and research institutions in the region to facilitate a sustainable transformation of farming in the HKH.
- iii. To identify priority areas for research, teaching, and training in sustainable mountain agricultural development in the HKH.
- iv. To identify mechanisms through which data exchange, sharing of

ICIMOD's comparative advantage lies in partnership and collaboration with development agencies both inside and outside the region.

Editors



Participatory on-farm research, training, and scientist-farmer interaction in Ningnan County, Sichuan, China
Tang Ya



Group photo of participants at the Regional Consultation with the Hon'ble Prime Minister of Nepal

experiences, and joint programmes related to sustainable development of mountain agriculture could be established and promoted in the future between universities, national agricultural research centres, and concerned agencies in the HKH Region.

Programme and Participation

This programme brought together the main actors in the Region concerned with mountain agricultural education and research to discuss sustainable mountain agriculture. By generating awareness about the condition of mountain agriculture, a dialogue was initiated between research organisations and agricultural universities through which stronger mountain-oriented agricultural education and research and extension programmes in the Hindu Kush- Himalayan Region could be developed. A number of

priority areas for ICIMOD programme activities was also discussed.

The participants were drawn mainly from the seven countries of the Hindu Kush-Himalayan Region. There were ten Vice- Chancellors; many Director Generals, or their representatives, from national agricultural research organisations; and senior officials from agricultural development agencies. There were also some participants from outside the region, one from a CGIAR centre, and others from a few international agencies. A number of bilateral agencies also participated, including the senior staff of ICIMOD.

Overall Concerns

Egbert Pelinck, Director General, ICIMOD

Over the past ten years, ICIMOD has developed active linkages with hundreds of research, development, and educational organisations in the Hindu Kush-Himalayas. As a relatively small international centre, its comparative advantages lie in partnership and collaboration with development agencies both inside and outside the region. Although the primary beneficiaries are the mountain people, ICIMOD works through different national, provincial, county, and local development organisations that have far better roots on the ground.

Insofar as mountain agriculture is concerned, ICIMOD has made major efforts during the past decade in a number of areas.

- Developed a better conceptual and empirical understanding of the changes in mountain agriculture in the Hindu Kush-Himalayas
 - Identified success stories and assessed their underlying processes, mechanisms, and policies in order to replicate them
 - Identified and promoted soil-conserving technologies
 - Undertaken different institutional strengthening activities to promote the sustainable development of mountain agriculture.
- The important achievements of past activities in sustainable mountain agriculture have been the following:
- development of the mountain perspective framework which has helped to assess the appropriateness of development decisions to mountain areas;
 - reviewed the status of mountain agriculture in different countries of the HKH region, which has improved our understanding of the diversity of mountain environments as well as of the policies and programmes of different governments;
 - identified success stories in the transformation of mountain agriculture, including an assessment of their replicability insofar as technologies, policies, programmes, and institutional mechanisms were concerned;
 - field-tested appropriate technologies for soil conserving farming systems in different ecoregions in the Hindu Kush-Himalayas, jointly with national partners; and

... The mountain perspective framework has facilitated a better understanding of the problems and opportunities in mountain agriculture.

E. Pelinck

....If the challenges are increasingly clear, the most effective development responses for sustainable mountain agriculture are far from clear....

E. Pelinck

- assessed existing institutional capabilities in mountain agricultural development and the support and strengthening needed for different national and provincial agricultural development agencies working in mountain areas.

It is in the context of institutional strengthening for sustainable mountain agriculture that ICIMOD is organising this present consultation to mobilise the support of agricultural research and educational organisations. The specific objectives of this consultation are:

- to assess the current state of agricultural research, education, and training within academic and research institutions in the context of a mountain focus;
- to identify the gaps in the required roles of agricultural universities and research institutions in the region for sustainable transformation of farming in the Hindu Kush-Himalayas;
- to identify priority areas for research, teaching, and training in sustainable mountain agricultural development in the HKH; and
- to identify mechanisms through which data exchange, sharing of experiences, and joint programmes related to the sustainable development of mountain agriculture can be established and promoted in the future between universities, national agricultural research centres, and concerned agencies in the HKH Region.

If the challenges are increasingly clear, the most effective development responses for sustainable mountain agriculture are far from clear - despite massive, if highly fragmented (or sectorally compartmentalised), government and aid agency interventions throughout the mountains. While there is no scarcity of gloomy predictions regarding mountain agriculture, successful and preventative methods seem very hard to identify and replicate with the speed and scale urgently required.

Rational management of natural resources in the mountains depends on the integrated development of improved and diversified mountain farming systems, better infrastructure support for the hill farmer, more effective forest and pasture and watershed management — but equally and essentially — on new attitudes and commitments (at local, district, regional, and national levels), integration of indigenous knowledge, decentralised community action, community responsibilities, and community-based gender-sensitive decision-making.

Today, the challenge for all of us is how to bring about growth in productivity without damaging the environment. I am confident that, with the growing interest and commitment of agricultural departments at the national, state, and provincial levels, Agricultural Universities and international organisations can join hands to work for a sustainable future for mountain agriculture. For all the good things we have enjoyed from the mountains, this is the minimum we can give back.

**Tom Derksen, SNV
(The Netherlands)
Representative, Nepal**

You may wonder why a flat and swampy country like the Netherlands, with half of its surface below sea level, is interested in mountains at all. Well, obviously there is the usual fascination with those things that one does not have, and this is why annually 8,000 plains' land Dutch mountain lovers come to enjoy the wonderous mountains of Nepal.

Yet, the development cooperation interest has another reason and stems from the fact that, in mountain regions, we encounter three areas of concern, all of them interlinked and constituting a central theme in Netherlands' policy. They are the following.

- Firstly, poverty: where do we often find pockets of poverty? Obviously in the mountains with their problems of difficult accessibility, scarcity of agricultural resources, and social and political marginalisation that commonly form barriers for economic and social prosperity.
- Secondly, environmental conservation: where does one often encounter serious forms of environmental degradation? Again, in the mountains, where the fragility of the environment, inappropriate planning of physical infrastructure, and intensive utilisation of available resources together result in serious environmental degradation.
- Thirdly, gender concerns. These are well described in one of

ICIMOD's recent papers by Jeannette Gurung. Women in mountain communities, given their overall lower status and literacy levels, often are doubly marginalised in the vicious circle of poverty and resource degradation. Their opinions, needs, and perceptions are rarely reflected in national policies and international fora.

Nowhere is the intricate link between poverty and environmental degradation more obvious than in mountain regions. And nowhere is the need for addressing these problems in an integrated and gender balanced manner more obvious. By putting people up front, sustainable resource management systems should be designed, integrating human needs with environmental realities.

What then is the specific Netherlands' interest in ICIMOD?

On the one hand, it is because the majority of the countries participating in ICIMOD have bilateral cooperation programmes with the Netherlands. This is the case with five of the eight ICIMOD countries.

On the other hand, it is because the Netherlands considers regional cooperation essential to address common interest problems and to translate them into transboundary action plans. Encouraging a sense of shared responsibility and facilitating an exchange of governmental and non-governmental actors in society, as well as strengthening the capacities of concerned organisations, are important objectives of regional cooperation programmes.

*...Putting
People
Upfront*

*...Listening is
crucial in such
cooperative
efforts.....*

*...ICIMOD
provides a
platform for...*

*... Mutual
listening and
learning*

T. Derokson

...Most mountain areas need to expand their economies at a fairly rapid rate to satisfy the legitimate aspirations of their people. This will entail a significant increase in the use of natural resources. The challenge is to attain this without harming fragile mountain environments.

S. B. Deuba,
Prime Minister of
Nepal

We believe that listening is crucial in such cooperative efforts, listening to other countries' experiences, listening within countries to the voices of the mountain men and women whose future is at stake. They are the keepers of the secrets of the mountains. Understanding their survival skills and embedded indigenous wisdom teaches us great lessons and helps to pave the way towards a sustainable future. We believe ICIMOD is in a unique position to bring the interests of individual countries together and to provide a platform for such mutual listening and learning. Operating at the interface between research and development, ICIMOD is well situated to address mountain problems, look at alternative strategies and approaches, and turn disadvantages into advantages and constraints into opportunities.

Today's regional consultation on agricultural research and education, which is part of the Netherlands' supported Institutional Strengthening Programme, sets out to do just that. The consultation's underlying objectives to move the focus of curricula and research agendas upwards, from the plains to the mountains, thus following the Dutch trekkers in their fascination with the mountains, is an important step towards increased listening and learning.

I would like to assure ICIMOD of continued Netherlands' core funding support in the years to come.

I would like to wish the participants

great success in the coming days - working in the mountains for the mountains - working with mountain people for the mountain people.

Sher B. Deuba, Hon'ble Prime Minister of Nepal*

It is a great pleasure and privilege for me to be here with you today. I am grateful to ICIMOD for inviting me to share with you some of my views in this important Regional Consultation on Agricultural Research and Education for Sustainable Mountain Agriculture.

I am greatly encouraged by the fact that such a highly reputed group of professionals has assembled here to discuss research and education for mountain agriculture. It is probably the first time that so much scientific, professional, and management wisdom is being brought together in one place to discuss mountain agriculture. If this can result in concrete follow-up activities in mountain areas, I am confident that the future has bright prospects for mountain farmers. It is only through consultations like this one that we can overcome the strong biases in development that work against mountain areas. Fortunately, many of the concepts of mainstream development are also being questioned today and changes are being made. Let us hope mountain areas will benefit from these changes by not only receiving more research and educational attention, but also through a style of development that is more mountain friendly.

Most mountain areas need to expand

** Shortened version of the speech that was read out at the meeting.*

their economies at a fairly rapid rate to satisfy the legitimate aspirations of their people. This process of expansion will entail a significant increase in the use of natural resources. The challenge for us all is to attain this without harming fragile mountain environments. Our lifestyles and development patterns must therefore be compatible with these environments, otherwise pollution, degradation, and damage will set in fairly quickly. Thus, while a progressive rise in the standard of living is a legitimate aspiration of the people of mountain areas, this does not mean that we should mimic wasteful and polluting lifestyles. On a priority basis, our development strategies should aim at satisfying basic human needs in terms of food, education, health, safe drinking water, and a healthy and secure environment. Full use should be made of modern science and technology, as well as indigenous knowledge, to realise these development goals.

I think we all agree that mountain populations will probably double in the next three decades. We have some

idea about how the majority of mountain people survived in the past—expanded their cultivated areas; migrated, both seasonally and permanently; and, more recently, started to develop other economic activities. The big question is are these changes adequate to meet the demands of future mountain populations? Already the difficulties, in terms of inadequate resources and environmental stress, are fairly apparent throughout the mountains. Poverty, the biggest curse in mountain areas, is common throughout.

Humanity's success in feeding the growing population of the world during the past five decades has been truly spectacular. In many areas, previously famine-ridden people no longer have to worry about food per se. They can turn their attention to improving their incomes to provide themselves with reasonable access to food and other necessities. Whereas the Green Revolution is now running out of steam in many areas of the world, and there is renewed concern about the future of agriculture in the plains, the

...Much greater commitment is needed on the part of governments in terms of investments in developing appropriate research and educational systems for sustainable mountain agriculture.

S. B. Deuba,
Prime Minister of
Nepal



Hon'ble Prime Minister of Nepal, Sher Bahadur Deuba, addressing the participants

.... much greater commitment is needed on the part of governments in terms of investment in developing appropriate research and educational systems for sustainable mountain agriculture.

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mountain areas did not benefit significantly from this technology. This is because these technologies were better suited to stable, uniform, resource-rich conditions accompanied by good water supplies and soils found in the plains. These technologies did not work well in ecologically complex and fragile environments such as the mountains of the Hindu Kush-Himalayas.

Ladies and gentlemen, it is now up to us to find the appropriate technologies, the practices, the human skills, and the solutions needed to make mountain agriculture sustainable. We need to devise systems that serve the needs of mountain farmers. This does not necessarily mean restricting our efforts to food crops, as experiences with high-value crops in many accessible pockets throughout the mountain areas are demonstrating. What are the comparative advantages of specific mountain areas? How can these be developed so that the benefits of these developments can be felt on small mountain farms? What are the problems in terms of environmental management and what can be done in affordable terms?

We cannot afford to be over ambitious or unrealistic. The resources available are extremely limited and, unless we can generate more resources ourselves, the well will run dry, as donors are unable to provide the resources as they have in the past.

The contribution that agricultural research and education can make to transforming mountain agriculture and

rendering it more sustainable is unquestioned. In the past, most of the efforts have gone into increasing output at the cost of other resources. In future, agricultural research and education should give priority to techniques and practices that enhance production without damaging the environment. To facilitate this, much greater commitment is needed on the part of governments in terms of investment in developing appropriate research and educational systems for sustainable mountain agriculture. There is also a need for a careful review of policies so that the prevailing biases against the development of mountain agriculture are removed. While you discuss the different issues during the next few days, think about the mountain farmers and their families and their homesteads situated on steep mountain slopes. How will your message be relevant to them? How can they benefit from your wisdom and insight?

Finally, as I leave you with these thoughts, I wish you a very productive meeting and look forward to your recommendations. I also invite you to look around, see this historic city, and enjoy the Himalayas; the mountains that may appear to be in the background, but which I am confident are in the foreground of your thoughts at this meeting. Thankyou.

Amir Mohammed*
President, ASIANICS,
Islamabad

The main source of sustenance for the population in the HKH region is

* Dr. Amir Mohammed's paper "Reforming the Agricultural Research and Education Systems of the HKH Region for Sustainable Mountain Development: Needs and Challenges" was the Keynote Address at the workshop

agriculture, including field crops, horticulture, livestock, forestry, and, to a smaller extent, fisheries. Land holdings are very small and becoming further subdivided as the population increases. Widespread poverty and the pressure of population force the people to eke out a living from non-sustainable and often environmentally damaging use of the natural resource base. The desperate need for food, firewood, and shelter — the very basic requirements for human survival have led to the degradation and widespread erosion of the fragile land resources and denudation of the forest areas.

Agricultural Production: A Complex System

Improved technology is only one, albeit a very important, input into the agricultural production system. Besides generation and dissemination of improved technology through education, research, and extension sub-systems, the organisation of input supplies' networks, farm credit, harvest

and post-harvest management of produce, and domestic and export marketing supported by an adequate communication infrastructure are very important aspects of healthy agriculture. Rural areas, particularly in the largely inaccessible mountainous regions, are devoid of basic amenities, and this makes the quality of life unattractive for ambitious youth who consequently migrate to urban areas in search of better amenities and social status. Land tenure aspects, especially absentee landlordism, outmoded land registration and transfer methods that have led to a lot of corruption and prolonged litigations, and several other socio-cultural aspects of rural life that adversely affect agricultural productivity need to be carefully researched and improved.

Unless all these aspects are simultaneously improved, the mere availability of improved technology cannot achieve the desired end result of healthy, vibrant agriculture at the grass

....absolute landlordism, outmoded land registration and transfer methods....

Prolonged litigations and several other sociocultural aspects.... adversely affected agricultural productivity.

Horticulture and pasture management... important in the mountain areas are not sufficiently covered in curricula.

A. Mohammed



Seabuckthorn replication feasibility mission of ICIMOD in China - facilitating the transfer of Chinese knowledge and experiences across the HKH (Jianping County, China, 1991)
Tej Partap

Agriculture in mountainous areas is largely based on integrated crop-livestock-agroforestry farming systems, whereas the educational system is implicitly based on the monoculture of individual commodities

A. Mohammed

roots. Thus, efficient management of the overall complex agricultural production system (along with improvement of the various components) is the key to development of progressive and sustainable agriculture.

Institutional Framework for Agricultural Education and Research

Most countries in the region have agricultural universities/colleges and research institutes located in mountain regions. These institutions, barring a few in the Indian and Chinese HKH territories, suffer from all the handicaps that their sister institutions in the plains suffer from: shortage of trained staff, funds, laboratory equipment, library facilities, and transport for field experimentation and contact with the farmers. In addition, being located in the relatively inaccessible areas, they find it harder to attract and retain qualified scientists as their staff members.

Agricultural Education Institutions

Educational institutions located in the HKH region have been extensively reviewed in the country reports published by ICIMOD in 1995. Most of these institutions suffer from the following problems.

- i. Their organisational structures and curricula emphasise crop production under irrigation, and this is unsuitable for mountain ecological and socioeconomic conditions.
- ii. Agriculture in mountainous areas is largely based on integrated crop-livestock-agroforestry far-

ming systems, whereas the educational system is implicitly based on the monoculture of individual commodities, mostly food and cash crops. Horticulture and pasture management, which are very important in mountain areas, are not sufficiently covered in the curricula.

- iii. Adequate emphasis has not been given in the curricula to the fragile aspects of the mountain environment.
- iv. Linkages of these institutions with research institutes, extension organisations, and the public sector development system are often quite weak. Educational institutions often confine themselves to on-campus teaching.
- v. There is little interaction between teaching institutions and farmers.

While it is difficult to generalise on the situation of all the agricultural universities/colleges in the HKH region, it would be worthwhile to describe, in some detail, the situation of the main institution in Pakistan.

- The curricula are copied almost entirely from and designed mostly for irrigated agriculture in the hot plains.
- Very little emphasis in the curriculum is given to livestock, forestry, range management, or aquaculture.
- The agricultural colleges have no expertise in agriculture at the senior management level.

- The Colleges have no formal linkages with State agricultural departments. The agricultural community is not involved in identification of problems in the agricultural sector or in finding solutions to them through research.
- The colleges have no outreach programme — the farmers rarely visit the college and the college faculty and students do not undertake research on farmers' problems.
- Very few funds are provided to the colleges for research and outreach.

This unsatisfactory situation needs to be rectified urgently by transferring the colleges to the State agricultural departments, drastically revising the curriculum to bring it in line with the prevalent farming systems, and entrusting them with the responsibility for research and outreach to the colleges. Above all, the colleges must develop close two-way linkages with the farmers and devote maximum efforts to improving the net income of farmers and conservation of natural resources.

Research Institutions

Most of the research institutions devote their efforts to field crops, especially cereals—wheat, maize, and rice, and, in some cases, potatoes. The research is limited mainly to evolving higher yielding varieties and pest management, fodder production, pasture management, horticultural crops, and agro-forestry, especially as com-

ponents of integrated farming systems based on several commodities, are often not included in the research agenda of these institutions. Most research efforts are limited to biological and agronomic aspects, while research on farm machinery, sustainable use of the resource base, soil conservation, and socioeconomic aspects is almost entirely neglected.

A principal problem in mountain areas is the primitive methods of post-harvest processing and marketing of produce, as a result of which the net income of farmers is quite low, even if yields are high as a result of using improved production technology.

Women play an important role in the household economies of mountainous areas, especially in livestock management, small farmer poultry production, harvest and post-harvest management of most field crops, production and processing of horticultural crops, and several other aspects of agricultural production and marketing. In spite of this, very little attention is given to training women in different aspects of agriculture and research on gender-specific problems.

There is an urgent need to critically review the research programmes of these institutions and orient them towards solving priority problems, with a strong emphasis on optimising farm incomes from smallholdings through sustainable use of natural resources. Most of the institutions have never been subjected to external peer review and continue to do research on the same topics, sometimes for decades. This results in considerable misuse and wastage of precious human and financial resources.

...Sustainable use of the resource base, soil conservation and socio-economic aspects are almost entirely neglected.

...Very little attention is given to training women in different aspects of agriculture and research on gender-specific problems.

A. Mohammed

Education and research programmes should be closely linked. Farmers need to be fully associated with both the teaching and research functions, and their perceptions should be reflected in the curricula as well as in the priorities of the research agenda. Finally, the institutions should be adequately funded so that qualified researchers do not feel constrained to undertake their approved research programmes due to deficiencies in the laboratory, library, or farm facilities. Because of the relative isolation of mountain areas, it is even more essential to provide adequate support to keep their morale reasonably high.

International Agricultural Research Centres

Against the background of the rapidly increasing population and growing food shortages in the developing countries during the 1950s; necessitating heavy food imports, which they could ill afford due to difficult economic situations; International Agricultural Research Centres (IARCs) especially for rice (IRRI 1960) and wheat and maize (CIMMYT 1966), based in the Philippines and Mexico respectively, developed dwarf, fertilizer-responsive varieties of wheat and rice which were quickly adopted by farmers, especially in Asia. These varieties gave substantially higher yields than the conventional tall varieties and led to the so-called Green Revolution.

Convinced of the tremendous impact of the IARC model on improving food production in the developing countries, the donor community, led by the World Bank, UNDP, and FAO as co-sponsors, decided to form a Consul-

tative Group on International Agricultural Research (CGIAR) in 1971.

As a result of the considerable expansion of the CGIAR system, the number of IARCs has increased to 16 and the annual budget of the IARCs in the system increased from \$19.5 million in 1972 to \$342 million in 1994.

Initially, the CGIAR centres focussed primarily on generating improved technology to enable increased, sustainable production of various commodities, especially under small farmers' conditions. The research agenda of the CGIAR has gradually increased emphasis to sustainable production, resource conservation, equity, gender issues, and development of national capabilities to organise research in the national institutions. The CGIAR centres have contributed substantially to the development of trained manpower in the national agricultural research systems (NARS), provision of research materials, and linking national institutions in problem-oriented regional research networks.

Several of the above IARCs already have active research programmes in the HKH region in collaboration with the national institutions. Since ICIMOD has the primary responsibility as an international institution for development of the HKH region, it would be desirable for this centre to play a coordinating role in packaging technology for improving the region's agriculture, in close association with the relevant national institutions and the IARCs. The comparative advantage of the three sets of institutions can be

The CGIAR Centres have contributed substantially to the development of trained manpower in national agricultural research systems (NARS)....

A. Mohammed

incorporated in devising a cost-effective strategy for organising research specific to the problems of agriculture in the HKH region.

The networking approach that has often been used very productively by several IARCs would be appropriate for linking institutions for such collaboration.



Mr. Egbert Pelinck, Director General, ICIMOD; the Hon'ble Prime Minister of Nepal and Donor Representative, Mr. Tom Derksen, at the Inaugural Session



Technical Session in progress: presentation of research and education issues by Dr. M. Banskota, Deputy Director General, ICIMOD

III

Mountain Agriculture: Current State of Education and Research*

Mahesh Banskota, Deputy Director General, ICIMOD
Tej Partap, Head, Mountain Farming Systems' Division, ICIMOD

.... The agricultural system is no longer able to provide adequately for the needs of the households and this has increased the pressure on fragile mountain resources....

The mountain farmer is increasingly being seen as sacrificing long-term strategies for short-term needs.

M. Banskota
& T. Partap

Introduction

In order to begin the discussion on mountain agricultural education and research we need to look at some of the basic ideas about mainstream development strategies as the education and research systems are strongly interrelated with these. Many believed that growth and increasing investments in new technology would provide all the answers to the problems of poverty and inequality and also help to restore the environment. It was believed that, by providing high-yielding varieties, better irrigation, more investments in new inputs, and promotion of trade and exchange, the problems of food and stagnant agriculture could be resolved. Many of these assumptions are now being questioned and this is best captured by the debate on sustainable development.

Whether or not the biophysical environment can support certain types of intervention in agricultural development is a very important question before agricultural education and research systems. Conventionally, there are two views about mountain

areas. The first view is related to the perceptions of people outside mountain areas. Their views are that mountain areas are good places generally for relaxation, that people in mountain areas have very colourful lifestyles, and that these should be preserved as museums for posterity and not be altered by development. A related view of the outsiders is that the resources in mountain areas must be used for the development of the plains and urban areas. As mountains do not have the absorption capacity to justify the huge investments needed to develop these resources, such as power and forests, these should be developed for users in other areas.

The second view is an insider's view — a view that is more mountain friendly. This view sees the mountains as a home for a large number of people. Mountains are living environments as much as any other and, indeed, one of the most complex ecosystems found on earth. Mountain areas need to be protected, rehabilitated, and developed as much as any other ecosystem or economy. It is in this context that the question of mountain agricultural research and education needs to be examined.

* Abridged paper. The Full Paper is available as Mountain Farming Systems' Discussion Paper Series No. MFS 96/1. ICIMOD.

The Changing Nature of the Mountain Agricultural Economy and Environment

What is wrong with mountain agriculture today? If in the past it was seen as a relatively successful system, what has changed now? The population density in mountain areas has moved from low to very high. Agricultural systems are no longer able to provide adequately for the needs of the households, and this has increased the pressure on fragile mountain resources.

Seasonal migration is now becoming more and more permanent migration, because the capacity of the mountain agricultural economy is declining. Many areas under shifting cultivation and pastoral nomadic systems, with rotational cultivation and grazing, now have decreasing fallow periods. Semi-permanent cultivation is becoming permanent cultivation with increasing soil erosion and declining soil fertility. There has also been a reduction in the diversity of crops. Previously hill farmers used to grow many different crops in just one season but more and more areas are changing to monocropping. Regarding forests, apart from deforestation, the patterns of ownership and control are also changing with resource tenures moving from community to individuals and private groups. Settlement patterns were dispersed and small, and people were close to their homesteads, but now there is increasing agglomeration. The economies have moved from being those based on barter systems to those based on cash as mountain areas become more monetised.

In spite of the large population, there is still a scarcity of labour during different seasons. The burden on women is increasing and a higher proportion of children makes up the labour force. Mountain farmers are increasingly being seen as sacrificing long-term strategies for short-term needs. Mountain farmers can no longer afford to think too far into the future. Most of the resource management mechanisms dependent upon institutional mobilisation, cooperation, and partnership are breaking down. Mountain people do not have too much faith in governments also because most of the governments have been more interested in extracting resources out of mountain areas and have not put back enough for the benefit of mountain people, their agriculture, and their economies.

Factors behind the Changes

There are a few common problems that mountain areas share with all poor and developing areas. On the demand side, the main problem is the rapid growth of population, both human and livestock. The livestock population has also put tremendous pressure on forest and pasture resources. The main challenge is how do you manage the scale of demand - the demand for food and other resources? Many of the policies did not properly look at the problem of mountain environments. Many policies related to resource extraction were indiscriminate insofar as their impact on mountain people and their environments were concerned. Policies were never sensitive to the mountain specificities like inaccessibility, fragility, and marginality. Policies were also slow in

... The main challenge is how do you manage the scale of demand - the demand for food and other resources ?

M. Banskota
& T. Partap

developing some of the opportunities that existed in mountain areas. Mountain areas have a goldmine of indigenous knowledge, but this was hardly used for designing more appropriate policies and programmes.

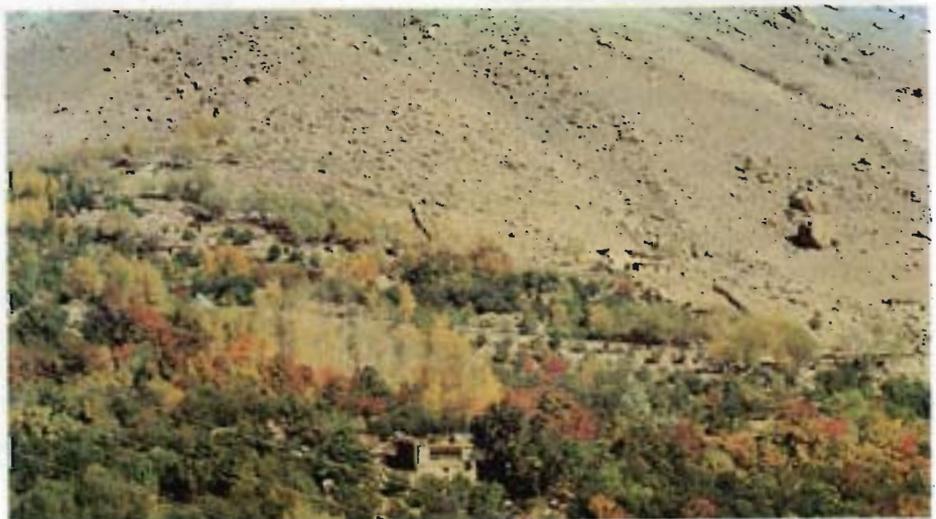
There were also data gaps and lack of understanding. Knowledge about mountain farming systems, the economics of natural resources, role of indigenous knowledge, changing production processes, and so on, was very limited. Understanding regarding farmer responses to different opportunities and challenges in different ecosystems was absent. How did the different components of mountain farming systems interact with each other and how did the system break down? Which components were more critical than others? Linkages between agriculture and natural resources in mountain areas are fairly apparent. More recently, the economic aspects are also becoming very important. How do we value many of these resources so that we can convince policy-makers that it is worthwhile investing in mountain areas, that mountain farmers are

making rational decisions and need to be supported just as much as farmers in the plains?

Status of Mountain Agricultural Education and Research

The reviews of agricultural research, educational, and development policies in the HKH countries undertaken by ICIMOD revealed a number of things. First, agricultural education in mountain areas has had very low overall priority. Secondly, the whole issue of agricultural education in comparison to general education was a very new field in many of the countries in this region. It did not have a very long history. Consequently, the experience was very limited. Many institutions were still experimenting with different options.

The low overall priority is because of the relationship of education with the job market. In order to make the educational system credible, it is very important that it is integrated with the job market. Agricultural education has suffered because agricultural



Many parts of the cold and dry zone of the HKH have niche for promoting horticulture
T. Partap

graduates have great problems finding employment opportunities. Even when agricultural institutions were looking for qualified people, overall job prospects were relatively bleak. If this is the prevailing situation in general agricultural education, the problems with mountain agricultural education are not difficult to imagine.

Agricultural education suffered from a lack of adequate integration between agricultural research, extension, and education. The agricultural education system was too theoretical, of poor quality, and had poor linkages with field-level problems. Education was highly compartmentalised in terms of very specific narrow subjects that did not allow a person to go out and tackle problems of a multi-disciplinary nature. Environmental aspects did not figure at all in agricultural education. Issues related to women (critical for mountain agriculture) did not figure in the curriculum. Planning by agro-ecological zones was lacking. Most courses were commodity focussed — with a heavy emphasis on lowland crops. Traditional community management systems for natural resources were also largely overlooked.

What about agricultural research? There is a lot of diversity in the agricultural research system in the region. For instance, the main research system was very strongly commodity oriented. The main crops were rice, wheat, and maize in food crops and tea, coffee, cotton, and tobacco in commercial crops. Some of this is slowly changing. Bhutan, for instance, having experimented with different types of agricultural research system is now emphasising a focus on

renewable natural resources. It is organising its research departments and human resources on the basis of particular types of resource. Lumle and Pakhribas research stations in Nepal have worked with a farming systems' orientation and have had some success.

The other aspects of agricultural research and education systems are that there were highly centralised systems. South of the Himalayas, the experiences have been very strongly those of centralised systems. There was one main agency guiding and controlling the research agenda and activities throughout the country. In China, judging from experiences in one of the counties in Sichuan, the system was relatively more decentralised, with information flowing from both top-down and bottom-up. It was also a strongly farmer-responsive system and has worked very well so far.

Another issue was whether it was a government or university-based agricultural research system. While government agricultural research systems dominated in the region, a few university-based agricultural research systems were also developing. At present, it is difficult to assess which is more effective as both of these systems have not been very effective, at least in mountain areas. There are a few examples in which research has had a very positive influence on mountain agriculture with the introduction of cash crops and high-yielding varieties. Once research systems have provided high-value crops that are marketable with the appropriate technology, farmers have accepted

....Research has also neglected women farmers. Most of the decisions regarding agriculture are made by women in the mountains, and yet there has been no recognition of this in teaching, research or in extension....

M. Banskota
& T. Partap

....The Green Revolution may be losing steam - not only because the potential areas have been covered, but also because of the environmental impacts....

M. Banskota
& T. Partap

Farmer and her husband: sericulture farming family of Ningnan County, Sichuan, China
T. Partap



these without question. The main limitation has been that only small areas have been able to benefit from these inputs. The environmental impact of these new systems has not been assessed — people are now more aware of the effects of monocropping, loss of gene pools, and pollution of soil and water from increasing use of chemical fertilizers and pesticides. Research has also neglected women farmers. Most of the decisions regarding agriculture are made by women in the mountains, and yet there has been no recognition of this in teaching, research, or in extension.

The issue of funding is also very important. Resources are extremely limited and, unless a major effort is made to pursue available resources far more effectively than in the past, this will continue to be a major problem. In this context we need to learn from each other through a partnership or a consortium approach or we will not achieve very much. The effort needed is the type of action that achieved the green revolution. It is a challenge to see if we can do the same

thing for mountain areas. Integration of research and education is essential. It is costly to have education and research bifurcated as in the past. The dichotomy should be broken down. There have been some good experiences to draw on in identifying effective ways to bring these together. There are also new directions in research and education and more of the same based on past research and education may not be appropriate. Priority areas for mountain agriculture need to be identified, and this means looking at some of the new areas. Investments in creating capacities and building up capabilities are essential as these are very limited at present.

One last point here is related to trade, exchange, and the green revolution. It is increasingly believed that the Green Revolution may be losing steam - not only because the potential areas have been covered, but also because of the environmental impacts. Just as each area must now find optimal solutions for its agriculture, so must the mountains. The search everywhere is for sustaining growth in productivity

...As the bulk of the farming responsibility was falling on the shoulders of mountain women, future research needed to find the answers to their problems....

M. Banskota
& T. Partap

without further deterioration of the environment, and our education and research systems must find answers to this on a priority basis.

Discussion

A wide range of issues was raised in the discussion following the presentation. Commenting on the need to further strengthen integration between agricultural research, education, and extension, it was noted that a lot of information was already available. Efforts should be mobilised to synthesise the information. This exercise was essential in order to avoid repeating past mistakes. Regarding priorities for research and education in mountain agriculture, greater emphasis was needed on the development of traditional mountain crops. Points were raised with regard to the preservation of mountain agricultural biodiversity. With increasing commercialisation, mountain farmers preferred to grow high-value crops rather than traditional low-yielding subsistence crops. Insofar as the activities of existing research

centres were concerned, it was pointed out that many of these operated in isolation, displaying weak linkages with the farmers. Many comments were made regarding the need to give greater priority in mountain agricultural education and research to mountain women. As the bulk of the farming responsibility was falling on the shoulders of mountain women, future research needed to find the answers to their problems. More micro-level studies needed to be undertaken for different agro-ecological zones in order to deal with their specific problems. It was also agreed that the absence of physical and social infrastructure in mountain areas was a major limitation to developing mountain agricultural education and research. Development of infrastructure in mountain areas was costly and needed to be promoted selectively, based on agroeconomic potentials. Insofar as technology arising from research activities was concerned, it was also essential to focus on the most effective methods for its dissemination.

priorities for research....

greater emphasis was needed on the development of traditional mountain crops

M. Banskota
& T. Partap

IV

Soil Fertility and Water Management Challenges for Sustainable Mountain Agriculture

Land degradation is a quiet crisis that is unfolding gradually in the hilly and mountain areas.

T. Partap
& P.B. Shah

Tej Partap, Head,
Mountain Farming Systems' Division, ICIMOD
P.B. Shah, Soils and Land Use Specialist,
Mountain Natural Resources' Division, ICIMOD

Agriculture in the mountains, broadly defined to cover all land-based activities such as cropping, animal husbandry, horticulture, forestry, and their linkages and support systems, is a primary source of sustenance for most of the mountain population. The general symptoms of decline in the agricultural sustainability of the Hindu Kush-Himalayas (HKH) include:

- i. increased population and declining per capita availability of cultivated land,
- ii. scarcity of farmland resources,
- iii. declining productivity of farm and non-farm lands due to erosion and land degradation, and
- iv. lack of diversification and resource regenerative farming practices.

Negative changes in mountain agriculture reveal that, barring a few exceptions of improvements, the

conditions of mountain habitats and their people are steadily deteriorating.

Soil and Water Concerns

Land degradation is a quiet crisis that is unfolding gradually in the hilly and mountain areas. Within the HKH Region, soil erosion from agricultural activities on sloping lands has been, by and large, the major contributor to land degradation.

The loss of topsoil has affected the ability to grow food in two ways. First, it has reduced the inherent productivity of land, through both the loss of nutrients and the degradation of other elements in the physical structure of the soil. Second, it has also increased the cost of food production. Increasingly, farmers losing topsoil are trying to increase land productivity by applying chemical fertilizers.

Declining Crop Yields

The productivity of farmland in upland areas has been recording either a

* Abridged version: the detailed paper is available with the Mountain Farming Systems' Division, ICIMOD

steady decline or stagnation in crop yields. For instance, average crop yields declined within a range of from five to 30 per cent during the past few decades in a number of mountain watersheds in the Indian Himalayas, in Nepal, and in the Tibetan Autonomous Region of China.

In rainfed uplands, where maize and millet are dominant summer crops, soil fertility is maintained mainly by the application of compost or farmyard manure. There are indicators of weakening forestry-farming linkages blocking the flow of nutrient cycling from forest to farmland. The loss of fertile topsoil from limited cultivated lands has caused many farmers to abandon their traditionally cultivated land and to move on to other marginal lands.

Declining Food Security

Households have been experiencing food deficits in varying degrees. Food deficits for at least six months each year are quite common in many mountain areas. The related concerns of local food security and rapid

agricultural growth are being pursued through the promotion of intensive cropping of both food and cash crops by using external inputs.

Weakening Forestry Farming Linkages

Some estimates point out that about three to four hectares of support land are required to maintain one hectare of cultivated land for normal production in the middle mountains of the central Himalayan region, notably in Nepal. The degradation of forests will affect farming in mountain areas as major sources of crop nutrients (leaf litter and animal dung) are adversely affected by loss of forests. In terms of foodgrains, the magnitude of loss is likely to be enormous.

Factors behind Soil and Water-related Concerns in the HKH

Population Pressure

Approximately 56 to 80 per cent of the working population of the region are engaged in agriculture. The

....All the soil erosion from the Himalayas is not man-made and, in fact, a large part of it is natural.

T. Partap & P.B. Shah



Tibetan farming family tending their potato plants (cash cropping) and the future farmer looking on, Central Tibet
T. Partap

...It is difficult to accept that agriculture and the farmer per se ... are responsible for the ...environmental crisis in the hills and mountains.

T. Partop & P.B. Shah

average size of per capita cultivated land in 1980/81, was 0.097 ha in the Chittagong Hill Tracts of Bangladesh and 0.272 ha in the State of Sikkim in India. In most areas, the per capita cultivated land declined by 30 to 45 per cent between 1960 to 1980.

Breakdown of Traditional Systems of Soil and Water Management

Terracing has been a critical aspect of sloping farmland management, because of its ability to reduce erosion substantially. Project interventions that include improving bench terraces are unlikely to have a positive effect, unless the productivity and profitability of the overall farming system are improved at the same time. The construction of new terrace systems is rarely seen today. Thousands of hectares of abandoned terraces can be seen throughout the mountains. This abandonment is a direct result of decline in soil fertility.

Swidden Farming

Swidden farming is an agricultural system in which the area to be cultivated is cleared, usually by fire, and cultivated for a short period and then fallowed for a longer period over several years (10-15 years).

In Bhutan, a large proportion (32%) of cultivated land is still under shifting cultivation. In the north-eastern Indian Himalayas, shifting agriculture, or *jhuming*, is a predominant land-use system, supporting 1.6 million tribal people over an area of 426 million hectares. In its typical form of a 20 to

30 years' cycle, *jhum* was a highly bioproductive system, but increased populations and reduced acreage have reduced the *jhum* cycle to four to five years. In the Nagaland State of the N.E. Indian Himalayas, for example, as much as 42 per cent of the land is under shifting cultivation.

In the South Yunnan province of the Chinese Himalayas, swidden farming covered about 90 per cent of Xishuangbanna farmland, supporting 48 per cent of its population. However, in recent years, the pressure of increased population, the need for cash crops, and the establishment of conservation parks have prevented these swiddeners from gaining access to sufficient land, resulting in the reduction of fallow periods.

In Bangladesh, *jhuming* (shifting cultivation) is practised by 13 hill tribes living in the Chittagong Hill Tracts. Once, over 95 per cent of the area was covered with dense forests, but, today, apart from the 25 per cent reserve forests, all other areas have been converted into scrubland due to shifting cultivation.

In Myanmar, hill farmers in the States of Kachin, Kayah, Kayin, Chin, and Shan largely depend on swidden farming. Realising the problems associated with shifting cultivation in today's context, the Myanmar Agricultural Services - a government agency responsible for managing and providing agricultural services to the nation - has introduced a programme of sustainable hillside farming.

Regeneration of forests is crucial for the long-term productivity and



Tibetan
pastoralists on the
move with their
yak herds
T. Partap

sustainability of swidden agro-ecosystems, and many swidden groups are no longer able to leave their fields fallow for the necessary period of time. This is not because the link between forests, soils, and productivity is no longer recognised by swidders, but because they are in a situation that makes the continuation of forest fallow impossible.

Agropastoral Farming

The agropastoral system is a response and adjustment to many factors of crop farming such as marginal lands, high degrees of slopes, and unfavourable ecological conditions for profitable crop cultivation, etc. In general, there has been an increase in the population of animals during the past decades. One also finds that the composition of animals has changed since 1958. The main increase has been in sheep. Barring a few exceptions, this system is also showing symptoms of decline in both resource conditions and carrying capacity.

Gaps in Technological Research

Sustainable land management would mean combining the technologies, policies, and activities to integrate socioeconomic principles with environmental concerns so as to simultaneously maintain or enhance production/services, reduce the level of production risks, protect the potential of natural resources, and prevent degradation of soil and water quality; and to be economically viable and socially acceptable.

The remedies offered by modern technology to mountain farming, involving a range of improved soil, water, and nutrient management methods, may be capable of producing sufficient yields. What is less certain is whether their use is known in these less favourable areas, whether the needed inputs are available, and whether their use is economic. The value of these technological options to remedy the

...The future research agenda for soil water and nutrient management must integrate socioeconomic, issues and biophysical processes.

...Regenerative agricultural technologies for the sustainable development of mountain areas revolve around the basic tenets of diversification and higher productivity; e.g., intensification without resource focus, combining production and protection concerns.

T. Partap &
P.B. Shah

problems of the mountain farmer has either not been wholly proved or is inadequately tested.

Information Gaps

One important issue is the lack of adequate and proper knowledge and information. It is difficult to accept that it is agriculture and the farmer, *per se* that are responsible for the alleged environmental crisis in the hills and mountain. All the soil erosion from the Himalayas is not man-made, and, in fact, a large part of it is natural. The scale of the Himalayas' natural mass wasting is enormous, and the fact is that this process has many other contributing factors besides deforestation, cultivation, and human activity.

Defining Integrated Soil and Water Management Research Priorities for Mountain Areas

The future research agenda for soil water and nutrient management must integrate socioeconomic issues and biophysical processes.

Reversing the above cycle will require an integrated research strategy involving new models, methods, and institutional arrangements significantly different from earlier production approaches. These shifts must incorporate natural resources, develop contingent values, identify ecosystem maintenance activities, include biodiversity management, and deal with complex issues of water recharge.

Natural resource management is complicated technically and

managerially for both farmers and scientists. It involves developing systematic relationships in a highly interactive manner. The issue of linkages within sociopolitical hierarchies and the scales of intervention at different levels also cannot be overlooked. Sustainability raises new issues, such as time and spatial dimensions, social hierarchies, and societal vs. individual benefits, and therefore requires new approaches to these problems. Unlike the conventional focus on crop and livestock improvements only, there are increasingly complex social aspects that have to be considered in the context of sustainable development.

An approach to solving problems at the farming system or catchment levels must incorporate the factors of time, hierarchy, benefits, and costs. This implies a participatory research approach involving farmers, policy-makers, and NGOs, besides scientists. Feedback must be provided to the researcher and flow through the whole research chain from adaptive to basic research. The farmer back to farmer paradigm provides a basis for conducting research in this way.

Platforms of negotiation between scientific understanding and local folk knowledge (including that of women) of soil and water management must be constructed.

Regenerative agricultural technologies for the sustainable development of mountain areas revolve around the basic tenets of diversification and higher productivity, e.g., intensification without resource degradation, resource focus, and combining production and protection concerns.

Recognition of the importance of organic matter maintenance and the long-term and off-site effects related to sustainability has led to renewed interest in so-called alternative agricultural methods. Maintenance of soil productivity is sought from the use of organic material, the maximisation of biological nitrogen fixation, and the minimisation of nutrient losses - while limiting to a minimum the use of inorganic fertilizers and synthetic pesticides in absolutely necessary circumstances.

The most serious issue concerning soils in the hills and mountains is that many areas have low or very low inherent fertility. Traditional methods of fertility maintenance, which involved the use of trees or animals to allow nutrients to be concentrated on the cultivated areas, are mostly no longer viable, because of the increased demands being made on the land. While recycling of all available organic residues is important, this will not raise the productivity of soils of low inherent nutrient status and fertility. Recycling by itself may not be an avenue of escape from the poverty trap for mountain farmers. Integrated organic/inorganic management methods will most likely be needed to raise productivity and ensure sustainability.

Much is known about the causes of soil degradation and the negative impacts of degraded systems. However, information on rates of degradation and the regenerative capacity of the system is less well established. This provides a new avenue for research in the quest for sustainability.

Technology alone has little impact at the farm level if the social, political, and institutional contexts of on-farm and off-farm activities are not considered. Applied soil, water, and nutrient management research that does not address issues of gender, social structure, indigenous knowledge, and the functioning of different local institutions is unlikely to have permanent application.

As a final word on research priority for soil and water management for the initial decades of the 21st century, technical research and development efforts in soil and water management will only have long-term impact if local community control of resources and the environment is promoted; income generation and reduction of risk is encouraged; intergenerational equity is sought; national policies do not conflict with sustainability efforts; the land-user has an integral role in the research and development effort; and appropriate attention is given to spatial and temporal issues of mountain watersheds and their communities.

Discussion

A wide range of issues and questions was raised following the presentation. It was noted that the data on soil erosion were based on studies on small plots. Scientifically this is very interesting and important, but, for a broader generalisation of results, more macro-level studies should be undertaken throughout the mountains. This will help to relate soil erosion with agro-ecological zones and other specific factors such as snowmelt, levels of organic matter, deforestation,

...The farmer back to farmer paradigm provides a basis for conducting research ...

T. Partap &
P.B. Shah

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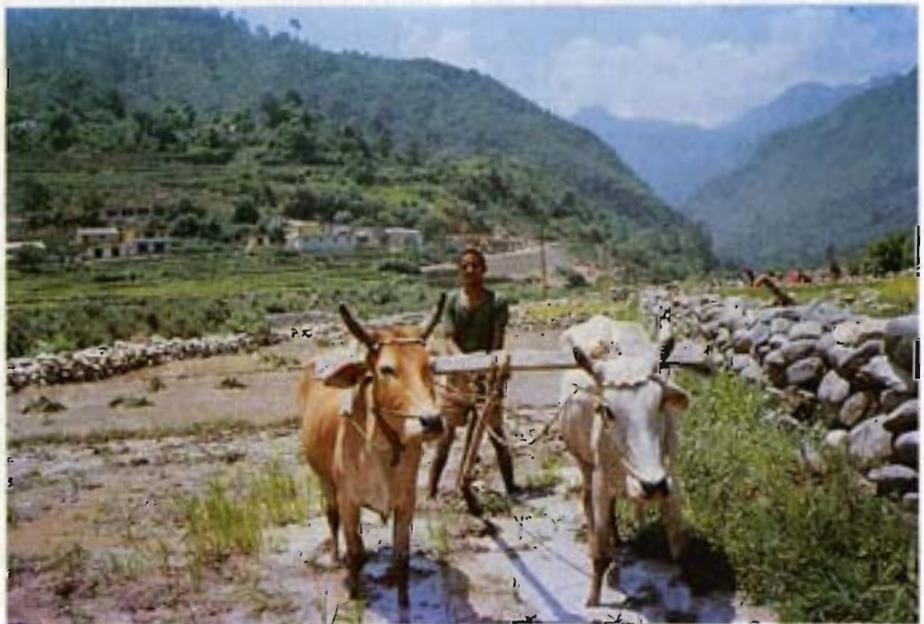
**.... farmers
alone cannot
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for soil
erosion
problems**

T. Partap &
P. B. Shah

cropping intensity, rainfall, and winds. Different opinions were expressed regarding the role of man and nature in soil erosion. While the authors hinted that man's role is quite limited in highly fragile and dynamic environments, others questioned this view suggesting that the natural process had been the same for ages and it was primarily man's activities that had changed, giving rise to increased soil erosion. The whole issue of population pressure had been overlooked and needed more careful scrutiny.

Another aspect discussed extensively was the role of the farmer in soil erosion. It was pointed out that the management of natural resources by farmers is influenced by many problems and developments in society. Consequently, farmers alone cannot be held responsible for soil erosion

problems. The entire society must be responsible for problems of population growth, poverty, lack of institutional support and poor understanding of the changing conditions of natural resources. What needs to be changed are the livelihood conditions of poor farmers living in fragile environments — people need better education and income levels need to be improved through greater productivity. As one speaker put it, we need to improve the nutrition of both the body and the mind to bring about the sustainable development of mountain agriculture. Many other comments emphasised the fact that research on critical issues was only the beginning and in future all agricultural development agencies should devote more resources to developing a better database and understanding needed to cope with these problems.



A pair of bullocks, the backbone of most mountain farming facilities, Uttarakhand, India
Vir Singh

Sustainable Farming and Livelihoods in the HKH: Micro-Level Evidence

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H. R. Sharma, Farm Economist, HPKVV, Palampur
Shiv Sharma, APROSC, Kathmandu

Many mountain economies and much of their environment are experiencing the serious problems of worsening poverty and degradation of natural resources. Mostly dominated by negative changes, the impact of development activities so far has been very limited. There is, therefore, a great deal of concern about making development more effective, and, consequently, there is a growing interest in learning more about successful experiences and the underlying lessons for replication. Some pockets have shown positive trends and are going through a considerable degree of agricultural transformation in terms of production, consumption, and the general welfare of the people. Some generally replicable components of sustainable development can be identified in such pockets.

Himachal Pradesh in India presents a unique case of agriculture-based hill and mountain development. Various state interventions have helped to make it one of the most highly developed hill states in India within two to three decades. The quality of life of the hill people has also improved substantially. Poverty declined from one person in every three

in 1971 to one in every seven in 1991. Two-thirds of the total population is now literate compared to one-third two decades ago. This literacy figure is higher than the national average of one-half. All villages receive electricity and more than 95 per cent of the population have access to drinking water.

Ningnan county in West Sichuan Province in China has set another example of change. It has become one of the most well-developed mountain areas from being one of the poorest counties in the country. Ningnan, a small mountainous county located in the eastern Himalayas, covers 1,674 sq.km. with altitudes ranging from 600 to 4,000 masl. Over the past 15 years, the net per capita income increased eight times, per capita foodgrain availability 1.5 times, and gross output per capita grew from *yuan** 225 to 668. A large proportion of the rural population now has access to better health and social amenities, recreational facilities, and other basic needs. Thus, the quality of life has also improved.

In Pakistan, the mountainous areas covered by the Aga Khan Rural

...There is a growing interest in learning more about successful experiences and the underlying lessons for replication ...

S. Shrestha
et al.

* There are 8.32 *yuan* to the US dollar.

...The contributing factors for high quality options are higher literacy rates and improved access to markets, services, and inputs.

S. Shrestha
et al.

Support Programme (AKRSP) have undergone considerable transformation. The number of households benefitting had risen to 53,000 by mid-1989, or about 54 per cent of the total rural households in the Northern Areas. Savings had increased at least four-fold (US\$ 3.0 million) within three years.

In Nepal, selected pockets have also undergone significant changes. For instance, vegetable cultivation has contributed to the tripling of household incomes in the Khani Khola area of Dhading district over the last 15 years. Similarly, the per capita foodgrain availability has increased almost four times. The production and consumption patterns in the community have changed. The resource regeneration capacity of the area has also increased, as indicated by increased biomass production at farm level. Farmers are practising stall feeding with no free grazing, thus reducing the pressure on forests. Similar changes in agriculture and the natural resource base have also taken

place in some pockets of the Rapti Zone and Ilam districts in Nepal.

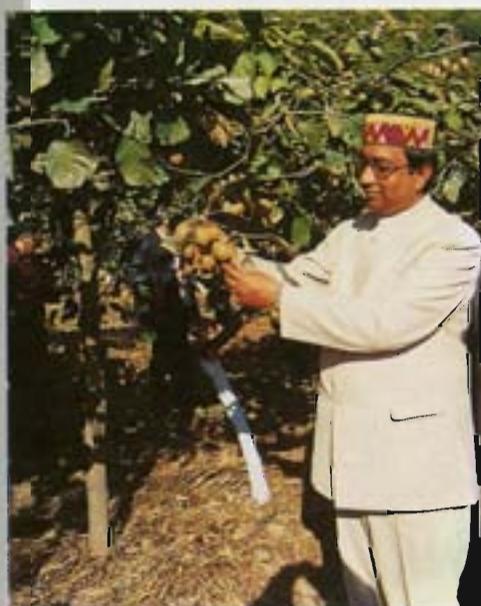
Empirical studies were undertaken to gain a better insight and understanding of the forces at work in bringing about positive changes in certain areas. These micro-level studies should help to identify some of the sustainability implications of changing hill farming systems, including their implications for agricultural research and education relevant to mountain areas.

India

Kullu, one of the districts in Himachal Pradesh, was purposely selected for the study. Within Kullu district the Katrain area in Nagar Block was again purposely selected. Plaich in Banjar Block was selected as a stagnant area in the same district.

Farm households (over 75 %) that were small with less than one hectare of land were selected for the detailed study. About four-fifths of the total households had adopted three to four production options in both transformed (TA) and stagnant areas. The production options included crop production, vegetable cultivation, livestock farming, and fruit cultivation in terms of farm activities, whereas non-farm activities included weaving, agricultural labour, non-agricultural labour, selling of wild plant products, services, business, and shopkeeping.

The household and the per capita incomes were higher in all categories of farm households in the TAs than in stagnant areas. This was mainly because households had adopted



Research into diversifying farming. Hon'ble S. P. Thakur, Horticulture Minister (HP), evaluating the performance of a newly introduced kiwi crop at a Research Station of the YSP University of Horticulture and Forestry, Himachal Pradesh, India
T. Partap

high quality options (i.e., those giving better returns) in transformed areas. If fruit cultivation and livestock farming were the major contributors to cash income in TAs, crop production and fruit cultivation were major activities in stagnant areas.

The contributing factors for high quality options were higher literacy rates and improved access to marketing inputs and services. Only 17 per cent of the households were literate in stagnant areas while in transformed areas the rate was about 50 per cent. The distance between the TA and the main market had been 18km in 1975, but was now only two km. Banking facilities had doubled within the same period, whereas in the case of the stagnant areas, these facilities were not available. The distance to market was more than five km.

Compared to the stagnant area, the crop yields of maize, wheat, and rice in the TA were higher by 60, 100, and 120 per cent respectively. The annual household food expenditure in the TA was twice (US\$ 1,000) that in the stagnant areas (US\$ 500). Furthermore, consumption of food products, such as milk and milk products, meat/fish/eggs, and fruits and vegetables, was much greater in the TA than in the stagnant area.

People were also better clothed and educated; the expenses for these two items were greater by 50 per cent, and 180 per cent respectively in the TA. In the TA houses had electricity, were equipped with TVs, and about one quarter of them had telephone facilities; these were not available in the stagnant areas. There was also a

lower incidence of disease and health problems in the TA due to better quality food, higher education (educated people take more preventive measures), and improved sanitation.

Female literacy was higher in the TA. Similarly, involvement of women in decision-making processes was reported to be increasing. Women had greater access to employment opportunities than ever before.

Nepal

The relationship between the number of options adopted and the level of income in both the TA and stagnant areas of Ilam was about the same. The households had adopted six or more options in both areas. Production options adopted by farmers included cereal crop production, *amliso*, cardamom, ginger, potatoes, fruits and vegetables, and dairy farming in the case of farm enterprises. Non-farm activities mainly included cottage industry activities, services, business, and so on.

Dairy farming remained a dominant activity in both areas as it contributed more than 40 per cent of the total household income. Livestock were followed by tea, cardamom, and *amliso*, and they accounted for another 40 per cent of the household income in both areas. Cereal crop production was minimal in both areas.

The main contributing factors to the adoption of high quality options were the access to marketing and processing facilities in the TA. As the transformed area was located on the periphery of all-weather roads, the TA was linked

to the Darjeeling and Silguri markets in India and the *terai* markets in Nepal.

An average farm household in the former area consumed at least 50 per cent more superior foodgrains (e.g., rice and wheat) and more than 100 per cent more superior fruits, vegetables, ghee, and oil.

The people in the TA were enjoying a better quality of life. The health and sanitation conditions were far superior in the TA. Most households had separate kitchens, lavatories, and guest rooms; these were lacking among the households in stagnant areas.

Unlike in the past, even small landholders had engaged in tea plantation, which had been the domain of large landholders until 10 or 15 years previously. Also, the resource-poor farmers generally possessing low-quality lands had converted them into *amliso* plantations. This option alone had helped them double their incomes. Such farmers could easily earn the equivalent of US\$ 300 to US\$ 600 per year from selling brooms made from *amliso*.

More than one quarter of the total households had electricity in the TA compared to five per cent in the other areas. Disputes related to land, water, and social evils had somewhat decreased because of the rise in incomes and employment. Women's involvement in managing (independently) different enterprises, such as weaving, rabbit farming, and vegetable cultivation, on a small scale was increasing because of credit facilities.

Synthesis

Sustainability is a dynamic process. Sustainable production options, or their appropriate configuration, today may not be sustainable tomorrow because of certain factors such as changes in demography, people's needs and expectations, markets, integration, and technology innovations. What is, therefore, essential is the promotion of an 'option enhancement' process through which individual households can modify, change, or diversify their production options, according to changing contexts, based on their biophysical and socioeconomic environments.

Unlike in Himachal Pradesh, the role of government interventions in Ilam had been minimal. The farmers had themselves introduced a variety of cash crops (e.g., cardamom, ginger, *amliso*, tea, potatoes, and dairy products) in their villages. This, in fact, was due to the demonstration effect from the bordering areas of India, such as Darjeeling district and the state of Sikkim, which are relatively developed areas. There are many other districts in Nepal that can be accessed by road and which have some institutional infrastructure, but the transformation process has yet to take place. The potentials of the area have not been properly harnessed environmentally, i.e., appropriate high-value crops that are easily marketable have not been promoted.

The experience of Himachal Pradesh strongly indicates that the development of infrastructure, such as roads, is the prime factor for the promotion of high-quality options. Significant differences

in cost for various activities were mainly due to transportation costs. Transportation costs were almost 20-25 per cent higher in stagnant areas.

The development of roads and communications is no doubt necessary for the promotion of high quality options. But the question is, can poor or developing economies afford such roads wherever needed? To be realistic, infrastructural facilities should be developed step by step, beginning with improved trails, mule tracks, earthen roads, gravel roads, and, lastly, good roads that require heavy investment. In the case of Ilam, mule tracks are being slowly replaced by better roads.

It may also be noted that programmes should promote low-weight and high-value products such as vegetable seeds, peas, etc. Apple production in Jumla (Nepal) has been greatly hindered because of the inaccessibility problem.

Had processing facilities not been available, neither tea nor milk

production by small farmers would have been feasible. Until five or ten years ago, only large farmers were interested in tea production and improved dairy products. The establishment of one semi-government milk powder factory and three private tea processing plants in Biratnagar has become a major driving force for all-season milk production systems and for opening up small-scale tea gardens.

Both areas have adopted the strategy of harnessing the local 'niche', but with different types of interventions. In Himachal Pradesh, local people were encouraged to go in for fruit production and, for this, the land ceiling was relaxed; access to government-owned marginal land for fruit cultivation was provided; subsidies were given for nursery establishment; and purchasing and public sector procurement and processing was established. In the case of Ilam also some of these aspects were evident. Credit was provided by public sector banks, while

...Development of infrastructure, such as roads, is the prime factor for the promotion of high-quality options.

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et al.



Improving access facilitates the transformation of subsistence mountain agriculture in the HKH
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... with increasing incomes, farmers also tend to invest more in better management of their natural resources...

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et al.

the private sector (both domestic and external) procured the final outputs.

In conclusion, the common factors that emerge from the Kullu and Ilam studies can be summarised as follows.

First, transformation needs high-value crops or activities that have the potential to generate higher incomes from the existing resource endowments of the farmers. Obviously, some areas have better comparative advantages than others. Organisational capabilities and the technical knowledge to promote these activities or crops are essential.

Second, strong forward linkages with processing sectors are necessary.

Third, in order to facilitate mobility and marketing, transport must be reliable and cheap. Improved access is an important precondition for changing subsistence agriculture.

Finally, there should be some degree of political patronage so that government agencies provide high priority to the development of hill and mountain areas. This will be reflected in service delivery and service expansion, which are extremely

critical in the early stages of development.

Discussion

The discussion that followed raised questions regarding the sample size of the studies, the nature of some of the results, and the lack of information on some critical issues such as investments and sources of capital for investments. There were also further elaborations on the role of agricultural universities in the process of change - particularly in supplying improved technologies for off-season vegetables and other horticultural crops. It was generally agreed that both government departments and universities must work together in this respect. Commenting on the factors responsible for bringing about change, it was mentioned that changing people's minds through education, training, exposure, and demonstration was an important first step. Regarding replication of successful cases in other areas, some of the critical factors were becoming evident, and development programmes should emphasise these critical aspects. It was also noted that, with increasing incomes, farmers also tend to invest more in better management of their natural resources - particularly soil and water.

Institutional Innovations for Sustainable Farming & Natural Resources' Management in HKH Region

VI

Institutional Innovations for Sustainable Farming and Natural Resources' Management in the HKH Region

A. Bhatia

*Natural Resources' Management
Expert, MNR, ICIMOD*

In simple operational terms, this phrase 'institutional innovation', means any institution which is trying to do things more effectively than it has done business in the past. Inputs for such changes can come from both internal and external sources. We see this as institutional innovation. There are components of our mountain village ecosystem which were fairly well integrated. I think it is fairly well understood now that, for mountain area development, we need to look at mountain farming systems as an integrated system incorporating livestock, forestry, and agriculture. If we look at mountain institutions, we find that, historically, there existed social and community self-governing systems. These arrangements were largely within the closed economies of mountain areas, and there was a very strong interdependence and a collective mechanism for agriculture and natural resources' management.

As government started to play a larger role in natural resource management, this led to the nationalisation of common property resources, mainly forests. These changes had an impact on private land productivity and household planning strategies, because of the interlinkages between food, forest cover, and agricultural productivity. Over the years, it has been seen that these institutions have also been involved in many endeavours of mountain development.

The common factor that has emerged is that they are all fairly large institutions. They have a large spatial spread, are fairly standardised in their approach, are generally centralised, and have common operational mechanisms. Any large institution must operate within certain norms, rules, and regulations. The impact of this in terms of R&D extension has been that it has been fairly poor at reaching the smaller and the weaker farmers. These institutions have also been unable to respond to the ecological, social, and cultural diversities which are all major comparative advantages for mountain areas. Failing to respond to these diversities has led to erosion of community-based systems of natural resource management and also to a crisis of confidence in national institutions.

...Failure to respond to these diversities (ecological, social, cultural) has led to erosion of community-based systems of natural resource management.

... Adaptation of liberalisation themes practices has started and this has implications for R & D institutions.

A. Bhatia

There has to be a diversity of institutions so that all can play a constructive role in sustainable agriculture for the future. It is not only the state-inspired institutions that have a role. Intermediary institutions also have a major role. These institutions are related to those that make policy; those that implement it, be they non-government organisations, national institutions or international NGOs; bilateral institutions; and, very important, community-based institutions. There are also institutions that are government-owned but run by farmers who are actually the stakeholders and the clients. There is some integration in natural resource management, but most of the institutions appeared to have been established, designed, and run on narrowly-focussed sectoral disciplines and are fairly conventional in their approaches. There is a need to deal with the problem of inaccessibility of terrain by decentralising institutional mechanisms. Because of this, the role and contribution of local institutions are going to be critical for the future.

People's participation has been recognised to varying degrees from country to country and institution to institution as essential for mountain development. However, for the future, if you are looking at harnessing the strengths that are present amongst people, they will need to play a much bigger and stronger role in sustainable mountain agriculture. This has implications for R&D institutions and also for extension. There is a sense of urgency in that we need to look at how to integrate farmers' perspectives into research and development institutions.

The advocacy for people's involvement has increased in recent times. Many institutions have taken steps to transform themselves so that they can respond better to farmers' perspectives and needs. And there is still a lot that needs to be done, because, if an institution is going to genuinely internalise the implications of working closely with farmers, this has to be looked at, in the context of planning, budgeting, and research priorities. Lastly, adaptation of economic liberalisation policy has started and this has implications for R&D institutions. Questions are being raised about the efficacy of institutions, the gaps that exist between research and its application, and privatisation. Bringing in the private sector raises many inter-generational and equity questions. In essence, we are looking at a future of change. Change is always painful, personally and also institutionally. Change is going to be a common thread, and the ability of institutions to adapt and to meet the challenges of the future is going to be critical for sustainable mountain agriculture.

There has to be a complementarity between organisational goals and strategies and structures should change to respond to those goals and strategies. While cultural values are abstract things, they are fairly important in terms of goals, leadership, and staff motivation, and it is necessary to have some consensus on certain values and approaches.

In the Hindu Kush-Himalayas, and probably even in the plains, the conventional approach is under



Afforestation with pine trees in many areas of the HKH has not been of much benefit to local farming communities
T. Partap

pressure. There is an urge now to look at transformation in a new light and to move to change the paradigm of conventional development. There are issues that R&D institutions might want to consider, and these are to change from management to leadership, from efficiency to effectiveness, and from control to release and empowerment. This would give professional staff space to be more participatory, to express what they would like to do when they would like to do things differently, to look at customer services rather than administrative efficiency, to be more client oriented, and to look at synergy between sectors and disciplines and professionals rather than at narrowly focussed techniques.

I would like to move now to an example from Bhutan. In Bhutan, they were also traditionally structured with separate line departments and research institutions located in each line agency. Over the last three to four years, they have gone through a process of institutional change and this is

applicable all over the country, not in one department only. In Bhutan it is known as the renewable natural resources strategy (RNR). In the past, subsistence agriculture has been the predominant activity, contributing 45 per cent of the GDP and supporting 90 per cent of the population. Some of the gaps identified in planning are lack of understanding about roles, inadequate consensus, and different departments pulling R&D institutions in different directions. There was no synergy and open communication channels were lacking. Through an extensive process of re-examining their institutional capabilities they have come up with the new RNR approach. Bhutan is a small country where human resources are still developing, and development strategies must take this factor into account.

Poor coordination and linkages between different departments and institutions and lack of monitoring and evaluation were common problems among agencies. Planning

... Cultural values are abstract things, they are fairly important in terms of goals, leadership, and staff motivation...

.. Institutions do not want to let go of their territorial boundaries, responsibilities, and the power that comes with them.

A. Bhatia

was centralised with overconcentration of decision-making. There were inadequate mechanisms to internalise farmers' perspectives and, of course, the issues of funding and lack of clear definition of responsibilities were common problems. The short-term objectives of the RNR approach involve integrating programmes, projects, and activities into the three sub-sectors; agriculture, forestry, and livestock. By doing so, the Bhutanese Government seeks to enhance the relevance, coherence, and effectiveness of their work within Bhutan and also to consolidate all available resources, thereby strengthening the capabilities of institutions; and, more importantly, they also seek to optimise the use of limited human and other resources. The long-term objective is to achieve sustainable production systems and to improve the income levels and the quality of life of the people.

This is the new organisational structure in Bhutan. There is a secretary of agriculture; the departments have been merged and there is no department of forestry, although they have a forestry services' division which has decentralised its functions extensively. In Bhutan these changes are still in their early days. It is not a blueprint for other countries or other institutions, but some principles might possibly be of interest. The department has been merged into the Ministry of Agriculture. This is always a very difficult issue. Institutions do not want to let go of their territorial boundaries, responsibilities, and the power that comes with them. They have merged the functions of agriculture and animal husbandry into crop and livestock and research. They have decentralised the functions of the forest

division and integrated all the departmental research. Earlier, research was being carried out by different sectors, and they brought those together. And lastly there is an RNR Board at the *Dzongkha*, that is the district level, which again integrates all three sectors. How this will work, only the future can tell. But it is clear that the new institutional responses will be critical for sustainable mountain agriculture.

Institutional Innovations in Tibet

*Liu Yanhua, Director,
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Beijing*

The purposes of research and education are to meet the long-term needs of the society. These achievements need to be applied to management and integrated into the development process. Education provides manpower training and most of the human resources generated from the educational process go into management. Only a few people are responsible for policy-making. For every kind of development process and activity, there are intermediate groups of people involved in different types of institutional activity. Institutional activities are very important for mountain development. To what extent any one institute can play a role depends upon the institutional situation. We know that policies are changing frequently, especially in China, and, when policies change, the institutional situation also changes.

With regards to Tibet, in the current situation we have three kinds of development needs. First, there are production needs. Development should assist production, especially in terms of meeting the food requirements of the people. The second need is for changing the quality of life. At present, about 13 per cent of the population live below the poverty line. These people are living mostly in very remote areas. Their well-being needs to be improved. The third need is that of the environment within which the development process and the economy grows. More and more of the development is today being undertaken at the cost of the environment. So, environmental issues have become very critical. In Tibet, research has shown that about 50 per cent of the pastureland is already degraded. The umbrella organisation responsible for the development of agriculture, forestry, and animal husbandry in Tibet is called CAFA (Commission on Agriculture, Forestry, and Animal Husbandry). Under this agency, you have many organisations, including those for research and education. On account of the recent policy changes, a need for institutional innovation is felt. Research and educational institutions have their own position and role in regional development. They are not the decision-makers. They cannot allocate budgets. So they have their limitations and also their own advantages. The role of these institutions should be properly understood.

In Tibet's case, research and educational organisations have three major roles. They support State decision-makers by providing needed information; they are engaged in

some research and provide training to the people concerned in these areas; and they are responsible for extension of different research findings. In order to play an effective role in all these aspects, several gaps need addressing. Firstly, the policy in recent years has changed decisively towards a market economy. This is a new problem in China. Institutions are very slow to respond to these policy changes. The government has informed institutions that research support will be related to the market economy, i.e., research for market-oriented production.

Institutions that have been used to the traditional type of research lack qualified staff for diversified activities. The production units are now very decentralised, with farm families playing a major role. In this case, many of the research workers need to deal with individuals rather than groups. But they are not adequately trained for this. The government is organising competitions between different research and educational organisations and this is also increasing the competitive spirit. Once the government has a new programme, different institutions have to prove their advantages. Otherwise they have no work and no money. There is infighting for survival. The development budget of the Government has allocated more funds to other development issues rather than to research and education, and this is also hurting many organisations.

Lastly, because of the open economy, there are more options for employment. People are looking for jobs that provide higher pay. Many

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Liu Yanhua

...Research staff have moved out of agriculture to find other jobs one answer to this is to promote women's development.

Liu Yanhua

agencies cannot afford higher pay without incurring budget deficits. In some cases, more than 60 per cent of the research staff have moved out of agriculture to find other jobs. Qualified staff are few. One answer to this is to promote women's development.

In the last three years, ICIMOD has been carrying out an Institutional Strengthening Programme. The programme has worked together with CAFA in human resource development. Under this programme, several activities have been carried out. The most important has been to introduce a dialogue between policy-makers, scientists, and farmers.

Several dialogues were held with policy-makers, planners, researchers, and professionals in different institutions in Tibet. A training course was organised to introduce the mountain perspective and other related topics. Through discussions between the

Government and research institutions, several priorities were identified and programmes developed accordingly. The most important activities were institutional collaboration and group participation in government planning. Prior to this, professors and researchers had never taken part in government planning activities.

There was a willingness on the part of research and educational institutions to undertake activities together with the Government. Following the approval of the agricultural plan, prepared through dialogue as Agenda-21 for Tibet's Agricultural Development, many of the institutions will be heavily involved in its implementation as well as in future planning and monitoring.

Another programme undertaken was to translate information regarding regenerative agricultural technologies into the Tibetan language and provide it to field workers and farmers. This



Senior officers and researchers discussing institutional strengthening for sustainable highland agriculture, Lhasa, Tibet, 1995
T. Partap

had a very big impact. Many of the farmers, after reading the book, have asked for support for specific technologies. Another activity was an extension study tour. In Tibet, because of the new policy changes, extension stations in many counties could not work in the fields. It was decided to organise visits to good experimental stations in other mountain areas of China to study their activities. ICIMOD helped to organise an extension study tour to Ningnan County, which is in the western part of Sichuan Province. This visit was highly successful and has resulted in the establishment of close collaboration between some of these organisations.

ICIMOD also had another programme in the agricultural college to develop a sustainable mountain agriculture curriculum and also develop an appropriate faculty for sustainable mountain agriculture, leading to a training manual and appropriately qualified staff for mountain agriculture. The development of faculty is already in progress. A compulsory course on sustainable mountain agriculture has been developed for the students of that college.

The conclusion from the experience so far is that institutional innovations are not an individual activity but involve closely linked group work with the full participation of different organisations. Institutional development should be pre-planned as a key focus for strengthening an institution. Finally, there is a very important facilitating role for international or regional agencies in national and local institutional innovations.

Institutional Changes at Lumle Agricultural Research Centre (Nepal)

P. Harding, Director of Lumle Agricultural Centre, Nepal

Lumle Agricultural Research Centre (LAC) is a British Government funded multidisciplinary agricultural research centre situated 30 kilometres from Pokhara in Nepal. Its research command area covers 11 hill districts, 18,500 sq. km., which contain about 360,000 farm households. There is a tremendous variation in altitude from 300 to 3,000 metres plus. Rainfall ranges from 1,500 mm a year to 5,000 mm, and the climate within the research command area ranges from subtropical to alpine. There is a fairly wide range of crops and agricultural products. The traditional farming systems are a complex mix of arable farming, livestock production, and forest exploitation. LAC operates within the framework of Nepal's agricultural perspective plan, which has recently been finalised. In that plan, for those areas with good access, good irrigation, and good infrastructure, the emphasis is on promoting high-value products. For those areas with poor access and lacking irrigation infrastructure, the emphasis initially is on improving subsistence production. This will change along with the improvements in access and irrigation infrastructure.

It is very important for all organisations, and particularly research institutions, to have very clear, well-defined, and understood aims and activities. The goal is to improve the hill districts of

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... for those with poor access

... the emphasis initially is on improving subsistence production.

P. Harding

...In this case the principal beneficiaries are the households in the hills

....One can't really introduce major institutional changes unless the staff are with you. The staff need to understand the change and the staff, by and large, need to support the change. A participatory process to institutional change was adopted.

P. Harding

Western Nepal. To do that, four activities have been identified.

These are to increase agricultural productivity and production, generate employment and income opportunities, improve nutrition, and sustain and possibly improve the resource base. There is a secondary project to enhance the capability of the hill agricultural research system in Nepal through the Nepal Agricultural Research Council (NARC). Because of declining funding, it is always necessary to focus one's attention on priority areas. In the past, the attention has been on national and regional priority commodities or various themes, in agreement with NARC. The current research mandate includes some cereal crops and some vegetables and provides research support in areas where advantages for certain cash crops, including livestock, exist.

It is also important, in a research programme, to understand who the target beneficiaries are. In cases, where the principal beneficiaries are the households in the hills (and the word households should be emphasised), households are targetted in accordance with socially required resources and needs, especially those of lower socioeconomic status. The second beneficiary is the National Agricultural Research System which receives better approaches and trained manpower. Lumle is generally recognised, in Nepal, as being a reasonably successful agricultural research centre, and, recently, an independent assessment has also confirmed this view. However, there is still room for improvement and various staff members have had

different ideas for improving different aspects of Lumle.

One cannot really introduce major institutional changes unless the staff are with you. The staff need to understand the change and the staff, by and large, need to support the change. A participatory process to institutional change was adopted. It included a three-day workshop in which staff from the junior technician level up to the directorate level were involved in analysis of strengths, weaknesses, opportunities, and threats before the organisation. Following this, areas in which performance improvement was possible were identified. Following the workshop, voluntary working groups were created to tackle five major areas such as staff assessment, monitoring, evaluation, privatisation, and extension. Working groups spent three months meeting and considering each of these issues in some detail, in their own time, and at the end of three months came up with discussion papers on different issues.

LAC is in the process of implementing some of these. One of the issues identified was institutional sustainability. As LAC has been funded entirely by the British Government, it needs to find other sources of support from the point of view of sustainability. Integrating with NARC over the next five-year period was seen as an option. Trying to broaden the support will improve the efficiency and effectiveness for research and thereby contribute to sustainability.

The bulk of the decision-making responsibility has been passed on to

a Central Research Management Team (CRMT) which meets once a month on average. It is a small working team which makes all the key decisions. It is the team that has the responsibility for strategic planning. Lack of strategic planning was one of the weaknesses identified. Because everyone was always so busy, there was never time to stop and think where LAC was heading before starting a new research activity. One of the strategic planning functions of the CRMT is to make sure that LAC is always tackling national and regional priority areas and that adequate resources are available for planning.

The other function of the CRMT is to monitor activities and achievements. It has also delegated this responsibility to different teams and units. There is also an independent planning, monitoring, and evaluation unit which reports directly to the CRMT. In the past, there were many field visits, but the results of these visits were never used to evaluate the research. Now one of the main functions is to coordinate and monitor all the activities on a regular basis and to draw criteria and procedures to evaluate these activities. While every group will monitor and evaluate their own activities, results will be coordinated by the unit which then reports to the CRMT. Managerially the institute is now divided into three divisions - administration, technical, and outreach divisions. The administration looks after all the personnel and management functions, including staff training.

The technical division contains about 40 scientists. In the past, there were

arranged officers (officers on secondment) and funded officers (funded from the core resources of the centre). It was felt that this was not successful in many ways because of duplication, and a narrow view of problems resulted in wastage of resources. There was a need to change the single disciplinary approaches and units. Scientists were divided according to their fields as it was thought useful for scientists of the same background and training to sit together and share experiences. The outreach division has a whole network of field-based staff. They are located in all the different recommendation domains. There are 25-30 different recommendation domains. Equally important is the feedback to the teams and the scientists of the farmers' needs and perceptions and their responses to the research and related activities. All the field-based staff are now responsible for providing this feedback.

One senior staff member from the outreach division has the responsibility for establishing linkages and coordinating them with extension workers, NGOs, and other projects in the outreach areas. NGOs in the 11 districts are being approached to establish linkages with the centre. These are not just communication but also operational linkages. The interdisciplinary teams and the staff identify priority commodities and themes. It has been emphasised that research should be farming systems' oriented and that it takes place in farmers' fields. Much of the research is undertaken by the farmers themselves. By definition it must be farming systems' oriented, although the individual research programmers may

...The research should be farming systems' oriented ...it takes place in the farmers' fields.

...At Lumle, the main centre, the focus is on high risk research

P. Harding

Practising
participatory on-
farm research,
Rapti Zone,
Nepal
P. Tulachan



work on a particular priority crop in that farming system.

For example, Team 1 could be a rice team. There will be a team leader, and they will have inputs from as many disciplines and experts as necessary—maybe a plant pathologist, entomologist, socio-economist, etc and they will contribute anything from five or 10 per cent of their time to 70 per cent of their time to that team. The rice team will have all the necessary disciplinary expertise in it and, equally important, they will have at least one, hopefully more, of the division staff in the team. Every team has socio-economic, outreach, and technical inputs. The field staff are implementing all the trials; they feel they are a part of the team because they are active members of that team. There are something like 12 teams, and these teams, in conjunction with their other colleagues, assess the needs of the farmers, in terms of research, and draw up a research programme consisting of project, sub-projects, and activities. It budgets the programme and submits

it eventually to the CRMT for final approval and allocation of resources.

The focus is on two types of research—technology generation and technology verification. At Lumle, the main centre, the focus is on high risk research, for example, the first one or two generations of a plant breeding programme and all research which requires very regular and perhaps somewhat sophisticated data collection such as some plant physiology studies or lab-based studies. On the station, the research focus is on technology generation, and there are exclusively researcher designed and researcher managed experiments. The next focus is on site testing. These are like little mini-research stations—mainly half a hectare or one hectare in size and located in agro-ecological zones that are not represented at Lumle. There are four testing sites, and each carries the same kind of activity as on the station, exclusively researcher-managed technology generation type research. But these two represent less than 30 per cent of the total research

...In Lumle outreach site activities are researcher designed but farmer managed.

This is where the researcher, the farmer, the extension agent, and the NGOs come together.

P. Harding

work. More than 70 per cent of the research work is carried out in farmers' fields at what are called off-station research sites representing each of five to six rural agro-ecological zones.

Activities selected from the recommendation domains are researcher-designed but farmer-managed. Researcher-designed experiments are conducted under farmers' conditions and managed by the farmers. The outreach sites are the focus of our research, because this is where the researcher, the farmer, the extension agent, and the NGOs come together. The research process consists of four phases: planning, implementation, review, and dissemination. The CRMT has an important role in each of these. The effectiveness of each research team is evaluated. LAC is less and less involved in extension. There are various ways in which the findings are disseminated such as publications,

training courses, mass media, and visitors. LAC gets over 4,000 visitors a year.

The research systems at Lumle and Pakhribas (its sister agency in East Nepal) have been working for more than 20 years. Research is based on a participatory approach, and institutional improvements have been made to respond to the needs. It has a clear set of goals and objectives, well-defined targets and an essential research management team, which includes monitoring and evaluation of all the activities. Research teams also include social outreach officers. There is delegation of responsibility and a network of all stations and outreach research sites. The emphasis is on farmer management and, as far as possible, even farm-designed trials. This is working quite well so far but needs to be carefully monitored in future.

Research is based on a participatory approach and institutional improvements have been made to respond to the need.

P. Harding

Role of Agriculture in Sustainable Development of the HKH Region

Institutional Perspectives on Achieving Food Security – Balancing Public and Prime Interests: Some Examples from Pakistan

*Zafar Altaf, Additional Secretary,
In-charge, Ministry of Food and
Agriculture,
Government of Pakistan*

... A lot of wealth has been created by the agricultural research centres, but they have not looked at how to distribute this wealth.

... How do you work out the optimal levels of market and non-market forces ?

Z. Altaf

How will farmers internalise the knowledge that is generated? How do we graft indigenous knowledge to existing systems? What is useful knowledge and how is it developed? These are some of the important questions we need to examine in the context of institutional perspectives to achieving food security. If we begin by finding out what needs to be done, then we can proceed to work towards the institutions needed, as well as formulating the policies and providing the enabling environment.

I propose to look at processes rather than structures, substance rather than form, design and creativity rather than search and discovery, and exploration rather than judgment. There is a majority of small and fragmented holdings in the mountain areas. If you have to look at productivity, how would you look at the knowledge situation? What kind of institutions do we need for productivity increases for small-

holders in the mountains? As the public sector moves out and the private sector assumes a bigger role, what is the extent to which the issues of the small-holders will be addressed? Are the inputs' distribution systems, which are mostly based on international market interactions, socially justifiable in terms of the small-holders? How would you look at wealth that has been created? A lot of wealth has been created by agricultural research centres, but they have not looked at how to distribute this wealth. Some people are receiving undue benefits out of the prevalent system. The World Bank says the inefficient input distribution system of the public sector must be changed. If one considers these aspects in the context of developing a receptive organisation, a different kind of approach is needed altogether.

Emphasis on institutional adjustments and changes are commonly advocated at present. Most of the developing countries have been subjected to the structural adjustment programmes of the IMF and the World Bank. But, more importantly, how does one adjust to the increasing commercialisation of all major sectors. How do existing institutions link to the market system? Are we discussing optimisation or maximisation in terms of sustainability? How do you work out the optimal levels of

market and non-market forces? There appears to be a complete absence of intermediary situations. It may be necessary to give up scientific solutions at times for possible solutions. It is important to explore and search. Judgement is very adversarial. It is like a gatekeeper. Today we are less concerned with ethical choices. Practicality has taken over. We are somehow being dominated in our thinking by an absence of other values besides those of the market, and this, to my mind, forces a degree of doubt about the prevailing systems of thinking.

We have to look at design versus analysis. Design will help us take things forward and look at it differently. Today we are obsessed with information. Data are coming in from all sides. There is so much documentation on different aspects of development, as for example- poverty. We have continued to define the poverty line by per capita income, by rupees, by calorie intake, and by other measures. Yet, the poverty aspect continues and is, in fact, increasing.

What have we done with more information? There is a need to get on with it and get on with new designs. Scales of design, of course, are to be learned. It is a thinking process, not something that can be immediately passed on. But, when one has a new design, it is possible to have fresh energy and start redesigning the structures rather than continuing in the traditional mode seen in the universities. One may have to recognise institutional contradictions and even do a bit of leapfrogging to overcome the hurdles in the system. There is a data paranoia. We want more information, even if it is the same information in a new form. Different policy issues have been advocated simply by reusing it. You have to create and discover and be willing to take risks for new discoveries.

We need to recognise that there are paradoxical situations in institutions. Neither should we hesitate to apply political principles. Federalism is a common situation giving rise to paradoxes of power and control. Institutional needs are both big and

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Z. Altaf



Marginal rangelands and increasing livestock pressure, Balochistan, Pakistan
T. Partap

small. If an organisation is big, it is less dependent on the outside, and, if it is small, it must remain dynamic in a highly competitive world of scarce resources. The actions needed are complex and multi- sectoral, and these actions cannot always be centre-oriented. Mostly the implementation is on the periphery, and the decisions are across many points. The responsibility may be with one, but power and resources with another. If you want to integrate both of these, you may need to take a bit of both by compromising. Linear linkages are unnatural. If you share power or if autonomy is granted, then we hold it together by trust and certain common goals, that are again based on alliances and trust between groups.

Humans are our chief assets. There is a degree of equality of thinking and living between them. We should provide space for individual contributions. Through transfer of decision-making points to lower functionaries and lower organisations, you widen the scope for contributions. Everybody wants to have authority but not responsibility. In psychology, we call this the 'handicapped theory'. According to this theory, you put all the blame on another person; you don't take the blame yourself. There are two types of error in this, you can get it all wrong or you may not get it as right as you possibly wanted. You are somewhere midway. The key element is pluralism and flexibility-and not being static. This requires appropriate changes in rules of conduct, common ways of communicating, and common units of measurement.

* For his, read also her (ed).

Let me now discuss balancing public interest and private interest by looking at Pakistan's experience. The agricultural sector last year had a 7.5 per cent growth, which has been documented by the World Bank and others. Rice exports were about two million tons. Export of cotton was about 2.5 million bales this year. Trade in cotton has been internationalised, there are no barriers, and the farmer is getting his* due. However, the distribution of wealth that has occurred as a result has started a debate in Pakistan. This will determine the future of the farmer's capacity and the quality of his living in a very fundamental manner.

Creating more socially just systems in the private sector has become a high priority. This has come about because the public sector is bankrupt. Over the last three years the area for some crops has increased by a factor of three, and these changes are very rapid requiring closer monitoring. Changes in the northern mountain areas are not so rapid as these lack the advantage of modern technology. The Northern Area's contribution has been potato seeds. Another major change has been seen in the case of Canola.

Changes in international trade policies have come about. Grants or soft loans are decreasing. One has to start worrying about how to use your output for the international market. It is not a question of what you can produce, but more what the international market wants. All of these have a very significant impact on the domestic sector and, unless we have appropriate agencies to deal with these issues and problems, food security does not carry

much meaning. We have developed a number of agricultural universities. We understand there are degrees of priorities that we have to work on. Many development research institutes will be looking at the existing technologies that have been developed and are available for different areas.

In the National Agricultural Research Council, it was found that 93 different technologies were sitting on the shelf. Similarly, there was a lot of activity going on in the International Agricultural Research Centres. These technologies are sitting on the shelf and need to be adapted and used. Potato seeds have been developed for all types of soils and for drought conditions. These also mature faster. There are a number of ways to improve production and productivity. All these will require new designs, new thoughts, and new analyses for farmer adaptation in mountain and other areas.

The type of institutional dynamics needed can be elaborated upon with a few examples from Pakistan. For instance, between the harvesting of sunflower, oil seeds and the monsoon there was a period of 10 days. The middleman used to exploit that short period to his benefit. There were 16 solvent extraction units, and we asked them to come forward with plans for the direct purchase of sunflower seeds from the farmers. They explained that they did not have a credit line for purchase of seeds, hence they preferred the middleman system. Following discussions in the Cabinet regarding a credit line from the State Bank of Pakistan, it was provided with great difficulty. Credit was controlled, because deficit financing was

controlled under the structural adjustment programme. By working behind the scenes, we were working in areas where normally no agricultural institutions had worked before.

Another case is that of Canola. Although the programme for its promotion had been around for many years, it had not gone forward. We looked into it and found the problem to be one of processing. We managed to get a couple of solid extraction units to modify their extraction processes. Here, we moved into engineering processes. We discussed it with the engineers, assessed the cost and the benefits, and moved ahead to provide the right solution.

The next area was cotton. Anybody who is aware of the textile lobby knows that it rules Pakistan. It rules Pakistan in the sense that cotton fibres constitute 63 per cent of its total exports. Cotton is a powerful lobby, and we had to fight it all the way on all the issues on behalf of the farmers. We asked the farmers when they produced 8.7 million bales not to sell cotton to the textile industry. We used the pulpit of the priest for disseminating information to farmers. We also discussed it in the cabinet.

It is all these non-traditional roles of the Ministry of Agriculture that have managed to get some results and hopefully something beneficial for the farmer. I think there are no model roles for any institution. One must be able to deal effectively with the problems and issues at hand. It is also not as simple as privatisation, as we saw from the examples above. Institutions must be competent enough to understand

... It is not a question of what you can produce but more what the international market wants.

... Institutions must be competent enough to understand the problems they have been established to deal with and must be willing to achieve results.

Z. Altaf

the problems they have been established to deal with and must be willing to achieve results.

Agriculture and Mountain Development: Farmers' Perspectives from the HKH Region

R.P. Yadav
Agricultural Economist

Poverty and mountain degradation are very well explained by the six mountain characteristics - inaccessibility, fragility, and marginality as liabilities or constraints. On the other hand, there are the diversity, niche, and adaptation mechanisms as positive aspects. Sometimes diversity can be a problem. Mountains have many diversities, many agro-ecological zones. When a technology is developed for one zone, it may not be applicable to another. This results in much greater costs for technology development. It is also a comparative advantage that different commodities can be produced at very short distances from each other. Here, diversity acts as a positive factor. The niche in the mountains refers to mineral resources, tourism, hydro-power resources, and so on. When we discuss farmers' perspectives, we mean understanding the farmers and the kinds of conditions, constraints, and advantages they have. A farmer would like to see that his* constraints are minimised and his* benefits maximised. Different educational and research organisations, government policies, and government interventions should really be coming up with ways

to help the farmers so that the constraints they face can be reduced.

The whole case of Himachal (India) has been very interesting to look at in terms of how to develop mountain areas. While preparing the 20-year agricultural perspective plan, we reviewed the experiences in Himachal and Nepal. The demands placed on the limited resources are enormous. Unless we identify priorities for investment, we cannot really think of long-term sustainable development. I think Himachal has focussed on infrastructure and tried to overcome the accessibility constraint.

In Nepal, infrastructural development has been very expensive. Construction of roads and other transport networks has been very difficult. Recently, private sector helicopter services have been bringing about some very interesting changes. In areas like Jumla and Helambu that produce a lot of apples and where there are no roads, the helicopter services have started bringing these apples to the market. New developments have been bringing new challenges and opportunities also. One of the research issues that could be looked into is how to remove these constraints and provide cheaper services to the people. Some of the very high-value products can now be brought to the markets. These innovations have changed the perspectives of the farmers. Farmers who were producing only for their own consumption or subsistence are starting to produce commercially for outside markets.

* For his, especially in this case, read also hers (ed).

The mountain farmer has some livestock, crops, and vegetables. One has to look at the farmer in this context. He cannot opt for monocropping because mountain characteristics force him to use a farming systems' approach to agriculture. We have to see how our research and educational institutions can prepare manpower and the technology to meet this kind of need. There is a Chinese proverb which says 'walking on two legs'. This basically means using both indigenous and scientific knowledge. The challenge to both research and educational institutions is how to really bring about this combination of indigenous knowledge and scientific knowledge.

The third element is multidisciplinary research. We are talking about a centre without walls, with linkages to various institutions, as well as various donors — a consortium approach. If different institutions start working in isolation, you cannot solve the problems, particularly in the mountains. The problems are so interrelated and show up very clearly between forestry and agriculture and between uplands and lowlands in the mountains. These conditions are forcing us to look at interdependence among institutions. The same thing also applies to donors. Unless the donors work together as a consortium, the problems cannot be satisfactorily tackled.

We cannot overlook production capacity in terms of the soil, land, and water resources. Balance is important. One should not kill the goose that lays the golden eggs. We have to protect

the goose as well. And I think this balance between production and production capacity forces us to go for resource-centered strategies in the mountains. When you look at the way the farmers have been practising agriculture, it becomes clear that they have given great importance to the quality of resources. In mountain areas, they have kept livestock that do not give much milk but which produce organic matter (cowdung) used for maintaining soil nutrient levels. Mountains farmers look at how to maintain the quality of their resources. Although one has to start with agriculture, gradually, off-farm activities, to create more income for farmers become very important. Introduction of off-farm activities and modern technology become essential in the hills, but this must take place gradually and in a manner that builds up confidence among the farmers. A participatory approach to development is also needed because of the need to integrate farmers' needs and potentials from lowland and upland areas.

In Nepal, several indicators demonstrate that mountain areas are changing from subsistence agriculture to more commercially-oriented production. I have mentioned already the role of improved access and the introduction of helicopter services. The installation of VHF telephone services has also helped farmers who have been producing vegetable seeds and other products to find markets for their products. VHF telephone services are not very expensive. Farmers are organising themselves into groups and raising the resources for installing telephones. Once they deposit the

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...The installation of VHF telephone services has also helped farmers who have been producing vegetable seeds... to find markets for their products.

R.P. Yadav

The pastoral lifestyle is under pressure in Tibet
T. Partap



funds, they receive the VHF connection. This has broken the isolation of the mountain regions in the context of the lack of information about prices. The third element has been the introduction of sprinkler and drip irrigation using plastic pipes. These have become popular, as surface irrigation is causing a lot of erosion problems. Sprinkler irrigation has been accepted very rapidly by farmers.

While you look at the mountain characteristics, farming systems, and farmers' perspectives, it is important not to forget that some of the farmers' problems in the mountains must also be looked at from outside the mountains. This has been the case in many areas through development of marketing linkages. Apples grown in Himachal are being sold in Bombay and Calcutta. Similar solutions have to be found for other mountain areas also. Different organisations have to work together in the mountains and look at the system as a whole rather than in parts.

Perspective on Developing Food Security in Mountain Areas

T.S. Papola, Head,
Mountain Enterprises and
Infrastructure Division, ICIMOD

Those who lived in mountain villages 30 or 40 years back will remember that purchasing food or even borrowing food was considered to be an indicator of very low status in the village. There was such a deep concern about household food security. People did borrow once in a while when there were shortages in the family, but they did it very quietly and did not advertise it. The situation, as you all know, has changed over the years – for two reasons. Mountain agriculture has not been able to meet the increasing demands for food and, therefore, mountain areas have to import a lot of food from other areas. The development of infrastructure and communications and the reduction in inaccessibility to mountain areas have

also facilitated the flow of food from other areas. The question today is should mountain agriculture be concerned with food security as traditionally the mountain population has been, or are there other kinds of approaches? Food security will still continue to be a major concern for mountain households because of the relative inaccessibility. Whatever happens, improvements in access are unavoidable.

Food security for every household could mean that adequate food is available throughout the year. This does not mean that for certain parts and times it is available and for the rest of the time it is not available. It should also be available at affordable prices, but it is not necessary that all the food should be produced in the mountains themselves. This is not possible even if one wanted to produce all the food in the mountains. Many mountain areas are not only subsistence focussed. They are also opening up to other areas. Therefore, it would be advisable to approach the food security question separately from the food self-sufficiency question. In the Hindu Kush-Himalayan Region, there are issues relating to big and small countries. There are issues relating to countries that have large areas in the plains and only small areas in the mountains, while there are other countries that are completely covered by mountains.

Individual countries have to approach this problem differently, depending upon trade between regions within the country and also between countries. Many factors govern such approaches. If one considers food security

in the sense of food availability, not production of food in the mountain regions, there are other issues that follow; i.e., questions of transport and, storage facilities and also public policy concerning food distribution systems. The other issue is whether there is adequate purchasing power in the mountains to buy this food. If they are not producing food, they will be producing something else. Sustainability of mountain agriculture is commonly approached from an ecological perspective. But if one is talking of mountain agriculture as a sustainable source of livelihood for mountain people, I think there may be a question mark. And that's when the whole question of diversification arises—going away from food crops to other kinds of crops and subsequently going into non-land based activities such as small-scale manufacturing activities, tourism, handicrafts or micro-hydel. All this suggests that the accessibility of mountain areas will have to be improved, which means that infrastructural development will be a very important consideration in the context of changing mountain agriculture and ensuring food security for mountain households.

Some type of public support system is essential for developing mountain infrastructure, because the mountain people themselves lack the resources to build roads or other kinds of communication systems. Mobilising resources from outside should be seen in the context of meeting the cost or compensating for the cost that mountain people are bearing for the overall development of the area. The subsidy question should be seen in a different perspective. If one is thinking

...It would be advisable to approach the food security question separately from the food self sufficiency question.

...If one is talking of mountain agriculture as a sustainable source of livelihood for mountain people, I think there would be a question mark.

T.S. Papola

...Leaving mountain development to the market will not be the solution if markets do not support the development of mountain infrastructure and the basic needs of mountain people.

T.S. Papola

of adequate livelihood patterns and progressively increasing the standards of living of the mountain people, public support is very important. Leaving mountain development to the market only will not be a solution if markets do not support the development of mountain infrastructure and the basic needs of the mountain people.

Public support is necessary for minimising risks and diversifying mountain economies to lead them to higher levels of employment and income.

What are the implications of this kind of approach to research and development institutions? Education and research, as well as extension, appear to be moving away from purely field crops to other kinds of activities. Energy, infrastructure, road building, and tourism should also be within the purview of the existing agricultural education system. They are capable of diversifying into these areas in order to contribute more to mountain development. In spite of the rapid diversification, agriculture will still continue to be the major activity in mountain regions for quite some time in the future.

Agriculture and Mountain Development Perspectives from the Andes

Jose Luis Reuda
International Potato Centre (CIP),
Lima, Peru

I think I am listening to the same problem that we have in the Andes. We lack money, we don't have staff.

Let me show you how we have approached this problem. I think we have a good wealth of institutions. If we try to do everything by ourselves, it will be an impossible task. We have learned from several years of work that we have to work together. Current budget restrictions have helped us to develop a consortium approach. This has been working very successfully in the Andean Region.

What we have done is to pull together a broad range of institutions-NGOs, universities, the private sector, the public sector, programmes, and projects, in terms of their comparative advantages. What can one do better than the other? This is the way our thinking has developed. In order to address research priorities, we have carried out different exercises that have given us research priorities. It has also identified who will do what.

We use a multidisciplinary research approach and the systems' approach for field activities. The consortium is based on sharing costs. To be able to share benefits, it means we have to invest and each institution will invest in funding their own staff. We did this through the development of the consortium. Another important aspect is that, by having a broad range of institutions, one is linking research and development. Usually these two are separate. The goal is not natural resources' management, but basically income generation. We have to add value to the products that come from the mountains. We have to improve technological interventions. We have several technologies that have to be taken to the farmers' fields, using a



Wool and pack animals of the marginal highlands, The Andes
T. Partap

gender perspective. Technology adoption is very much linked to the family conditions in the farming systems of the Andes.

The use of a consortium approach tries to identify close working teams from

different organisations. This is also what we have done now under the global mountain initiatives by linking the Andes, the African Highlands, and the Hindu Kush-Himalayas through ICIMOD.

...We have to add value to the products that come from the mountains

J.L. Rueda

Perspectives of National Agricultural Research Systems on the Challenges of Sustainable Development of Mountain Agriculture

Arid Zone Agriculture and Research in Pakistan

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The arid and semi-arid areas of Pakistan produce 12.5 per cent of the national wheat production. These rainfed crop lands also contribute 69 per cent of *Jowar* (*pennisetum* spp), 31 per cent of millet, 53 per cent of barley, 65 per cent of gram, 17 per cent of other pulses, 82 per cent of groundnuts, 17 per cent of sesame, 23 per cent of rape and mustard, 17 per cent of sun hemp and a significant percentage of *guar* (legume) seed to the overall national production of these crops.

The arid and semi-arid areas of Punjab support about 70 per cent of the livestock population, while more than 80 per cent of the livestock population in Balochistan is supported by the arid lands of this province which contribute more than one-third of the country's sheep and goat population. One estimate indicates that Balochistan produces about 56,000 tonnes of meat from 11.2

million sheep and 7.2 million goats, representing about 3.9 per cent of the total red meat production in Pakistan. If the live weight of each animal at slaughter is increased from 27 to 30 kg, an additional 62,000 tonnes of sheep and goat meat could be produced, increasing Balochistan's contribution to the national meat supply. Alternatively, better nutrition before mating could increase the lambing rate from 60 to 70 per cent and would result in another 5,600 tonnes of meat.

We use a multidisciplinary research
In arid and semi-arid areas of Pakistan, a single crop system of a *rabi* (winter) or a *kharif* (summer) crop is generally followed but, where rainfall patterns permit, a winter crop may be followed by a summer crop. Wheat continues to be the single largest crop for dryland agriculture. The rangelands, which constitute about 46 per cent of the area of the country, provide forage for 30 per cent of the cattle and buffaloes and 75 per cent of the sheep and goats. A large portion of these rangelands has been overgrazed and severely degraded. A comparatively smaller area of arid and semi-arid lands is used for growing fodder crops. In some areas, even wheat and barley are grazed once

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A.S. Alvi

before they are allowed to mature. Although livestock production is a major industry in the dryland areas, it suffers from mismanagement, malnutrition, and various diseases.

The farming systems in Balochistan integrate crops and livestock to produce foodstuffs for human and animal consumption. The animals are sold to raise cash whenever it is needed. The income from sheep and goats as a percentage of farm income ranges from 40 to 70 per cent for transhumants to 100 per cent in the case of nomadic pastoralists. Off-farm income is becoming increasingly important, as families fail to make a living from the land. It stabilises the farm income which is very susceptible to rainfall fluctuations.

Before the introduction of tubewells in the early 1970s, most wells in Balochistan were hand dug. By 1988-89, there were thought to be more than 10,000 tubewells. The water is used mostly for high-value cash crops such as apples, almonds, apricots, and vegetables, although some is used for wheat and alfalfa.

The farming systems in the arid areas vary from livestock and rangelands' management, subtropical crop systems, and range agroforestry to small grain *khushkaba* (dryland) and *sailaba* (irrigated) farming systems. However, these areas are experiencing a continuous process of intense land use from increasing human populations and livestock numbers. Periodic droughts have also been a factor. This has led to the disturbance of the fragile ecosystem with consequent degra-

dation of vegetation, deterioration of soil, depletion of rangelands, acceleration of desertification, and lowering of agricultural productivity. Thus, the problems of arid land development and desertification control are complex, requiring a multidisciplinary approach for sustained economic amelioration of rural/pastoral communities in the hitherto backward regions.

Realising the magnitude of the problem, Pakistan Agricultural Research Council (PARC) has established a multi-disciplinary Arid Zone Research Institute (AZRI) for improving agricultural production in the arid and semi-arid areas of Pakistan. The AZRI is one of the federal agricultural research organisations forming part of the PARC's national network of agricultural support agencies. Its headquarters are located in Quetta, Balochistan, and it has three substations at Umerkot in Sindh, at Bahwalpur in Punjab, and at Dera Ismail Khan in the North West Frontier Province.

AZRI's ecological mandate in Pakistan encompasses two zones, the arid zone with annual rainfall of less than 150 mm and the semi-arid zone with less than 350 mm. These zones constitute about 85 per cent of the country's total area. A substantial part of this dryland, amounting to about 14 million ha, is at present served by canals and other sources of irrigation, and thus does not come within AZRI's sphere of responsibility. However, 40 million ha (or about half of Pakistan) are normally serviced by research from the Institute.

...Increase in small ruminant productivity by improved livestock management...

Multidisciplinary Arid Zone Research Institute (AZRI) for improving agricultural production in the arid and semi-arid areas of Pakistan.

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Major Research Thrusts

The principal objective of AZRI's research programme is the sustained improvement of small ruminant production in the arid and semi-arid zones of Pakistan. To achieve this, four major research thrusts have been adopted. The first of these was, for the most part, completed between 1985 and 1990, and the other three are currently receiving attention.

The AZRI has made a sustained effort to collect the information necessary for devising an appropriate research programme and for formulating its development policies. This effort mainly consists of:

- extensive surveys of farmer practices and of household agricultural production systems,
- generation of community profiles,
- examination of constraints to and opportunities for agricultural extension,
- compilation of agricultural and related statistics for upland Balochistan from secondary sources, and
- compilations and probability analyses of long-run rainfall and temperature records.

The research designed to improve range forage resources by range rehabilitation and establishment of forage reserves on cultivable land currently focusses on identifying and testing indigenous range plant species, such as perennial grasses, forage legumes, and forage shrubs. The

thrust for research designed to increase small ruminant productivity by improved livestock management has the following three components:

- nutritional management studies, feeding value trials, and examination of prophylactic health care against parasites;
- the effect of improved quantities and qualities of animal feed on sheep and goats throughout the annual cycle of production and determination of the relationships between different and variable sources of feed and key animal parameters; and
- studies on the feeding value of fourwing saltbush.

The thrust for research designed to increase animal feed sources by improving cropping systems on cultivable lands incorporates both analytical, agronomic and germplasm evaluation trials. Conventional technological interventions include improved varieties, use of nitrogen and phosphate fertilizers, weed and insect control, and tillage techniques.

Research activities at the AZRI Headquarters are focussed on high-land Balochistan with six research disciplines; namely, (i) livestock management (ii) range management, (iii) germplasm evaluation, (iv) agronomy, (v) agricultural economics and farming systems, and (vi) agricultural extension and communications. AZRI's research activities in different provinces are carried out by its sub-stations.

AZRI-Generated Technologies

The AZRI has been working on multidisciplinary topics of dryland agriculture since 1985-86 in collaboration with ICARDA. As a result of intensive research in highland Balochistan as well as other arid parts of the country, the following technologies have been generated to help increase the agricultural productivity of the farming community.

- Yellow Rust Resistant Wheat and Barley Varieties
- High-yielding Food/Forage Legumes
- Catchment Basin Water Harvesting
- Computerised Rainfall Database
- High-yielding Forage and Fuel-wood Shrubs
- Improved Livestock Management

Specific Long-Term Targets

For the development of arid lands, the AZRI needs to set itself certain long-term quantitative targets. The overall target should be to achieve the adoption of a number of technologies generated by AZRI for the farming community. More specific targets include:

- registration and releases of four varieties of bread wheats with resistance to yellow rust, three barleys, three lentils, and one forage legume;
- establishment of a greenhouse at AZRI to enhance the variety release programme;

- establishment of a seed industry for new crop varieties in collaboration with Provincial Departments and the private sector, so that the farmers in arid and semi-arid areas can get seeds for newly developed, high-yielding and disease resistant crop varieties;
- Development on a long-term basis of a large chunk of fallow or marginal land in highland Balochistan to establish forage reserves of fourwing saltbush or another shrub in collaboration with the Forestry, Livestock, and Agriculture departments;
- re-vegetation of degraded rangelands by using local and exotic grasses, shrubs, and trees in arid parts of Cholistan, Thar, and highland Balochistan (such activities would be coordinated with the Forestry and Livestock departments as well as NGOs involved in range improvement work in arid areas);
- implementation of a management plan for Maslakh Range, which will involve farmers who used to have access to the area, in collaboration with the Forestry and Livestock departments;
- application of improved sheep/goat husbandry practices that increase flock and herd off-take by 50 per cent, in a collaborative study with the Livestock Department;
- development of simple ex-ante bio-economic models to help define AZRI's research agenda and indicate the priority that

should be given to promising and sustainable technologies that have a high potential for adaptation and substantial impact on farm productivity; and

- conduction of studies on saline agriculture by using different salt tolerant crop and forage species for the reclamation of arid and semi-arid areas affected by salinity.

Problems of Agro-pastoral Farmers in China

Liu Yanhua

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In the pastoral areas of China where there is no food production, food security is a very important issue. With increasing economic liberalisation, marketing systems, have also reached pastoral areas. Food has to be transported to the pastoral area, but markets are still developing and cannot always be relied upon to deliver food, especially at affordable prices. We have found that the farmers have been losers with increasing marketisation. They have limited ideas about marketing and most of the benefits have gone to the middlemen. Some kind of intervention from the government, or even from different institutions, has become necessary until people learn to deal with their own marketing problems.

The next point is that the government also wants to introduce taxes in the pastoral economies. However, this has not been successful because the farmers have to pay most of the taxes

while the middle men are taking most of the profits. After five years, these farmers, having realised that they are the losers in the marketing system, have organised themselves and formed village organisations to market their products collectively. With this kind of organisation farmers not only get better prices but can also deal with the middlemen in more favourable terms. This emphasises the fact that, when farmers are not organised properly, they cannot benefit from changes — as a matter of fact they could even suffer. When they are properly organised they can take advantage of the prevailing system. While scientists, decision-makers, and others can create the environment, it is only when farmers begin to help themselves that their conditions can improve.

In Southwest Sichuan Province in China, the mountains are very high. Irrigation is very difficult at 3,000 - 4,000masl. These areas are rich in vast pastures and forests. But there are also several important problems, among which low temperature is a major constraint.

Soil erosion is increasing because of poor land management. Fragile sloping lands are fragmented into many small pieces. Transportation, communications, and markets are poorly developed. In these areas, the people are very poor, most of them are living below the poverty line. In these areas the first thing is to get enough food for the people; the second is to increase incomes for the poor people; and the third is to conserve resources and the environment. A team of experts has been

... Farmers have been losers with increasing marketisation ...most of the benefits have gone to the middlemen.

..The current status of research... is very commercially oriented and focusses on specific commodities...

Liu Yanhua

working in this high mountain region since 1988. Last year this team received a prize from the Chinese National Council for all their work and achievements. They focussed on producing enough food by introducing new varieties, advanced technologies, and fertilisation. Today food production in this area is improving. Some of the counties do not import food any more. A few are even exporting some food to neighbouring counties.

The pastures are also being managed for higher productivity. Improved yaks and pigs and new animal husbandry practices have been introduced. Orchards have also been developed along with the introduction of marketing. Research institutions are helping in many important aspects, and this will continue in the future.

Mixed Farming Systems in the Middle Hills of Nepal and the Education and Research System

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Many institutions present here from Nepal have been doing something on different aspects of farming systems. Farmers are engaged in raising crops, livestock, and multipurpose trees. Large numbers of crops are being grown in these mountains, because there are many different kinds of niche, given the fact that the climate ranges from tropical to subtropical.

Looking at the mixed farming system, what is the kind of education we are providing? In the Nepalese context,

the current agricultural curriculum is oriented towards achieving high production using the green revolution. Very little focus has been on developing a holistic approach such as farming systems. Although many graduates have been produced, these graduates have not been taught about the farming systems' concepts needed for a proper understanding of farmers' problems. They have also not been exposed to the problems faced by the farmers — including ways to solve them.

The current research is also not oriented towards farming systems. It is very much commercially oriented and focusses on specific commodities. It is also mostly carried out in research stations. The agenda for researchers comes from the top and from higher authorities. Farmers' inputs are lacking and there are very few trained staff in research. The other problem is that the incentives for work are low and poor. People are not very motivated towards doing good research work. Facilities are inadequate. For example, research stations lack chemicals, proper laboratories, libraries, and so on. Consequently, because of the poor quality of research, most of the research recommendations are not accepted by the farmers.

We know that the farming systems' concept is very area specific. There are many niches, and the research findings vary from one place to another and do not completely apply to other places. There is a need for research on many of these different research sites. This needs many human and other resources. Insofar as the role of different institutions is concerned, there

The agenda for researchers comes from the top and from higher authorities

F. P. Neupane

We also take the students to observe faculty members during their research. They assist in data collection and, by watching different activities, begin to learn a few things about mountain farming systems

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are two categories — universities and other institutions. The universities are supposed to develop and implement the farming systems' concept and practices in their curricula. The curricula need to be revised totally and focussed on this concept of farming systems. In the university, there is one course on farming systems and sustainable agriculture. This is not adequate, but a beginning has been made in exposing the students to the concepts of farming systems. When they go to the villages and meet the farmers they will at least know how to interact with them. On the research side, we have a research laboratory near the institute in the low hills where faculty members go and conduct different kinds of research.

We try to bring together different faculty members. We also take the students to observe faculty members doing their research. They assist in data collection and, by watching different activities, begin to learn a few things about mountain farming systems. This is a small beginning. There is a major role for other institutions such as ICIMOD, which has a pioneering role. The mountain farming systems' programme of ICIMOD has brought us together. Discussions like the present one are very important for bringing about the needed changes in research and educational programmes in mountain areas.

The Nepal Agricultural Research Council was part of the Ministry of Agriculture, and, for the past five years, it has been an autonomous institution which has many research stations throughout the country. It is also changing its focus towards

research. The Institute of Agriculture and Animal Sciences, however, is part of the University, and not much research is being undertaken there, because we have not been mandated to focus on research.

Based on considerations of different agro ecological zones, the north-western areas are predominantly high altitude pastures with livestock ranges playing a very important role. The main livestock here are yak, sheep, and goats. There are a number of other opportunities in valley areas during the summer — especially seed and off-season vegetable production. Both teaching and research are directed towards improving human resources, and the agricultural productivity of these areas needs to be strengthened.

In mixed farming systems in the lower hills, the role of livestock is secondary, because the main activity is crop production. Other factors to be considered are livestock rearing, improvement of genetic potential, and fodder production.

Shifting Cultivation in the Northeastern Hills of India and Research Initiatives

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As far as the north-eastern hill (India) region is concerned, cultivation practices can be classified into four major categories — shifting cultivation, terrace system of cultivation, wet and dry valley land cultivation, and home gardens. The major thrust in

research has been to generate technology for all the different categories of farmers. Most hill or mountain areas, more or less, have a number of common problems and constraints, — marginality, inaccessibility, inadequate markets, and poor infrastructure and institutional linkages.

Interlinkages are weak at present. While this is a major constraint, there are also good opportunities and potentials because of the diversity of climate, biology, and culture in the north-eastern region. Seventy per cent of the people practice shifting cultivation on very steep slopes ranging from about 60 to 100 per cent. About four million tribal people are involved in shifting cultivation, covering an area of about two million hectares. A very purposive strategy has been adopted to solve this problem of shifting cultivation.

The first component in this strategy was to improve the productivity of shifting cultivation and minimise the soil erosion without upsetting the ecological balance. Because it has been a way of life, the system cannot be done away with completely. Alternative strategies will take some time. The first strategy was to improve the productivity of traditional farming systems. Under conditions of a 15 to 20-year fallow period, shifting cultivation is not as hazardous as people perceive it to be. The problem has been aggravated because of the growing population pressure. As a result, the fallow cycle has been reduced from 20 to 30 years to two to five years. Anthropologists were of the view that there was no loss at all of soil resources. If losses had

occurred, the people, who have been practising shifting cultivation over the centuries, would have altered the landscape from sloping land to flat land or terraces. They have expressed the opinion that so-called changes would actually disrupt traditional practices if farmers were forced to stop shifting cultivation.

Realising the need for further studies, elaborate runoff studies were carried out under different systems of cropping. All the important soil parameters, such as erosivity, erodibility, and crop management factors, were examined. Climatic conditions were found to be much more responsible for erosivity than the soil erodibility factor. It was also found that grass strips introduced or integrated with mixed cropping systems can reduce soil erosion. Improved varieties were recommended for improving the productivity of shifting cultivation, particularly for maize. (As far as rice is concerned, we are not able to breed any varieties that can be well adapted to the mixed cropping situation.) Use of fertilizer was also advocated.

The second approach was to replace this traditional system of shifting cultivation with an alternative land-use system or farming system. Different land-use alternatives were comprehensively assessed on a micro-watershed basis and a land-capability classification was developed. If the soil depth was one metre, an agri-horti-pastoral system was possible, a silvi-pastoral and many other systems emerged. Agro-forestry scientists also helped to identify a sericulture-based system. The combination resulted in seri-agricultural, seri-horticultural, and sericultural systems.

... Climatic conditions were found to be much more responsible for erosivity than the soil erodibility factor

...the problems associated with shifting cultivation, particularly land degradation, could be effectively managed using integrated land management systems.

S. Awasthi

The more we studied the traditional systems, the better we understood the reasons behind the practice.

S. Awasthi

In the process of developing the new systems, we also did not lose sight of the traditional wisdom and ingenuity of the farmers and their knowledge. Their rich knowledge was seen in some of the classical examples of managing water for rice cultivation; the organic farming system, drip irrigation, and the *Chyabo* (which includes agroforestry, rice cultivation, and fish farming) system of cultivation in Nagaland used for collecting runoff water. The more we studied the traditional systems, the better we understood the reasons behind the practice. This also greatly helped to identify improved practices. The problems associated with shifting cultivation — particularly land degradation — can be managed effectively using integrated land management systems. The systems discussed have shown great potentials with regards to food security, employment, and maintenance of soil fertility. These need to be properly monitored and further developed.

Shifting Cultivation in Myanmar and the Development Process

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There are two major problems of hill farming in Myanmar; i.e., shifting cultivation and poppy plant cultivation. The country is heavily forested in mountains that are remote and mostly inaccessible. Native people living in these areas are isolated and their standards of living and educational levels are also very very low.

Shifting cultivation is a common practice in these regions. This practice

is known as the *Tarria* cultivation method. In fact slash and burn techniques are widely used. Usually upland rice and maize are grown, and, after some years, the land is abandoned and the people shift to another place. Due to these practices, erosion and landslides are common.

In Myanmar more than 20 per cent of the cultivated land is still under shifting cultivation. The Government has laid down plans to eradicate shifting cultivation and poppy plant cultivation. Four regions have been selected covering about 49 thousand square miles (that is 9.1 % of the total area of the country). The Ministry of Progress for Border Areas was established in 1994 to look after these areas. The plan focusses on development of infrastructure such as roads and housing. Developments in education, health, trade, agriculture, livestock breeding, forestry, mineral exploration, and so on have been emphasised. Some of the hilly areas have minerals, such as rubies, that can be exploited. A number of external agencies are also helping the Government in this effort. ICIMOD has provided support to promote Appropriate Technologies for Soil Conserving Farming Systems such as Sloping Agricultural Land Technology (SALT) and water harvesting activities.

Different training programmes to help local farmers improve their knowledge of agricultural techniques, land management, and use of improved seeds, fertilizers, pesticides, and farm equipment have been undertaken. Myanmar Department of Agricultural Science has opened 67 agricultural extension stations around the border areas and posted more than 400

extension workers in those areas. All round efforts for development and coordination are being made by the Ministry of Border Areas and the results are showing.

Farmers' Perspectives on Role and Priorities of National Agricultural Research Systems (NARS)

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The first point to note is that farmers do not see agricultural research as being something separate from the overall agricultural process. One has to see the whole process in position if there is going to be a successful impact on the farmer. And the farmer himself will judge whether it meets his needs and aspirations or not.

Any technology or intervention must have some immediate impact on his or her actual situation. This is related to the fact that farmers are very conscious of the risk they are taking in adopting something which is outside of their perspective. It is not possible to ignore both the economic and the agro-ecological situations. The actual ingenuity of the farmer is quite amazing. Farmers will adopt technologies to suit their particular needs and also, in fact, engage in research. One example from the Eastern hill is *Charito*, a medicinal herb exported to India which is rapidly declining in availability. Already farmers are taking this herb and trying to cultivate it in their fields. There is no intervention there, in terms of research and support from any other part of the agricultural

organisation. Assessment of the perspective of the farmer means that we must be able to identify farmers' problems, which are obviously their priority. They must have a reasonable chance of intervention because we are working in adaptive research and not on basic research.

Many of the problems the farmers actually face or put forward are not researchable. They are problems that can be solved by interventions in other areas. In fact, if you talk to many farmers, direct agricultural intervention does not rank at the top of their priorities. They talk about the need for education, water, and roads. These should be taken into consideration when thinking about the priorities of our farmers. Obviously, given the priority in the hills, we have to be able to cope with these wide differences and, as a result of such considerations, we must be able to provide farmers with not just one but a portfolio of technologies that they themselves can pick up and adopt. Involvement of the farmer in all stages of research is critical. We also need to be able to provide the information and tools for both policy-makers and those providing support services. Involving farmers, not only in the identification of priorities but also in the research process, is essential for effectiveness. We need to know and understand what farmer strategies are being applied by them now and to use their knowledge.

How do we do this? We do it obviously by using some of the more traditional ways, through meetings and appraisal, but I would like to

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E. F. Tollervey

... without understanding the household it is not possible to determine how a particular farmer will respond.

...the education system has isolated most of the educated people from the environment.

...they focus on getting more income regardless of what happens to the environment.

E. F. Tollervey

emphasise just one or two approaches we are using here. One is the emphasis on farms rather than on the centre. Most of our research in Nepal is in research centres, but at Lumle and Pakhribas we use the farmers and the farmers' fields for over 60 per cent of our work. We use both the typical and traditional agro-ecological means to identify common goals. The socio-economic aspects that we have used have in fact been determined by the farmers themselves. We have carried out a modified form of wealth ranking by asking farmers to identify differences in their own situations. The baseline of all their categorisation is to see how much food is going into the household. So we actually are now working on four categories of farmer based on household food supply.

This leads us to focus on households, rather than farmers, because we have found that you need to take the household completely into consideration. Without understanding the household, it is not possible to determine how a particular farmer will respond. Women members of the household will be affected and respond and criticise any particular technology. The age-wise perspective is important in extended families, as the elders are also involved in the decision-making process in the household. We are taught a lot about using indigenous knowledge in a form that we can relate to in scientific terms. Much of the indigenous knowledge that we know is farmers' knowledge which is usually captured in an anthropological manner. This seems to be very descriptive and not so quantitative.

We are experimenting with using computerised systems that actually break down statements by farmers into a system of their own. Finding that this is much too flexible and descriptive, we have tried to refine it further. I would just say that we use a systems' approach, but I would also like to point out that we prefer to call it interdisciplinary rather than multidisciplinary. Pakhribas, being a multidisciplinary institution for a long time, is organised along a disciplinary line. We have found that, in fact, this has not always led to an interdisciplinary approach to answering the problems of the farmers. It has also tended to identify priorities based on a discipline rather than on a priority basis. And this is one of the major reasons that has led to the type of change in the institutional structure which Dr. Harding described earlier (Chapter VI).

Farmers' Needs and Horticultural Research and Development in Himachal Pradesh

D.P. Sharma

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In the temperate region of Himachal Pradesh, apples and some flowers, along with other conventional agricultural crops, are grown. By tradition, the people from the hills are nature lovers. They are peaceful. But, with the advancement of industries and development during the colonial era the education system has isolated most of the educated people from the

environment. With industrialisation, development, and population growth, people started looking for prosperity in the plains, and this put pressure on the natural resources in mountain regions. What I am trying to say is that the self-sustainable living style of the mountain people was actually disturbed by the pressure from the plains rather than by the mountain people themselves.

The role of the National Agricultural Research Services was to increase productivity. By increased productivity, I mean increasing incomes. They focussed on getting more income regardless of what happened to the environment. Most of the time they recommended large fertilizer dosages and promoted varieties that later needed very high inputs in terms of pesticides, both of these interventions spoiled the environment. Apple-growing specialists recommended the cultivation of apples and nothing else. But, in the mixed farming system that is seen in the Hindu Kush-Himalayan region, where landholdings are very small, we need an integrated approach. Horticultural scientists describe only horticulture. They don't give the complete picture to growers who have cattle and other farming systems. Similarly, around the farms are forest areas also. Due to exploitation, forests are being lost, along with many medicinal and other plants, but scientists and extension people do not refer to any of these problems.

If our aim is to make the mountain farming household more sustainable, two things need to be done. The first is that somehow we need to curtail the use of natural resources by the people

who do not belong to the mountains. I think this would control some of the environmental degradation. The second is to increase the standard of living by suggesting better crop combinations and identifying ways to improve productivity. The climate is very uncertain during the monsoons. There is no systematic study of the climate in the mountains. For every 100ft, there is a change in climate, but so far no predictability factor has been developed. So the apple growers sometimes pray to God that the weather will be good during the coming season. Surely this can be more scientifically managed? If it can be managed as in the west, through the use of satellite and other technologies, there may be ways to help the farmers.

Similarly, information on soils, soil survey maps, and soil fertility maps is not accessible to farmers, at least in Himachal Pradesh. They do not know the chemistry of the soil on which they are growing crops. Earlier scientists recommended monocultural practices, but now apple growers are facing lots of problems. Sometimes there were no crops at all for two to four years.

Small farmers cannot market their produce when they grow perishable products such as flowers and vegetables. We are trying to organise all the aspects of production and marketing through farmers' associations. We are also trying tissue culture. We have preserved at least four to five species that are becoming extinct in the Himalayan region. Through tissue culture, we are trying to mass propagate these and give

them to the farmers as new crops. The Government has not been helping us in any of these aspects.

Pest control is important, no doubt, but , instead of chemical sprays, we need to develop biological control measures.

The next important issue is plant genetic resources. Specialisation has created a situation in which many indigenous crops, e.g., *Setaria*, *Buckwheat*, *Amaranth* and *Chenopodium*, which used to grow in mountain areas, have been lost. Very few farmers even know about these now. So the genetic base is becoming very narrow. It is up to

research scientists to do something about this and preserve these crops for future generations.

Many people still blame farmers for environmental problems in agriculture. This, however, shows little understanding of the problems that farmers face and the types of products that research organisations and development programmes are providing to farmers. If this can change, the farmers will also change. After all, no other group is as critically dependent on the conditions of the environment for their survival as the farmers of the mountain areas.



Amaranth, a traditional crop of marginal farm lands in parts of the HKH region
T. Partap

Perspectives of Educational Institutions on the Challenges of Sustainable Development of Mountain Agriculture

IX

Appropriateness of the Existing Academic Training and Human Resources' Development

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Everywhere in the developing world, we hear criticism of educational systems — that universities have failed to produce graduates who fulfill the needs and requirements of development. This could be a genuine criticism to some extent, but it could also be a gross exaggeration. Most of the criticisms suggest that the curriculum is outdated as teaching is just involved in passing materials from the notesheets of the Professor to those of the student without much qualitative change in the latter.

It is useful to start out by identifying some of the needs of modern society that we expect to fulfill through our agricultural graduates. The first development responsibility is to serve the needs of our farmers who are also the centre of our development activities. In most of the universities, we have been emphasising crop prod-

uction, increasing crop productivity through improved soil fertility, livestock production, better yields, and so on. But what we have forgotten is the farmer. In most of the universities, including the university I belong to, this fact has been overlooked. We have been unable to tell our students about the needs of the farmers, their values, customs, and how we should adapt modern technology to his* requirements. Whenever we look at the Green Revolution or any other development projects, the participation of the farmer has been minimal. As somebody once said, there is no transfer of knowledge from the professor to the student if it does not go through the brain of either of them. Exchange of notes alone makes little difference. Unless there is participation of students in the curriculum development process and in our classrooms, we cannot create a sense of participation. Similarly, with the farmers, they should participate in all development projects that are going to affect them and our teaching should focus on ways to promote this to make it more relevant. The Harvard model of teaching tries to do just this - where the professor is not supposed to teach only, but also to participate in discussions with the students.

... what we have forgotten is the farmer...we have been unable to tell our students about the needs of the farmers, their values, customs, and how we should adapt modern technology to their requirements.

M. A. Khan

* For his, read also hers (ed)

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... The relevance of agricultural education will depend upon how successful the graduates are in the field.

...unless our graduates are able to communicate with the farmers on their level and in their language, there is little value in their knowledge to the farmer.

M. A. Khan

The next aspect is planning and decision - making. What exactly are we trying to diffuse among the farmers? Are these social innovations or innovations created to improve technology or both? Is the objective of education to change behaviour or improve skills? Is it to improve technology or engage actively in a process of social innovations? In my opinion, the main objective of education is to bring about a change in behaviour. If there is a change in the behaviour of the students, then we can expect them to bring about changes in the behaviour of the farmers. And that change in behaviour will lead to adoption of improved technologies. Our need for human resources for future development should be looked at very carefully.

The next issue is local models for education and extension. So far we have been importing different models from abroad. The Training and Visit (T&V) System and many other models have been a failure in most countries. What we need to do is develop models based on our experiences and learn from each other. Our systems have therefore a major role to play in providing answers to our development needs. The relevance of agricultural education will depend upon how successful the graduates are in the field. Obviously agricultural graduates in any field — livestock, crop production, soil science, and so on — must be technically competent. They must be able to raise crops. They must know what type of livestock production exists and the type of practices that are being followed, including ways to improve local production practices.

Our curricula should provide the technical inputs needed to make the individual competent in handling practical matters. The theoretical aspects must be properly balanced with the practical aspects. There is also the issue of economic analysis and soundness. Graduates in agriculture must be able to demonstrate to farmers that certain technologies or innovations are economically viable. Such demonstrations can focus on either the maximisation of profits or the minimisation of costs. The third area we have to look at very carefully is scientific competency. Graduates in agriculture are required to demonstrate to farmers through scientific experiments. They must have some basic background in science to carry out small experiments on the farmer's fields. The fourth area is farming competency. As far as farming competency is concerned, graduates must be able to grow crops in the ways in which farmers are growing them. They must be able to raise livestock. This is the area in which most of our graduates are deficient, as they have practically no experience in working with farmers, nor adequate practical training.

The last area of competency is communications. Unless our graduates are able to communicate with the farmers on their level and in their other language, there is little value in their knowledge to the farmer.

To properly communicate with farmers, it is essential to understand their value systems, their social systems, speak the same language, and practically demonstrate new agricultural techno-

logies in ways farmers can understand and use in their environment. Without these there is no effective communication with farmers. This is the main problem at present with our agricultural graduates. This is one reason why agricultural graduates are hesitant to go and work with farmers in rural areas. We therefore have to look back critically and see how these issues in development are integrated into our agricultural curricula. In my university we have introduced internships in which students are expected to spend a good part of their time in the field with the farmers. We are working with a three-year degree programme and one full year of internship. Students can work either individually or in groups and learn about the different problems of agriculture in the field with the farmers.

Agricultural Education and Research in the Northeast Indian Himalayas

*M.P. Singh, Vice-Chancellor,
Central Agricultural University,
Imphal, India*

In 1993 the Central Agricultural University for the States of the Northeastern Indian Himalayas was established. The principal objective behind the establishment of agricultural universities in India, such as Punjab Agricultural University, was to address the problems of agriculture, and, more specifically, food shortages faced by India during the 60s. It was for this reason also that many of the agricultural universities were established in the potential agricultural belts in Punjab, Haryana, Western U.P., and the southern part of India. Later

on, when food problems became less serious, agricultural universities were established in other areas to look at other issues as well. In Himachal Pradesh, the University of Horticulture and Forestry was established. In the northeast, there are seven campuses of the Central Agricultural University spread throughout six hilly states. Our approach has been to develop curricula that are most appropriate to a particular area. Each agricultural university is free to prescribe its own courses. It has complete autonomy, and there are differences in curriculum between the universities. For example, in the northeast, the curriculum includes studying about tea and coffee. In the northeast, the demand for milk is not as great as that for animal meat. In our animal husbandry courses, we are trying to incorporate these aspects to make our teaching more appropriate to local conditions.

One problem in trying to be strongly location-specific (in teaching) is that the graduates do not always stay in these areas. When they move and find out that their knowledge and skills are not relevant to problems in other areas, they have great difficulty in fitting into the needs of other areas. In the Indian Union, one can move from one State to another. Under the NARS, i.e., the Indian Council of Agricultural Research (ICAR), people can be transferred from Jammu Kashmir to Kerala or from the northeast to the western part of the country, e.g., the Maharashtra and Gujarat regions. Because of this, some uniformity and standards have to be maintained. This is the reason behind the establishment of the Deans' Committee to review the courses every ten years; it

One problem in trying to be strongly location-specific (in teaching) is that the graduates do not always stay in these areas.

M. P. Singh

is to incorporate the latest developments and maintain some uniformity in standards, while retaining the freedom to make certain changes at local level. There should be some flexibility. In order to enhance the practical side of the courses, every student, depending upon the college, is given one hectare of land for group cultivation. The entire cost has to be borne by the students and the profit is also theirs. They cannot employ hired labour. The entire farm operation has to be carried out by the student or the group.

Unlike previous programmes, at present we have a four-year degree programme in all professional courses such as agriculture, veterinary science, home science, agricultural engineering, and others. We are trying to maintain some degree of uniformity, taking into consideration the overall requirements in India, but, at the same time, a major focus is also on simultaneously meeting local demands, needs, and requirements. For hill and mountain areas we may require more specific courses. We need to think of this within the overall framework, because the overall acceptability for other areas cannot be overlooked.

Educational Institutions' Experience in the Western Himalayas

*K. P. Nautiyal
Vice-Chancellor
Garhwal University
India*

At present, given the rural setting of Garhwal University, subjects such as

horticulture and forestry are being taught along with other subjects. These two subjects were selected because of their relevance to the sustainable development of mountains areas. The students have the option to choose these subjects, and they can also select them for post-graduate studies. Apart from this, there is also an autonomous research centre focussing on high altitude plant physiology, and this has been providing a very good service to the people.

The university is also involved in providing different types of training through small centres in different areas, including centres addressing some of the problems of mountain women.

The aim was to open these courses to attract the youth of these areas, so that they could go back to their villages and work with the people there. However, the impact so far has been fragmented on account of different constraints.

Insufficient manpower, limited linkages with adjacent agricultural universities, lack of funds for exchange of students and staff with other agencies, limited infrastructural facilities, no extension budget, and so on are some of the important constraints which seriously dilute the efforts being made by the university to address mountain development problems. Keeping in mind the requirements of the mountains and their development, all students are exposed to some of the special courses, e.g., modern methods of agroforestry and horticulture, importance of traditional crops, the need to develop high-value, low-volume products, the possibility of

... an important area for support is exchange of faculty and exchange of information about mountain development.

K. P. Nautiyal

domesticating wild fruits, and the development of appropriate processing are some of the important subjects being taught which are relevant to mountain areas.

To develop human resources in all the above aspects, the university needs high-level inputs. While governments are convinced and committed, international agencies, such as ICIMOD, can also play a very important role in helping to achieve the goal of developing suitable human resources for sustainable mountain agriculture. An important area for support is the exchange of faculty and information about mountain agriculture and related subjects. ICIMOD should also extend its support to sharing experiences from the regional countries on agricultural courses for mountain areas. Close partnerships among the regional countries, facilitated by ICIMOD, will be a welcome step in promoting sustainable agricultural development in mountain areas.

Mountain Agriculture and Education, New Challenges Ahead

*R.P.S. Tyagi, Vice-Chancellor
Himachal Agricultural University
Palampur, Himachal Pradesh
India*

I think the education system in this part of the world is very important for sustainable development. We are at a junction at which the challenges are many. The most important challenge is the emerging economic scenario on the national and global level. We are very conscious of it. The existing

educational systems in India or Pakistan or Bangladesh, or other countries in the region, have more or less the same pattern. Today, the expansion has been so fast that the quality of the programme has deteriorated.

The curriculum has been divided into too many separate units. While there is a core element which is common, consisting of the basic and applied aspects, the need is for diversification. Although the students entering agricultural universities today are much more informed than in earlier times, the demands today are also much greater. There is a great need to improve the quality of educational programmes. In India today, there are 31 agricultural universities and the intake is about 22,000 undergraduate students every year. The faculty number about 15,000. If we include the ICAR Institutes, the number of scientists increases to about 22,000. This is a vast resource and should be used effectively for the development of our agricultural sector.

Our information system is very weak. Neighbouring institutes do not know what others are doing.

While we borrowed the American land grants' model for our agricultural universities during the 1960s, we have not succeeded in creating the culture and environment to make this model functional in India. Very recently, the Indian Council of Agricultural Research established a Deputy Director General of Education who is responsible for coordinating all the agricultural universities. There is also an accreditation board that will

...today the expansion has been so fast that the quality of the programme has deteriorated.

R. P. S. Tyagi

function as a regulatory body. It will be visiting universities, examining their infrastructural facilities and staff, and making decisions regarding whether or not the college can be recognised for the purpose of undertaking degree programmes. There are no doubt many problems. But new responses are also being made. Collaboration between all the parties concerned is very essential for the future of our agricultural educational programmes and institutes.

University of Agriculture and Technology, Pantnagar, and Its Experiences in the UP Hills

S. C. Mogdal
Vice Chancellor,
University of Agriculture and
Technology, Pantnagar, UP, India

In terms of natural resources, the major problem faced by hill farmers is the degradation of forests. Clearly, this cannot be stopped unless we find alternative sources of energy.

... there is no system of working together on a regular basis

S. C. Mogdal

Pantnagar university has the responsibility for the entire hill area of Uttar Pradesh. A very strong hill research and extension centre has been established at 6-7,000 ft. In this centre three dozen PhD scholars live, work, and undertake different experiments. At the university, an adequate infrastructure for research, teaching, and extension has been created.

There is a fully-fledged College of Forestry and Hill Agriculture with a very strong extension wing. A series of diagnostic surveys was carried out and, on the basis of these surveys, we identified some of the important problems of the hill areas. One of the major tasks for our scientists is that of managing the resources in the hills. Understandably the hills have a lot of problems, but they also have very

valuable natural and human resources.

In terms of natural resources, the major problem faced by hill farmers is the degradation of forests. Clearly, this cannot be stopped unless we find alternative sources of energy. Scientists are working on these alternative sources of energy. Fortunately, the hills have many alternative sources of energy in the form of sun, wind, and water. We have ongoing research projects in all these areas. Through experiment, we have identified multi-purpose trees suitable for plantation on farmers' fields and in nearby villages. These trees will give them fuel, fruit, and will also improve the hill environment. We have also many innovations in water harvesting, particularly for rain water. We also provide training in farming systems.

Regarding gender, it is well established that mountain women are the farmers mainly responsible for mountain agriculture. Most of the able-bodied men have migrated to the plains and left behind their women or the elderly. These women are busy with domestic chores, rearing children, doing other work in the home, and being responsible for agriculture or horticulture as the case may be. They have to go about seven to eight kilometres to fetch drinking water and a similar distance to gather fuelwood, fodder, and foliage. These are the problems of hill women. Most of the extension workers are males. These are critical problems for our agricultural education, research, and extension systems.

We have a network of various research stations and extension units in the 12

hill districts where we work. Through these, we are organising training for farm women on the campus and, because it is difficult for them to move from their farms to the training centre, we are also organising on-farm or in-village training for women.

Regarding sustainable farming systems, one important aspect is that these farming systems not only have to be sustainable but also market oriented. It seems to me that these two aspects are almost irreconcilable. It is a big challenge to find systems that are environmentally safe, eco-friendly, and market oriented. The right combination could make them sustainable.

What we need to do is to find eco-friendly farming and cropping systems and then find the marketing channels for the outputs from these systems. But this is not easy. I am not against farmers becoming prosperous. They should also have the right to earn a decent income. But, in the process, they should not damage the environment. As most farmers do not monitor their environment, somebody else might have to do it for them so that timely corrective measures can be introduced.

Mountain farmers generally have very small pieces of land, and they produce food for only three to four months in the entire year. For the rest of the period, they have to depend upon money coming from the plains. Therefore, providing 12 months' food security to the hill farmers is a high priority in hill development programmes. This could be done by providing alternative sources of earnings to hill farmers through

activities such as horticulture, small-scale industries, mushroom production and packaging, sericulture, rabbit raising, milk production, apiculture, off-season vegetables, vegetable seed production, and so on. The list is fairly long and many of these can help improve the economy of the farmers. One of the major problems here is communication. In spite of rapid changes everywhere, hill farmers have not harvested the fruits of this development. All the agricultural universities in India have been connected, as indicated earlier, through Internet. We need to ensure that the hills are connected through Internet and other information systems so that they can take advantage of changing demand conditions in different places.

NGOs can also play a great role in taking the farm produce from the hills to the markets. In China, Korea, and other newly developing countries, farmers are reported to be receiving about 60 to 70 per cent of the final value of the produce. Here farmers hardly receive 10 to 20 per cent. We must protect the farmers from exploitation by creating systems that are farmer owned and managed.

Research and technology linkages have been well developed in India with the help of ICAR and state government structures. With these agencies, the dialogue is increasing. There is representation on the research and extension advisory committees. Farmers are also being represented on the research advisory committees. These are very important changes that will help to promote the sustainable development of hill agriculture. While

... traditionally a village family is not happy if it cannot grow rice for its own consumption. If they have to buy rice, they are considered to have low status in the society.

S. M. Farouk

there are many problems, activities on numerous fronts are also being organised.

Technical Research in Universities and Linkages with NARS

S. M. Farouk
Vice Chancellor, Bangladesh
Agricultural University,
Mymensingh, Bangladesh

In Bangladesh, we have one agricultural university which is a multi-disciplinary, multi-faculty university established in the early 60s, more or less on the pattern of land grant colleges in the United States. We are providing education, research, and a little bit of extension. Research is mostly at the Master's and PhD levels.

Master's degree students have to write a thesis as part of the curriculum and PhD's are based completely on research. There are no courses at the PhD level. This research is mostly demand driven. The Bangladesh Agricultural Research Council is the apex and coordinating body determining the national research priorities in the agricultural sector. We have been conducting research for the last 20 years, and some of the research findings are now beginning to reach the farmer. We have been able to release some crop and vegetable varieties along with simple technologies in fishery development, agricultural engineering, irrigation systems, vaccine production, livestock management, and a few others.

One of the main weaknesses is poor linkages within the educational system.

The National Agricultural Research System is comprised of about 10 institutions which are fairly autonomous. The Agricultural Research Council does not have any administrative or financial control over these organisations. It just coordinates and awards research grants and research contracts from the funds it receives from the Government, international donors, and other agencies. While the agricultural university is formally represented on the Research Council along with some of the major agricultural research institutions, this linkage is formal. The scientists from various institutions also get together and formulate research projects at times, but this cooperation is more or less voluntary. There is no system of working together on a regular basis. This problem is being addressed now, as comprehensive NARS legislation has been drafted which will hopefully integrate the NARS components and bring together the scientists and resources. We hope this will overcome the current difficulties experienced in formulating research programmes and implementing these on the ground.

Out of 10 or so research institutes, only the Bangladesh Research Institute is multi-crop, multi-commodity, and multidisciplinary oriented. Most of the others are mono-disciplinary or mono-commodity oriented, e.g., the tea research institute, forest research institute, rice research institute, jute research institute, and so on. These are all under different ministries. For example, the Forest Research Institute is with the Ministry of Forest and Environment, the Rice Research Institute is with the Ministry of Agriculture, the Fishery Research

Institute is with the Ministry of Livestock and Fisheries, and so on. The coordination problems are huge. Hopefully, the proposed legislation will bring about more integration and greater cooperation among the agencies.

We have not so far given much focus to hill agriculture. The Bangladesh Agricultural Research Institute and the Forest Research Institutes have some work in the Chittagong Hill Tracts. From the early 90s, we have been trying to address some of the problems in hilly areas — such as gender, diversification of crops, and farming systems' development. Hopefully, in collaboration with ICIMOD, the hill areas and their farmers will also begin to receive greater attention in the future.

The gender issue is becoming very important, as we have found that, during the last 20 years, more women are coming into farming. Although the statistics do not reflect this, we can see it while visiting the villages. As already indicated by other speakers, the small farming families are being split up and the males are going out to cities and even abroad for employment. Thus women are left behind and are engaged in farming, small-scale poultry raising, goat raising, and vegetable gardening. In the hill areas the scenario is a little bit different. As the tribal people in the hill areas are traditionally matriarchal families, women take the leadership in all family affairs. Integrating gender issues with all our research projects has been a policy decision of the agricultural university, and this will ensure greater attention to this issue in the future.

With the traditional focus on rice and jute, there is a need to diversify agricultural production. Depletion of soil nutrients and other problems have also made it necessary to motivate the farmers to diversify their cropping systems by growing off-season vegetables, oil seeds, and other crops. Traditionally, a village family is not happy if it cannot grow rice for its own consumption. If they have to buy rice, they are considered to have a low status in society. So farmers grow rice, even if it is more economical to do something else. While this psychological barrier is gradually breaking down, our research should also provide appropriate crops and the teaching and extension services should motivate them to understand better the opportunities available in the context of their overall priorities.

Another problem is that we are losing our qualified manpower. Many well-trained people are being lured away to Australia or New Zealand, and this is a big problem in Bangladesh at present.

Capacities of Universities in Extension Education and Extension

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India*

In the case of Himachal, there was some concern about the university taking over the department's extension role because of manpower and other resources' constraints. However, after extensive discussions, a clear line of demarcation between the university and State department has been

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S. M. Farouk

... once a technology is considered suitable by extension and research wings of the university, then it is demonstrated on the farmers' fields with the participation of the farmers.

L.R. Verma

established. It has been now accepted that the university extension education programme will be at the front line, and this is also the first line extension programme.

A very close relationship exists between the department and the university. Specific functions have been identified, such as farm advisory, communication, and training services. Under the Farm Advisory Service there are programmes such as technology verification at the farmer's level, technology refinement at the farmer's level, technology extension at the farmer's level, and demonstration and correspondence course programmes, including a farmers' club and the use of a watershed approach.

Under the training programme, there are two short training courses for extension personnel from the State Department. The State Department has accepted that technology generation should be within the university, and that university personnel are also the best to impart the training needed to upgrade the professional capabilities of the extension personnel of the State Department, voluntary organisations, and semi-government organisations, including the co-operative sector. Even the fertilizer industry people are receiving training from the university. Unemployed graduates for self-employment have very similar programmes in various sectors. Similarly, many universities have special correspondence courses under different educational programmes and here the farming advisory services and correspondence courses are complementing each other reasonably well. While the

theoretical aspects are taken care of by the correspondence courses, the practical aspects are covered by programmes under the district units of the *Krishi Bigyan Kendra(s)* (Agricultural Science Centres).

For communication purposes, there is also a video production programme. With the permission of the All India Radio and the National Radio Network, we have started to produce regular farming programmes. We also have a very big publications' unit for publishing in local languages. For each of the agroclimatic zones, we recommend special packages reflecting the specific recommendations suiting the particular agroclimatic conditions.

A farmer's magazine is published in various languages, depending upon the area covered. ICAR is also publishing in English and local languages. Once a technology is considered suitable by the extension and research wings of the university, then it is demonstrated on the farmers' fields with the full participation of the farmers and local extension personnel. Thereafter, they take the technology to the farm, and this is done through various mechanisms. The same approach is used for feedback, identification of new problems, and for communication to the Directorate of Research for initiating new research programmes. There is very close coordination between the research and extension within the university and between research and the State Department and the agricultural extension education programme. The interlinkages are very strong and provide a reasonable direction for the university research programme.

Expectations from Universities and Other Issues

*M. Bashir, Director General,
Department of Livestock,
Govt. of Balochistan, Quetta,
Pakistan*

I believe the expectations from the universities are very high and the responsibilities these universities and institutions are sharing are on a higher scale still.

The point is whether the universities or the educational institutions are up to the expectations and whether they are adequately client-oriented or not, particularly in terms of addressing the needs of the farmers.

It was rightly pointed out that probably the products of our universities being sent out to market are not of adequate quality, and the farmers are not satisfied, not to talk about other organisations. This is a very poor state of affairs! The exceptions are always there, but the overall situation is that the products from the universities are not up to the mark, or of good standard, and therefore we should look into this problem very seriously. If you take the case of sustainable mountain agriculture, the courses that are taught in our institutions have been mainly brought from the plains; the courses have been borrowed from those developed for the agriculture in the plains. With the passage of time we are making changes, but there is a need to look into the matter seriously. We should come out with a very unique syllabus for institutions located in the Hindu Kush-Himalayan Region. The courses need to be designed ac-

ording to the needs of the environment, the aspirations of the farmers, and the potentials of the market place.

The next point is institutional stability. This is important because institutions take time to develop and without stability we cannot expect good results from these institutions. We need to decrease interference from outside, whether it is political interference or other types. Adequate facilities and infrastructure should be provided so that the institutions with the mandate for research can do a good job. The research is divided between the research institutions and agricultural universities. There is also some duplication with the same problems being examined by different research institutions. This duplication should be removed. Research should be the responsibility of the universities. I think a good example is the University in the Indian Himalayas, Himachal Pradesh Horticulture and Forestry University, which has produced marvellous results. It has incorporated education, research, and extension. Fellow scientists should first emphasise good research work. They should also help to build up confidence amongst the farmers who are the main clients. The outreach programmes of the universities are very weak at present. The programme should work in two ways, so that we not only go out to the farm but also invite the farmers to come to our institutions. This dialogue has always yielded very good results. Twice or thrice, when we called meetings of the farmers and had direct communications with them, it yielded very good results.

Another very important point is gender participation. In most mountain areas,

We should come out with a very unique syllabus for institutions located in the Hindu Kush-Himalayan region. The course needs to be designed according to the needs of the environment, the aspirations of the farmers, and the potentials of the market place.

M. Bashir

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M. Bashir

100 per cent of all agricultural activities are undertaken by women because the men are out in search of jobs. In the past we have ignored this group. We have been able to admit some female students in our college. Even with low ratios we are seeing some very good results amongst the rural community. As a source of dissemination of knowledge amongst women, there are different barriers for male contacts and consequently women extension workers and professionals should be encouraged.

Lastly, I would like to discuss the problem of monoculture. Farmers have abandoned the cultivation of apples, because of many problems, viz., insects, low yields, costs, and so on. Natural resources, such as soil,

are also deteriorating. I am a scientist, and I have been working for the last 15 years in those areas in different capacities. I have worked with various organisations. What I see is that natural assets are being degraded and very little attention is being given to this aspect. The sooner we look into these problems, the better. Erosion is going on all the time, but it is not visible. We have to save the natural assets as soon as possible. I feel it is the responsibility of the universities and agricultural research institutions. The challenges are enormous, particularly in the mountains which are still very neglected. I hope fellow scientists will pay greater attention to the mountains in the future. Where there is a will, there will be a way.

Recommendations

X

Strategies for Transformation of Educational Systems for Sustainable Mountain Agriculture

Academic Courses

- The first issue was agricultural education systems and the curriculum. The degree programme being offered in all the universities in the region was found deficient with regard to mountain agricultural development. This was true for core as well as applied courses. The practical component in agricultural education systems was also found to be relatively weak. The main reason for poor quality and lack of practical focus was probably that labour is not thought to be a very dignified undertaking in this part of the world. Students and professors do not like to go to the field and engage in practical work with their own hands.

It was the general consensus that, in most of the universities, educational standards and quality of education were declining. This was mainly because of the lack of external reviews and evaluations. Many of the changes in the courses and the performance were mainly the result of internal reviews and decisions.

- It was felt that, at the B.Sc. level, there should not be much specialisation in agriculture, and courses in entomology, plant pathology, horticulture and a number of other agricultural subjects should be included. The consensus was that a person with a BSc. degree cannot be seen to be a specialised professional. It is here that some courses in mountain agricultural development could be added, in order to overcome the gaps and weaknesses in practical training which are common throughout most of the agricultural institutions.
- It was recommended that an internship programme be introduced at least for one year, because, with one year, you can cover all the seasons as well as different livestock operations. This internship could be on the farmers' fields, if some farmers are willing to support this programme, or it could be at the research stations. By making it mandatory, the students will have to finance it themselves.
- Another recommendation was to have periodic external reviews of the curriculum. If programmes are regularly poor, it may be necessary to cancel some of the courses. In order to generate a better

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Participants

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...Courses to farmers and entrepreneurs. ... help them enter into agri-business by providing technical knowhow.

Participants

appreciation of the social and cultural values and customs of particular societies in mountain areas, students should also be made to take courses in other departments of the university, e.g., anthropology and sociology. Inputs from the farmers in the courses and practical work were also considered very useful, and these should be provided by seeking their help. Regular meetings with farmers will assist the universities to be more responsive to their priorities and concerns.

Vocational Training

It was generally agreed that the curricula should be divided into degree and vocational programmes. Some of the universities were already offering some vocational programmes at different levels. One was the Diploma Course after 10 years of High School: one year diplomas or two year diplomas for middle-line technicians from government departments. In some cases, vocational training was being offered to farmers. It was agreed that as formal diploma courses created problems of compatibility with formal academic courses, non-diploma training courses should be recommended for mountain agricultural development. Such courses should be open to farmers and entrepreneurs. These should help them to enter into agribusinesses by providing them with the technical knowhow needed to start a business or make certain improvements in their businesses or help them to learn new post-harvest processing techniques, etc. More specialised vocational courses on income-generating activities as well as

improving technical knowhow were seen as being very important for mountain areas. Special focus can also be given to the problems of mountain women. Innovative approaches for the dissemination of knowledge that already exists in the universities was also needed. The recommendation was to use the mass media such as the radio programmes. Where television is available this can be used.

Human Resources' Development

Faculty improvement in terms of technical skills and overall quality was considered very essential. In-breeding in the universities had increased. Universities were very often hiring their own graduates, and this might be a reason for the lack of new inputs and ideas in most of the courses in the universities.

Another problem was that there were too many local students that had to be accepted by compromising every aspect of academic standards.

Summer Schools and Fellowships

It was recommended to interchange faculty staff among regional universities and research institutions. There might also be possibilities of exchange between some universities and international agencies like ICIMOD. Universities should adopt the practice of faculty sabbatical leave where, after six to seven years of work, a faculty member is eligible to go on leave for one year with full salary. The member can spend this period at some agricultural research system or in another university where she/he can

be involved in teaching or research or both.

It was recommended that ICIMOD should serve as a focal point for short-term training and summer school. In summer most of the students are gone and the faculty is less involved in teaching, so they have more time for short-term training. This type of training might not be sufficient to increase their productivity or technical knowledge but could serve the purpose of regional exchange from which one could learn a lot about others and their work.

ICIMOD can play a major role in this particular case. It was also recommended that student fellowships be provided for both exchange of students within national university systems and also outside to various international agencies and universities.

Information Exchange

The need to establish mechanisms for exchange of information among regional educational research institutions was strongly emphasised. Information about new technologies and innovations can be facilitated through better communication links.

The creation of a technical database for mountain agriculture was important and ICIMOD could be a focal point for this.

Committee of Vice Chancellors

It was also considered useful to create a committee of Vice Chancellors representing one university from each HKH Region, and such a committee could meet periodically and discuss

the needs of the universities and the region and identify ways in which the universities could play a more effective role in development of sustainable mountain agriculture.

University and Agricultural Extension

Regarding the role of the university in extension and agricultural extension education, it was agreed that some universities in the region, especially those in northern India, had been playing a very effective role in extension and advisory services. But, in general, most of the universities in the region were operating in isolation without links with the farmers. They also lacked a proper emphasis on extension education. In most universities, the subject of extension education had not even been defined properly. The recommendation was that extension education should become an integral part of teaching and research. Teaching cannot be effective unless we know the problems of the farmers and can provide reasonable solutions to these problems. Agricultural universities should have strong links with the farming community, and these can be established through effective extension services.

It was also suggested that advisory committees at district level should be established within the jurisdiction of the university. Highly-qualified professors should serve as members of the advisory committee. We should try to incorporate more income-generating activities by introducing medicinal plants, floriculture, herbal medicines, etc. The faculty should also be involved directly in extension pro-

....extension education should become an integral part of teaching and research.

...The private sector should be tapped.

Participants

grammes. There might be some constraints, but, in most of the universities, the faculty is already spending ten to fifteen per cent of the time in extension activities. We should accelerate a two-way communication network between the university and the farming community. Unless the university or the faculty is aware of what the farmer is doing, effective communication links cannot be established. The farmers can come to the district extension office and discuss their problems, priorities, and concerns with the faculty who can then take them back to the university and try to find solutions. The technologies being generated at the university could be first tested in these centres before the farmers and then modified as the need may be. Two-way communication links between the university and the farming community are critical for an effective agricultural research education and extension programme.

Natural Resources' Management

The next issue was natural resources' management. It was observed that, in the HKH Region there was a general deterioration of natural resources. The recommendation was that the ecological situation affecting agriculture should be understood and efforts should be made in all the ecological regions to harness the indigenous knowledge and practices of mountain people for the management of natural resources.

Funding

Lack of adequate funds is a general problem for all agencies today.

Without a reasonable amount of funding, research, training, and extension simply cannot be undertaken. There is too much government control and regulation over funds at present, as most of the research funds come from the Government. Government rules and regulations are very rigid. There should be some flexibility as far as the universities are concerned. Lack of innovative research has been another problem area, and universities have to become more and more self-financing through innovative programmes.

The private sector should also be tapped. It was recommended that at least 10 to 15 per cent of the State Agricultural Budget should go to support agricultural research, whether it is based in the departments or in the universities.

Many new entrepreneurs in the agricultural sector would most probably be willing to finance university research if they derived some benefits from the research work to be carried out. Many students are also willing to pay higher tuition costs if they can receive good education. This is being demonstrated in many institutions in the region.

Interdisciplinary approaches were emphasised. An important aspect of inter-regional cooperation was to overcome the communication gap between different universities and research institutes even within countries. In the past there was no appropriate forum. ICIMOD can play a more active role here.

Association of HKH Universities

An association of the universities in the HKH Region was recommended. It was suggested that the universities could contribute a small amount for this type of regional cooperation. ICIMOD could serve as a focal point for annual/regional conferences to share new discoveries and ideas. ICIMOD, being an international centre, could play an effective role in this type of annual conference. ICIMOD should serve as a communications' link between regional universities and government line departments. As already mentioned, there was a lack of cooperation and coordination between the universities. ICIMOD could again play a very effective role in bringing together universities, line departments, and others involved in mountain development.

The communications' gap between the universities and the farming community is a very important issue. Lack of effective communication between the universities and the farmers or the private entrepreneurs is very apparent. Universities are working in isolation in most cases. They do not feel that they are obliged to the farming community. The time has come to start acting in such a way that the farmers and tax payers benefit from the work. Otherwise, there will be no basis for continuing support.

The universities should not only produce graduates for employment, but they should also be in a position to produce future businessmen in the field of agriculture. Innovations are the solutions to the problems of

mountain agriculture. Our main target should be to identify new income-generating activities and to start new entrepreneurship. An educated person, instead of looking for a job, should be able to establish his own job from which he can make a decent living.

For many organisations, routine work is always of a higher priority than innovations. So there is likely to be lots of resistance from many sides. Unless we can make the needed changes by becoming more responsive and accountable, the future will remain very shaky.

Redefining Research Priorities for Sustainable Mountain Agriculture

Agro-ecozoning

There is a great need for agro-ecozone referencing in the HKH region. Unless we have an agro-ecozone reference, it will be a difficult task to define research priority. Socioeconomic studies or farming systems' studies or agricultural operations have to be based on the concept of agro-ecozones. Different countries have their own agro-ecozones for mountain areas. One classification system would be very useful for the HKH Region. There is a need for the creation of databases for each farming system in the different agro-ecozones and for the dissemination of such databases also. Some of the national agencies are doing this for their countries. They have the database and are also the clearing agencies for this type of information. Information on different farming systems in different countries

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Participants

In the very high and high hills ... the problem is water harvesting and efficient use of waater,...

...In the mid - hills... the number one problem for the region is soil erosion.

...Low hills...the major problem is again water. Unless there is irrigation, the dry slopes are not very productive.

Participants

can be coordinated by some agency and made available to other researchers in the region.

Very High Hills and High Hills

In the very high and high hills, there are both cold and arid regions as well as cold and humid regions. Both of these require different types of approach. In the cold and arid mountains, there are some common crops such as cabbages, cauliflowers, beans, and pumpkins. Among the livestock, yaks are the most popular. The problem here is low moisture availability. In these regions, if moisture is available then, because of the very high photosynthetic efficiency as a result of very high radiation, the performance of vegetable crops is excellent. So the main concern is that moisture availability should be assured. As the dominant system here is livestock, the carrying capacity of pastures is a major concern. While there are many research areas, the most important was considered to be water harvesting and efficient use of water, mainly snow.

The development of these water resources involves both harvesting as well as conserving it. If the systems are efficient, it is possible to increase the cultivated area two to three times. Regarding the humid and other high hills, the crop range is greater with spring wheat, barley, mustard, buckwheat, and potatoes. In summer, there are excellent mustard crops even at 14,000 masl in certain regions. Buckwheat is, of course, a common crop.

There is livestock diversity. Sheep, cattle, goats, mules, and *chauri* (a

type of yak) are found. The problems here are low fodder availability because of the low productivity of the crops and high pressure from livestock. Productivity is affected by the very unfavourable temperature regime. There has not been much work carried out on increasing the productivity of these crops under the temperature regimes found in these areas. This is one of the major concerns. The low productivity of crops and livestock in general is another major concern. It was felt that this region suffers the most on account of the lack of information and because of the inaccessibility of the area. The research strategy is to assess the optimum level of the carrying capacity of the pasture and devise management strategies based on this. There are very few studies on flora composition, or on ways to enrich the flora of alpine pastures. For the development of suitable crop varieties and their management, selection needs further strengthening. Environmental resources such as plant population regimes, planting time regimes, harvesting time, and so on have economic potentials but should be pursued only after careful study in these highly fragile ecosystems. Regarding the improvement of livestock, experiences in other countries of the region, as, for example, experiences with yaks in China, should be taken advantage of by the other countries. Mechanisms for the exchange of such information should be developed while also continuing systematic breeding work. Evaluation of flora and fauna, for their cultivation and use, botanical surveys, and expenditure need to be carried out.

Some countries, e.g., India have already done this. Others need to undertake similar activities.

Mid-Hills

In the mid-hills one finds mostly mixed farming systems consisting of crops, livestock, horticulture, and forestry. It is very difficult to say which one is dominant, because in one place one might find horticulture and livestock as dominant regimes (Western Himalayas) while in others (the Eastern Himalayas) crops and horticulture may be dominant. The major crops here are maize, rice, and millet with citrus and stone fruits. There are also other subtropical foods, vegetables, and cash crops. Tea and cardamoms are very common in this region. The predominant livestock are cattle, goats, and pigs. The number one problem for this region is soil erosion. As rainfall is high, the runoff is also high and carries with it a lot of soil. Because of the slopes, the soil erosion aspect is a serious problem.

Water management practices are poor and, because of this, in spite of the huge water potential, there is a lot of wastage. The focus has been on harvesting rainwater. With huge losses of water and soil, excessive amounts of soil nutrients are also lost, affecting soil productivity. Emphasis should be on soil and water conservation farming technologies. On the slopes, while there must be a contour system of planting in most of the hills, potatoes are planted across the contour lines. If proper soil conservation technologies are provided, the problems of soil erosion could be reduced.

It is important to emphasise that, if a complete package is not given to the farmers, they will not follow the soil conservation practices, and this will lead to further problems. There is also potential for the introduction of tree-based farming systems. Tree introduction is considered to be a major intervention for fodder and firewood. It is already seen in the systems in Nepal and Sikkim. Species that are productive have to be promoted. Certain types of trees could also help to enrich soil fertility. There are also appropriate water harvesting technologies for the efficient use of water. Small reservoir structures can be used for irrigation. Fodder and livestock management and the development of agro-processing are also important. However, unless one has a suitable marketing outlet and processing structure, horticultural or vegetable development will not be of much value, and, consequently, it is very important to have access to markets.

Low Hills

The low hills have crop-dominant farming systems, with mainly rice and maize. Wheat, mustard, other oil seeds, subtropical fruits, tropical fruits, vegetables, and livestock are also found. The major problem here is again water. Unless there is irrigation, the dry slopes are not very productive. Since cropping is intensive and biomass removal is very high, plant nutrients are constantly needed. Strategies for development should focus on management of water resources and their efficient use, improvement in crop and livestock productivity, promotion of extension education, and development of post-

...Principles for partnership should focus on... diversity of institutional stakeholders.

Participants

... general consensus was that there should be access and flow of information among mountain-based institutions with regards to education, research, and training.

Participants

harvest technologies. In addition to this, integrated use of nutrients and integrated pest management systems are very critical for this region.

The potentials for intercropping of legumes as a source of rizobium induced nitrogen addition is very high. All the biological nitrogen-fixing crops can be intercropped, e.g., maize with soya beans. This kind of intervention can enrich the soil and reduce the need for chemical fertilizers. Although shifting cultivation is the main farming system in the Eastern Himalayas, alternatives to it are being found. These have focussed on improvement of the existing shifting cultivation practices through introduction of improved varieties.

Information Exchange and Interaction

Regarding the mechanisms for interaction with ICIMOD, the general consensus was that there should be access and flow of information among mountain-based institutions with regards to education, research, and training. It was thought that ICIMOD might directly interact with the institutions in the mountain areas of the HKH Region to collect and disseminate information. With regard to exchange of technologies, materials, and personnel, this would have to be routed through accepted channels in each of the countries. A consortium of the resource persons in member institutions should cooperate with ICIMOD in monitoring activities and promoting mountain development priorities. The consortium approach can help ICIMOD to improve organisation and im-

plementation of programmes in the Region.

Consolidation and Coordination

The universities in the Region also need to consolidate their research, education, and extension activities within their own countries for the exchange of information. Within the countries, there is also a need for coordination so that someone working on something knows what is happening elsewhere in the country.

Livestock Research

In the case of livestock, breeding is important, but there are other factors also that influence the productivity of livestock, for example, husbandry practices, housing, and other management aspects. These should be considered in the research priorities to be undertaken to improve the productivity of the livestock. The diseases of livestock in the high and very high areas have not been mentioned. There are many livestock diseases in these areas. Research should be carried out in mountain areas where the livestock, pasture, and ranges are important with the objective of eliminating diseases from such areas. Range and pasture development to improve the productivity of sheep and goats should receive high priority.

In the past, the focus has always been on more production-oriented research, and now it is time to be more people oriented. Strategies that promote equitable management of scarce resources should be developed. It is always more difficult to get groups of people to work together to produce something.

Strategies for Creating Regional and International Partnerships and Alliance for Sustainable Mountain Agriculture

Mountain Agricultural Development Committees

In order to ensure full representation of farmers and their agenda at the national and regional level, each country should consider the establishment of national mountain agricultural committees (to include livestock and forest resources) at the central, state, provincial, and local district levels. Chairmanship of these committees at the central, state, provincial, and local levels should be on a rotational basis.

Inventory of Mountain Development Resources

Each country should carry out, through an inter-institutional team, an analysis of the institutional framework in each territory and prepare an inventory of what is what and who is who institutionally and individually for mountain development. Second, a focal point should be identified from among the various institutions. This could also rotate between organisations in a country. Third, identify the subject area specialisation, thematic research components, human resources, strengths and weaknesses, gaps, and so on in each institution. Fourthly, coordination mechanisms should be identified. Fifth, the sources of national and international funding should be identified. Reports on mountain agriculture, their conclusions, and recommendations, including a dir-

ectory of institutions, should be disseminated widely.

Principles for Partnership

Principles for partnership focus on using participatory approaches. Focal points should not be inward looking. Diverse institutional stakeholders were needed. Functions should be based on institutional capabilities. Developing consensus through participatory programme planning was advocated. A two-way flow of communication and a feedback mechanism were needed. At the regional level, ICIMOD should act as a focal point for these activities. ICIMOD should establish a regional mountain agricultural advisory committee made up of representatives of national resource committees and convene a meeting of committees at the earliest possible date, and as and when required. All institutions working on sustainable mountain development in the region should share their respective policies, plans, publications, etc, through their national focal points. ICIMOD should be the regional depository for all research information data and for repackaging and dissemination of the same by using both publications and the electronic media. Short-term regional refresher courses and in-service training programmes should be developed for government officials, researchers, and educationalists as well as for extension agents and formal organisations.

Gender and Sustainable Mountain Agriculture

Internalising Gender

Throughout this conference gender issues have been frequently touched

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The language of this seminar is gender biased. The farmer is always referred to as 'he'.

Participants

upon. Most of the presentations and discussions have mentioned them as a need in educational institutes and research institutes, but it has never gone beyond that. So it was felt that more information is needed on how women are to fit in specifically to the research, extension, and education programmes of our institutions. Interestingly the language of this seminar is gender biased. The farmer is always referred to as 'he'. Even when we refer to professors or researchers they are always 'he', 'his', and 'him'*. This language reflects our own internal thinking. We have sufficient studies/ observations from the Region and we know, without any doubt, that women are in fact the predominant farmers in the region. Substantial re-orientation in our thinking to begin referring to the woman farmer and her husband is required.

Once we can realise this fact and internalise it in our own minds then there will be a gender focus. If we remember that our primary farmers are females and our primary clients are therefore female then the rest of it will follow. Our research becomes focussed on the female. Research then takes her needs into account. Extension will design programmes around the needs and constraints of female farmers. The main problem lies in our own attitudes and minds. Old habits die hard. It is not an easy thing to change. In some cases it is believed that research carried out at the household level will automatically bring in the gender perceptiveness. This is one good step, but if we think of farmers and know that they are female, we do not even need to look at the household level.

Household implies there is a male farmer with his wife busy doing domestic chores. So why not focus on the female farmer?

Mainstreaming Gender

Women-specific activities are often those with low status and low remuneration. Because of this, many times, without knowing, we are promoting women's status as a marginalised position. We would like to suggest that women be seen in the mainstream agricultural activities of research, education, and extension. It has been recognised that women have been neglected in the past. We need to become aware of developments in this field, including the need to get involved.

Overcoming Gender Biases

More specific adjustments to the curricula to include gender concerns for students at all levels are necessary. This could be in all fields. We first need to look at the curriculum and see if it has a gender bias. Most likely it does. It is coming from our training and our education largely, so we need to first examine those textbooks and the curricula to see where the bias is coming from and how we can change and correct this. Courses on participatory methods for researchers and extension workers should be taught. This could be under a social science curriculum or it could be also under an agricultural research methodology. If we really do participatory research properly, we will have to involve the perspectives of all the concerned agents, and that should include women, as well as low caste and other

* Note to the readers: This tendency has been 'noted' by the editor on the relevant pages.



Women farmers engaged in vegetable cash crops farming, Hurla, Himachal Pradesh, India
U. Partap

groups, that researchers and extensionists might normally miss out. We also recognise that one way to get over the inaccessibility problem that always faces extensionists is to, in fact, mobilise local women leaders to help assist in the change process in extension, to teach them to become trainers in order to quickly spread the technologies to women in the region.

Organising Mountain Women

Why not first identify the local women's organisations in the region that could be used to help and offer them training in extension? Where they do not exist perhaps other organisations could assist with establishing such groups since we know now from experience that women are able to work together better when they are organised. We have a lot of examples of this from rural support programmes. This makes it much easier to deliver services to them and also helps them become more effective agents in development. They are more confident in bringing up their own needs and demands for services from other institutions. It is also proposed that agencies linked to other organisation, such as NGOs working

in the region, promote women's empowerment and help improve their capacities. It is also suggested that training materials could be developed for non-literate women since many of the women in the mountainous region cannot read and write, and the traditional extension materials, even in local languages, may be useless. Partnerships should be built between scientists, extension workers, and rural women. A certain level of decentralisation is required so that women can benefit from training held near to their homes; since as we all know they are very busy, and they often find it difficult to travel very far outside to attend training. All available means of information transfer should be used, including radio, T.V., and folk theatre. The cultural constraints that male extension workers face in dealing with women can be overcome by organising groups of women. However, the reality is such that there will never be sufficient female extensionists to meet the needs, and, therefore, male extensionists need to take on the responsibility also. There are ways to sensitise them about women's needs and methods for communicating with women.

...Why not focus on the female farmer?

...women are able to work together better when they are organised.

Participants

Regarding skill improvement and the need to provide women with marketable skills, it is important not to marginalise them. In the areas of research, it would be useful to conduct research on time-saving technologies to reduce women's workloads and free them for more productive activities.

Participants

Women's Knowledge and Skills

Regarding skill improvement and the need to provide women with marketable skills, it is important not to marginalise them. In the areas of research, it would be useful to conduct research on time-saving technologies to reduce women's workloads and free them for more productive activities. We know across the mountains what the major constraints on women are, and, therefore their low levels of participation and development are a result of them being overworked and too busy. Scientific organisations are not addressing these problems. Technologies to reduce women's workloads are not being emphasised. For women, this is a necessary pre-condition before they can be fully involved in more significant development activities. We should also conduct research on women's indigenous knowledge, including mountain agro-biodiversity. Particularly relevant is the significant knowledge they have of seeds, seed production, seed storage, and seed management. When talking about biodiversity, loss of knowledge and loss of resources must also be kept in mind. Women must become involved in gaining a better understanding of gender processes. Also we need to conduct research through participatory methods on rural women's specific needs and constraints. We need to understand these better and develop extension programmes accordingly to address those needs. We need to conduct on-farm and adapted breeding trials for livestock with women on their own farms. We need to understand clearly which sex is involved in which activity and to what degree. We

suggest that information be collected on the work that agricultural institutions are involved in in the field of gender. We should collect information on technologies for women, particularly the time-saving, drudgery-reducing ones. There are lots of technologies, but most of them do not seem to be adopted by women or even other local people. We need to look into this. Sometimes the green technologies related to agroforestry can in fact reduce the workloads of women. ICIMOD could facilitate the compilation of a directory of resource persons in this topic. ICIMOD is working on institutional strengthening of some agricultural institutions in the region to address these concerns of farm women and to sensitise the staff of the institute. One such pilot programme is being held at the University of Solan. This is just the beginning. ICIMOD will probably be undertaking similar activities with other universities also and would like to develop programmes on mainstreaming gender in agricultural institutions in the mountains.

We should encourage women to enter every field and at all levels. The option should be open. This is the best way to internalise gender concerns and not by reservation of seats, positions, etc.

Regarding upgrading technology, just handing technology over to people is not enough. We must put them in a position to earn financial profits. This is why we have emphasised the need for women's organisations, because it is often through organisations that this kind of confidence and empowerment can come about.

Closing Remarks

XI

F. A. Yusuf
Secretary, Special Affairs'
Division, Prime Ministers'
Office, Bangladesh

My participation here and interaction with all you friends have further reinforced my feeling that ICIMOD can do a great deal for the betterment of the people of the hilly land which we call the Chittagong Hill Tracts. This area is underdeveloped in comparison to other areas in Bangladesh. We also have special problems, particularly ethnic ones. Whatever development activities we intend to pursue in the Bangladesh hill areas, the Special Affairs' Division looks at these in a holistic way. We have already benefitted from the advice and assistance provided by ICIMOD, and we intend to increase our collaboration with ICIMOD in the near future, because we believe we do not have sufficient expertise in our country for the development of hilly areas.

I think we are expecting many useful outputs from ICIMOD. ICIMOD has made it clear that it can provide forums where we can discuss problems and share information. Through these interactions, we have an opportunity to establish regional as well as inter-regional collaboration for which ICIMOD can act as a window for all of us.

Liu Gengling
Vice President, Chinese
Academy of Agricultural
Sciences, Beijing

In this meeting, I learned a lot. I learned about the many outstanding activities of ICIMOD for the farmers, of course for men and women folks in the mountainous regions. In this meeting, I have come to know scientists and friends. I hope the friendships among scientists established today will develop sustainably. I hope the cooperation among scientists will also develop sustainably.

R.P.S. Tyagi, Vice Chancellor,
Himachal Agricultural
University, Palampur, India

I must congratulate ICIMOD. They have achieved within the last three to four days what we have not done in three to four decades. The credit goes to the organisers. After visiting ICIMOD I realised our fortune that we are in this region to have such a centre. In fact, I will say that it becomes the duty of the countries in this region to really support this centre. It should be very independent and made a viable centre so that it can give guidelines to the region. It is our duty to support this centre through our governments.

Through these interactions, we have an opportunity to establish regional as well as inter-regional collaboration for which ICIMOD can act as a window for all of us.

F. A. Yusuf

I hope the friendships among scientists established today will develop sustainably. I hope the cooperation among scientists will also develop sustainably.

Liu Gengling

Leela Pathak, Joint Secretary, Ministry of Agriculture, HMG/Nepal

I would like to congratulate ICIMOD for holding such an important meeting and choosing Nepal as the venue. In fact, assembling so many distinguished agricultural scholars and practitioners has provided us with a very good opportunity to discuss this particular region's development and share each other's experiences. This is going to be very fruitful for all of us in our future work while formulating strategies for the development of agriculture.

Kyaw Than, Rector, Institute of Agriculture, Yezin, Myanmar

Frankly speaking, before I came here I was not quite aware of what ICIMOD is doing in this region. Because of ICIMOD, we have possibilities for greater cooperation and coordination between neighbouring countries and

for sharing our knowledge and experiences.

M. Azam Khan, Vice Chancellor, Arid Agriculture University, Pakistan

I would like to express my sincere gratitude to ICIMOD, the Director General, his colleagues, and staff for the wonderful arrangements and the facilities provided and the wisdom they have shown. I was also delighted to meet with a large number of Vice Chancellors who are all my senior colleagues. I have recently been appointed, only a couple of months ago, so I had the opportunity to learn from their experiences which range from 30 to 40 years in most cases.

Closing Address by Chairperson

**Egbert Pelinck
Director General, ICIMOD**

I noticed that there are numerous recommendations for follow-up



I must congratulate ICIMOD. They have achieved within the last three to four days what we have not done in three to four decades.

R.P.S. Tyagi

The added value of looking at sustainable mountain agriculture from a regional perspective is that it makes possible the exchange of information, the storing of information, and the exchange of people.

E. Pelinck

Director General at the Closing Session

activities and I appreciate it, and I hope some kind of follow-up activities will take place in your own organisations, in your own countries, and that you have a certain trust and confidence in ICIMOD to follow up on those aspects of sustainable mountain agriculture that can gain by a regional approach. The added value of looking at sustainable mountain agriculture from a regional perspective is that it makes possible the exchange of information, the storing of information, the exchange of people from one institution to another, fellowships, and study tours.

Some of the recommendations that have been made have rather a long-term perspective, such as change in curricula or change in certain institutional structures, and I think there is not a single country in this region or in Europe or elsewhere where institutional changes take less than two to three, sometimes even five, years. The problems and concerns of

mountain people and their environment cannot afford long-term thinking only. We also have to look at short-term solutions. ICIMOD will look at some of these very carefully and identify what we can do in the short term and what we can do in the long term. In the short term, we can do many things by exchanging of information.

If I may ask you also to do something in the short term. Going back to your own countries, to your own institutions, you should become an ambassador for mountain people and the mountain environment. You should not forget about mountain people and mountain agriculture. In your own institution, in your organisation, in your own government, and also in international associations. Many of you are on national committees and international committees where you can promote the cause of mountain people.

Thankyou

In the short term, we can do many things by exchanging of information.

Going back to your own countries, to your own institutions, you should become an ambassador for mountain people and the mountain environment.

E. Pelinck

Plenary Sessions

Session I	11:00 - 12:00 hrs Chairperson: Dr. Zeng Shou
11:00 - 12:30	Theme 1: Education, Research, and Sustainable Mountain Agriculture: Building Frontiers for the 21st Century M. Baudouin and E. Pelinck Commentator: Upton
12:30 - 13:00	Theme 2: Soil Fertility, Water Management Challenges Facing Sustainable Mountain Agriculture W. Porceddu and P. S. S. S. Commentators: K. Iken, G. Thapa
Session II	14:00 - 17:30 hrs Chairperson: Prof. Zhu Zhonglin

Programme

January 23, 1996

Inaugural Ceremony

9:30 - 10:30 hrs

- | | |
|---------------|---|
| 9:30 - 9:40 | Welcome Address,
Mr. Egbert Pelinck, Director General, ICIMOD |
| 9:40 - 10:10 | Keynote Speech on Regional Consultation
Dr. Amir Mohammad, President, Asianics Agro-Dev.
International, Ex-Chairman, PARC, Pakistan |
| 10:10 - 10:15 | Address by Mr. T. Derksen
Representative of the Govt. of the Netherlands, Nepal |
| 10:15 - 10:25 | Address by the Chief Guest, Hon'ble Sher Bahadur Deuba,
Prime Minister of Nepal |
| 10:25 - 10:28 | Vote of Thanks |

Technical Sessions

Session I

11:00 - 13:00 hrs

Chairperson: Dr. Zafar Altaf

11:00 - 12:30

Theme 1: Education, Research, and Sustainable Mountain
Agriculture: Defining Priorities for the HKH
M. Banskota and T. Partap,

Commentator: V.Hoon

12:30 - 13:00

Theme 2: Soil Fertility, Water Management Challenges
Facing Sustainable Mountain Agriculture
Tej Partap and P. B. Shah

Commentators: K. Than, G. Thapa

Session II

14:00 - 17:30 hrs

Chairperson: Prof. Zhu Zhonglin

14:00 - 15:30

Theme 3: Transformation Processes and Indicators of Sustainable Farming Systems in the HK-Himalayas: Micro-Level Evidence
S. Shrestha, H.R. Sharma, S. Sharma

Commentators : R. Chandra, Rash Khan

16:00 - 17:30

Theme 4: Institutional Innovations for Sustainable Farming and Natural Resources' Management in the HKH Region
A. Bhatia, Liu Yanhua, P. Harding,

Commentator: Prem Sharma

January 24, 1996

Programme

Session III

09:30 -10:40 hrs

Chairperson: *Dr. Jose L. Rueda*

Theme 5 : Role of Agriculture in Sustainable Development of the HKH Region

09:30 -10:00

Institutional Perspectives on Achieving Food Security
Zafar Altaf

10:00 -10:30

Farmers' Perspectives on Sustainable Livelihoods
R.P. Yadav, T.S. Papola

10:30 -10:40

General Discussion

Session IV

11:00 - 1:00 hrs

Chairperson: *Dr. A. I. Chowdhury*

Theme 6: Perspectives of National Agricultural Research Systems on the Role, Priorities, and Problems in Meeting the Challenges of Sustainable Development of Mountain Agriculture

11:00 -11:30

Agropastoral Farming
A.S. Alvi, Liu Yanhua

11:30 -12:00

Horticulture-led Agriculture
L. R. Verma

12:00 -12:20

Mixed Farming Systems
F.P. Neupane

12:20 -12:40

Shifting Cultivation
K.Than, S. Awasthi,

12:40 -13:00

Farmers' Perspective on the Role & Priorities of NARS
E.F. Tollervey , D.P. Sharma

Session V

14:00 - 16:00 hrs;

Chairperson: Dr. G.B. Singh

Theme 7: Perspectives of Educational Institutions on the Challenges of Sustainable Development of Mountain Agriculture

- 14:00-14:30 Appropriateness of Existing Academic Training
M. Azam Khan, M.P. Singh
- 14:30-15:00 Tech. Research in Universities & Linkages with NARS
S.C. Modgal, S. M. Farouk
- 15:00-15:30 Capacities of Universities in Extn. Education & Extn.
L.R. Verma, S.B.A. Shah, Zhu Zhonglin
- 15:30-16:00 Expectations from Universities and Other Issues
M. Bashir
- 16:30 - 17:00 Short Meeting On Group Discussion Planning

January 25, 1996

Programme

Group Discussions
9:30 - 13:00 hrs and
14:00 - 17:00 hrs

GROUP I

Theme: Strategies for Transformation of Education Systems for Sustainable Mountain Agriculture

Convenors: M. Azam Khan & Pitamber Sharma

Members: A. Hassanyar, B. Weijie, K.K. Joshi, F.P. Neupane, Kyaw Than, A.I. Chowdhury, M. Azam Khan, M. Bashir, K.P. Nautiyal, L.R. Verma, Liu Gengling, Pei Shengji, A. Yusuf

GROUP II

Theme: Redefining Research Priorities for Sustainable Mountain Agriculture

Convenors : G.B. Singh & J. Gurung

Members : R.P.S. Tyagi, M.P. Singh, S.B. Ali Shah, O.S. Tomar, Zhu Zhonglin, R. Khan, R. Chandra, H.R. Sharma, E.F. Tollervey, L. Pathak, Tang Ya, Sugandha Shrestha

GROUP III

Theme: Strategies for Creating Regional and International Partnerships and Alliances for Sustainable Mountain Agriculture.

Convenors : Z. Altaf & S. Akhtar

Members: Khalida Khan, Pratap M. Shrestha, Prem Sharma, J.I. Rueda, A.S. Alvi, A. K. Dwivedi, S.M. Farouk, A. Bhatia, S. Malik

GROUP IV

Theme: Gender and Sustainable Development of Mountain Agriculture

Convenors : Leela Pathak & T.S. Papola

Members: R.P. Yadav, Liu Yanhua, M.M. Hassan, P. Harding, R.P. Mishra, Mya Maung, M. Bashir, Shiv Sharma, V. Hoon, A. Negi, J. Gurung, M. B. Chaudhari

**January 26, 1996
Programme**

Session IX

9:30 - 12:30 hrs

Chairperson : Egbert Pelinck

- I. Presentation of Findings of the Groups and Subsequent Discussions on Recommendations

Group I: Strategies for Transformation of Education Systems for Sustainable Mountain Agriculture

Group II: Redefining Research Priorities for Sustainable Mountain Agriculture

Group III: Strategies for Creating Regional and International Partnerships and Alliances for Sustainable Mountain Agriculture

Group IV: Gender and Sustainable Development of Mountain Agriculture

- ii. Remarks by the Representative of the NARS' Group
- iii. Remarks by the Representative of the VCs' Group
- iv. Remarks by the Representative of the Development Departments
- v. Closing Address by the Chairperson

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- ❖ Bhutan
- ❖ India
- ❖ Nepal

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