# CHAPTER 1
# Introduction

## The Context

The Mountain Farming Systems (MFS) Division of the International Centre for Integrated Mountain Development (ICIMOD) has already made a considerable effort to improve understanding of the sustainability of mountain agriculture trough micro-level case studies. So far these case studies have focused on the transformation processes taking place in successful farming areas. The purpose of this was to examine how successful experiences in transformed areas can be replicated in other parts of the Hindu Kush-Himalayan (HKH) region in order to improve the livelihoods of mountain households. The case studies on Himachal Pradesh, Sikkim, Illam, and Ningnan County (Liu Yanhua et al. 1993; Partap 1995; Sharma 1996; Sharma 1997; Sharma and Sharma 1997) are good examples. They contain valuable information on how in these areas subsistence agriculture has been transformed into viable commercial agriculture, thus alleviating poverty and improving living conditions. Some of the studies focused on how farming of horticultural[1] crops has increased food security and employment (Partap 1995; Sharma 1996; Sharma 1997; Sharma and Sharma 1997; Tulachan 1997; Badhani 1998). The studies showed that accessibility to a wider market network and strong research and development (R&D) institutions are critical to the commercialisation of subsistence agriculture in the mountains.

Although valuable, these case studies have certain limitations. Each relates to a particular period of time and a specific location within the vast tract of the HKH region. It is not possible to draw broad generalisations from this limited number of micro-level studies unless they are supported by facts at the macro-level (Singh 1992). Equally, the studies have only a limited coverage of other important components of farming systems like the production of food grain (cereal) crops and livestock. The case studies do not in themselves provide a broad or regional picture of the state of mountain agriculture across the HKH region.

There are many issues related to patterns and trends in mountain agriculture that need to be analysed empirically. Only recently, however, have attempts been made to develop an empirical picture of the existing conditions in agriculture in the HKH region, the changes over time, the policies that effect agriculture, and factors related to long-term sustainability (Jodha et al. 1992).

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[1]The term horticulture in this text refers to the cultivation of fruit and vegetables for sale.

These attempts have been hampered by the lack of an empirical database on mountain agriculture that can be used to identify long-term trends and their implications. This need has been realised for some time (Jodha et al. 1992). The lack of an adequate database on horticultural crops was cited in an ICIMOD regional consultation meeting (1996) as a major bottleneck to systematic planning and programming of agricultural development in the mountains. The Regional Consultation on Education and Research for Sustainable Mountain Agriculture, held at ICIMOD during 1996, recommended that ICIMOD could be a focal point for the creation of a technical database for mountain agriculture. Similarly, Rhoades (1997), in his review and analysis of the work on mountain farming systems at ICIMOD, identified the lack of an empirical database as a major constraint and also recommended the creation of a systematic database.

In 1997 ICIMOD started to create a systematic database on agricultural systems for the HKH region focusing on socioeconomic data. Data have been obtained from government statistics, project reports, consultancy reports, case studies, and grey literature. A user-friendly computer framework called the 'HKH Farming Systems' Information/Database File' has been designed to enable systematic storage and easy retrieval of information and is being developed to assist those involved in planning and policy formulation for the sustainable development of mountain agriculture in the HKH region.

## The Study

This paper describes the results of one of the first studies made as a part of the activities involved in setting up the new database.Patterns and trends related to three key components of agricultural production systems in the HKH region were studied: cereal (food grain[1]) crops, horticultural and cash crops, and livestock. These three are the main components of integrated mountain farming systems and the basis of the livelihoods of mountain households. The issues addressed included the following: what are the patterns and trends in land resource allocation (land use) for cereals and other crops compared to horticultural crops, like fruit and vegetables, and other cash crops? what are the trends in crop yield or productivity for cereals and other crops compared to horticultural crops? what are the crop yields for cereals and other crops compared to horticultural crops? what changes have taken place in livestock population and composition? and which animal species are gaining importance in the livestock economy? The aim was to analyse data from the past ten to fifteen years related to these issues in order to obtain an idea of the sustainability of different components of mountain farming systems across the HKH region.

A broad range of socioeconomic data related to mountain agriculture was collected from government sources. The national governments in the region collect agricultural data annually based on administrative units and publish these in the form of government statistics. These government statistics were collated and analysed to assess the patterns and trends of mountain agriculture from a socioeconomic perspective in selected mountainous provinces, states, and regions in five Hindu-Kush Himalayan (HKH) countries:Bhutan, China, India, Nepal, and Pakistan. Time-series' data were used to estimate growth rates. In addition to the large amount of, often, scattered data and information collected from government sources, other research reports

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[1]Cereals and food grains are used interchangeably in the text

were reviewed and analysed to obtain information about land use, farm size, and cropping patterns. Since these data are aggregated from farm household level data, the analysis should reflect the conditions prevailing at farm level.

The emphasis was on analysing the economic agricultural data in order to describe the state of mountain agriculture (farming systems). The analysis provides an inter-regional view of mountain agriculture and farming systems across the HKH. (General characteristic descriptions of the dominant farming systems found in the HKH, by administrative unit, are available in the 'HKH Farming Systems' (FS) Information/Database File' at the Mountain Farming Systems Division, ICIMOD.)

The objectives of this publication are as follow:

- to characterise the present patterns of mountain agricultural systems in terms of land use, landholdings, cropping systems, and crop productivity;
- to analyse present trends and patterns in mountain agriculture in terms of area, total production, and yield of major food crops;
- to assess the trends and patterns in horticultural crops in terms of area, total production, and yield;
- to analyse the trends in livestock population and composition; and
- to summarise the constraints to, and the implications of present trends for, the development of sustainable mountain agriculture.

## Methodology

Macro-level data were used to examine the broad patterns and trends in mountain agriculture across the HKH region, in particular in the three sub-systems of cereal crops, horticultural and cash crops, and livestock. Agricultural census data from different time periods over the last 10 to 15 years were obtained from government agricultural statistics for the selected mountain provinces, states, and regions. The government sources for the time series' data used for estimating growth rates are shown in Box 1.1. These data are from different time periods and the methods of data collection were different: for example, census, field survey, and estimates. Also, since the data are based on administrative units, in some provinces/states, data collected include some parts of the plains too.(The raw data are available on request on an ICIMOD CD.)

A comprehensive review was made of relevant secondary sources and data and information from them analysed. Case studies carried out by other organisations were also reviewed and the data and information from them collated.

The study areas are shown in Figure 1.1:Balochistan and NWFP in Pakistan; Himachal Pradesh and the Uttar Pradesh hills in India; Tibet, Yunnan, and Sichuan in China; high and mid-mountain regions in Nepal; and all of Bhutan.

The time series' data were analysed using the econometric tool shown below to estimate the average annual growth rates of food grain crops and horticultural and cash crops. A simple

Box 1.1
# Sources of the Time-series Data Used in the Analyses

## Pakistan
- Ministry of Food, Agriculture and Livestock, Economic Wing (1995) *Agriculture Statistics of Pakistan*. Islamabad: Govt. of Pakistan
- Bureau of Statistics (1996) *Statistic Handbook of Balochistan (1995)*. Quetta: Govt. of Balochistan

## India
- Chand, R. (1997) *Agricultural Diversification and Development of Mountain Regions with Special Reference to Himachal Pradesh*. New Delhi: MD Publications
- Mehta, G S (1997) *Development Experiences and Options in a Hill Region: The Case of Uttarkhand, U.P. India*. Kathmandu: ICIMOD
- Himachal Pradesh Horticultural Department (1993) *Horticultural Development in Himachal Pradesh, Statistics at a Glance*. Shimla (India): Himachal Pradesh Horticultural Department
- Jindal, K.K. (n.d.) *Statement Showing Area and Production of Food Grains and Vegetables in Himachal Pradesh from 80-81 to 1995-1996*. Solan (India): YS Parmar University of Horticulture and Forestry (In Hindi)
- Dhar, T N; Gupta, S P (1994) *Development of Horticulture in the Himalayan States of India* Lucknow (India): SHERPA
- Dhar, T N; Gupta, S P (1995) *Development of Agriculture in the Himalayan States of India*. Lucknow (India): SHERPA

## Nepal
- Agricultural Statistics Division (1996) *Statistical Information on Nepalese Agriculture 1995/96*. Kathmandu: HMG Ministry of Agriculture
- Agricultural Statistics Division (1997) *Statistical Information on Nepalese Agriculture (1993/94 To 1996/97)*. Kathmandu: HMG Ministry of Agriculture
- Agricultural Statistics Division (1996) *Statistical Information on Nepalese Agriculture (Covering 1985/86 To 1995/96)*. Kathmandu: HMG Ministry of Agriculture
- Department of Food and Agricultural Marketing Services, Agricultural Statistics Division (1990) *Agricultural Statistics of Nepal*. Kathmandu: His Majesty's Government, Ministry of Agriculture
- Ministry of Agriculture (1997) *Statistical Information on Nepalese Agriculture (1996/97)*. Kathmandu: His Majesty's Government of Nepal

## Bhutan
- Ministry of Agriculture (1995) *LUPP Dzongkhag Data Sheets for Bhutan*. Bhutan:Land Use Planning Project

## China
- Editorial Board of China Agriculture Yearbook (1997) *China Year Book of Agriculture (from year 1984 to 1997)*. Beijing: China Agriculture Press
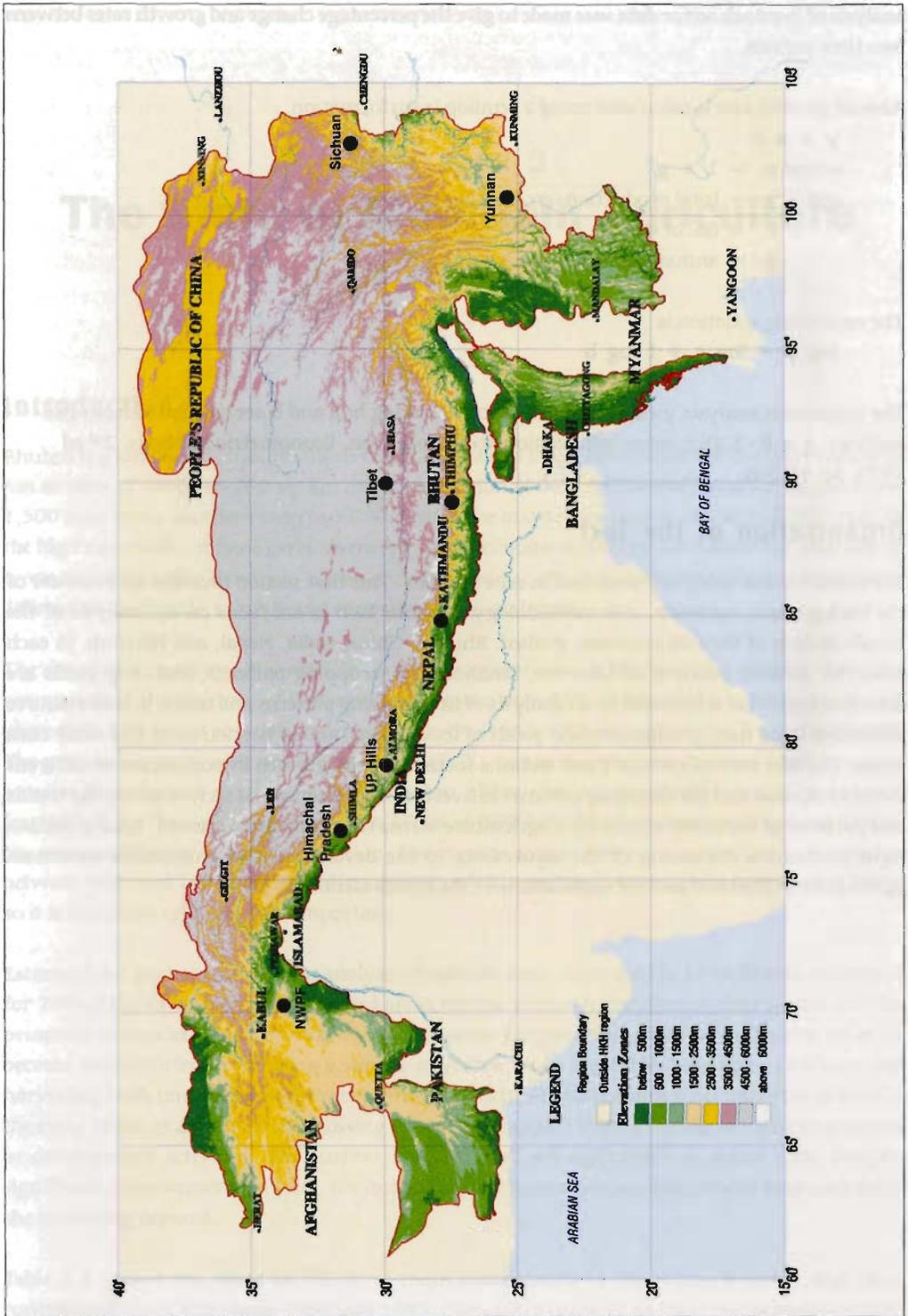
Figure 1.1: Selected provinces/states/regions for the study

analysis of livestock sector data was made to give the percentage change and growth rates between two time periods.

Annual growth rate is calculated using a semilog transformation.

$$y = a\,b^t$$
where $b = 1 + g$
and $y$ = total production/area/yield over time t
$t$ = no. of years
$g$ = annual growth rate

The estimating equation is

$$\log y = \log a + t \log b$$

The regression analysis yields estimates of $\log a$ and $\log b$; $a$ and $b$ are calculated from the antilogs; $g = b - 1$. (For more information see J. Johnston, Econometric Methods, 2nd ed 1972, pp 47-50)

## Organisation of the Text

The results of the study are presented in nine sections. This first section provides an overview of the background, rationale, and methodology. Sections two to six focus on an analysis of the trends in each of the five countries studied: Bhutan, China, India, Nepal, and Pakistan. In each case, the existing patterns of land use, landholdings, cropping patterns, and crop yields are described first. This is followed by an analysis of the changing patterns and trends in land resource allocation (land use), production, and yields of food grains, and of horticultural and other cash crops. The last part of each of these sections focuses on the growth in population of different livestock species and the changing patterns in livestock composition. In section seven, the trends and patterns of sustainable mountain agriculture across the region are discussed. Finally, section eight contains a discussion of the constraints to the development of sustainable mountain agriculture in the HKH and the implications of the trends identified.