CHAPTER 5
Identifying and Mapping Mountain Agricultural Systems and Societies

1. The MASSIF Project

In this chapter, I argue that an information database and mapping of mountain farming systems in the HKH region—similar to existing geoclimatic and vegetational maps—should be developed for the purposes of priority setting and extrapolation of knowledge between appropriate scale levels. I argue that a methodology already exists for this exercise and, given the present gaps in knowledge, this is a necessary first step in priority setting for research and development on sustainability of farming systems in the HKH. I refer to this approach as the 'Mountain Agricultural Systems and Societies' Information Files' (MASSIF), which is derived from the time-tested methodological approach of the Human Area Relations' Files (Murdock 1971). MASSIF is based on the following points.

- The comparative advantage for developing MASSIF rests with international centres (e.g., ICIMOD and its strategic partners) and their ability to retrieve, store, and integrate ethnodata in a computerised and relational interactive GIS database which is relevant and complementary to other databases for priority setting, planning, and targeting research. The 'World Geography of the Potato' and 'World Geography of the Peanut' projects developed at The International Potato Centre (CIP) and the University of Georgia can serve as protocols.
- This method is based not only on government statistics but also on ethnodata (ethnographic and ethnobiological), grey literature, and non-conventional sources of information. Since useful and practical farm-

ing systems' databases for priority setting, research design, targeting and extrapolation, and policy-making and planning do not presently exist, it is necessary to develop a methodology for their creation.

- The database will be so constructed as to allow systematic delineation of comparable farming system types within the ecoregion. MASSIF will store information on the diversity of agrarian systems based on secondary data but will also recognise farmers' classifications of environment and resources.
- The methodology can be applied to the Andes, East African Highlands, and other mountainous regions involved in the Global Mountain Initiative.

The development of a systematic database on mountain agroecosystems has been elicited from many quarters over the years (cf., Ives and Messerli 1989). Although seemingly overlooked in the rush to immediately "solve mountain problems of poverty and ecological degradation", all **six** objectives of Chapter 13, Agenda 21 (Managing Fragile Ecosystems: Sustainable Mountain Development) deal **explicitly** (objectives 13.5 a, b, c, d, and f) or **implicitly** (objective 13.5e) with the creation of such an informational database and system. To repeat: **this is the very essence of Chapter 13, Agenda 21**, not a side, minor recommendation. To dismiss this necessary task as too expensive, too overwhelming, or as duplicating government activities is to deflect from the unavoidable *a priori* task for sustainable development of mountain ecosystems.

2. The Data Gap

Given scarce resources, time, and a huge geographical area covering eight countries, only an international centre like ICIMOD has the comparative advantage to provide a ***Himalayan Vision***, an overview or bird's eye view of the terrain below. No particular country or international agency has this mandate or comparative advantage. Furthermore, an international centre needs to set priorities that can be addressed given limited resources and time so as to maximise returns to the investment in the centre by the global donor community. Thus, a first step in sustainable farming systems is to map their distribu-

tion in much the same way as vegetation, ecological zones, or climate patterns have been mapped on the ecoregional scale. In such a mapping exercise, details will be sacrificed for the benefit of giving an overall vision of the ecoregion.

The need to develop MASSIF grows from the irrefutable reality that official, national agricultural statistics are woefully inadequate to deal with important policy and planning decisions for the HKH. ICIMOD and other HKH watchers are painfully aware that there is a data constraint in the mountains which leads to the invisibility of the mountain situation to the mainstream statistical system of national governments. Beyond the feeling of 'inadequacy', however, little agreement prevails on the severity of the problem or on what can be done about it. The government data apologist simply shrugs his shoulders and says "it's the best we have." Others, particularly those who try to use this data for a specific piece of planning, are more sceptical. The extreme critic may even argue that, in some cases, no data are better than the wrong data for they might force us into false decisions that can have harmful consequences (Hill 1984). To compound matters, neither the critics nor the apologists seem to have many cost-effective solutions for improving mountain agricultural data so that they accurately reflect on-the-ground conditions. Apologists for government data do little more than argue that proper statistical analysis and modelling using computers can help reduce biases, while critics likewise argue that there is no substitute for closer attention at the moment of data collection. Accomplishing either of these at the national or local levels, however, is immensely difficult. In any case, governments do not collect data about farming systems *per se*; they collect data about specific components (commodities, soils, human populations, rainfall) which are jerked out of context and certainly out of the "systems" in which they are embedded.

Space-age technologies might be one solution to the data lacuna. Such new technologies will surely in the future give agricultural scientists new tools with which to cross-check estimates provided by national census statistics. Unfortunately, it is still difficult and often impos-

Computerisation - *File photo*

Space-age technologies might be one solution to the data lacuna.

sible to detect patterns in mountain environments, given the complex intercropping or mixed systems in which cloud cover still obstructs clearer images from space. Also, due to cost and availability, space information technology is not available to most national programmes. But, more importantly, space age technologies tell us next to nothing about the cultural, socioeconomic, or human knowledge base spread across the landscape. The MASSIF method suggests a low-cost approach which complements both conventional data sources (such as agricultural census data and FAO sources) and the latest developments in GIS or remote sensing. This approach is based on a well-known ethnographic method (human area relations' files) and, with computer-driven adaptation, is useful for mountainous areas. I will briefly describe the history of the method and how it was first applied to global mapping of potatoe productive zones and systems.

3. The Human Area Relations' Files: An Appropriate Methodology

The Human Area Relations' Files (HARF; pronounced "Ha Raf" by users) has its origins in the 1940s. American anthropologist, George Peter Murdock (1971), realised that government statistics would never provide much information about traditional cultures and their ways of life. He also knew that most ethnographers, extension agents, geographers, and explorers, who were knowledgeable about such cultures, did not necessarily collect the information in a systematic way but could still provide a great deal of information that would be useful if properly analysed. Murdock developed a way to classify human cultures and to systematically organise specific information

about everything from technology, settlement patterns, kinship, economics, agriculture, language, and trade, among other categories. To show how useful it was, he collected detailed data on the incidence of and distribution of cultivated plants in Africa from over 2,000 ethnographic sources and generated original maps for the distribution of unreported crops such as bananas, date palm, finger millet, cassava, and sweet potatoes. In this respect, Murdock was ahead of his time for agricultural research since he was able to provide useful information on subsistence crops often grown in tribal gardens and cared for by women. Eleven of these maps were published in **The Geographical Review** (October 1960). In the conclusion to his unusual article, Murdock argued passionately that a wealth of information exists in the published and unpublished reports of anthropologists and other agricultural field workers who had the advantage of working locally and who were therefore knowledgeable about local conditions. He also recognised that government statistics are a completely independent source of information on many of the same facts, capable of being mapped in a similar fashion. Murdock (1960:540) came to the following conclusion.

> *Would the comparison of maps from these two sources show a degree of correspondence reassuring to the practitioners of the several disciplines concerned, or would it reveal discrepancies of such an order as to raise fundamental problems in their reconciliation*?

Given that statistics and qualitative data on mountain farming systems are non-existent or mainly found in the grey literature, the relevance of Murdock's method for mountains becomes clear. In the absence of good data, ICIMOD—as the centre with the mandate for the HKH—is the only organisation that can mobilise its strategic partners to create a quality, practical database. Murdock's method, however, is the only approach now available for the construction of such a farming systems' database that has meaning beyond district or national-level censuses.

I was the first to resurrect Murdock's method and apply it to creating a database on potatoes, today called

the **World Geography of the Potato**. To make the story short, CIP—which focusses on the underground crops of potatoes and sweet potatoes—was having a hard time justifying its funding level since these crops were not well reported in the FAO agricultural statistics, at least compared to the grains and other commodities which enter into international trade. Like mountain landscapes, roots and tubers in particular pose embarrassing problems for the FAO and for national statistical approaches. Unlike the grains, roots and tubers do not enter into international trade and are less likely to be reflected in national production statistics than cereals, oil seeds, sugar, and commercial crops traded on international markets. Remote sensing or aerial photography has limited use, since these crops are often in mixed cropping systems and are grown in visually confounded mountainous areas. Fortunately for CIP, I had been developing a country-by-county database with maps using non-conventional data sources, just as Murdock had for the African crops mentioned above. When we acquired GIS capability and relational database software in the mid-1980s, we were able to handle the data with greater ease. In the end, we collected detailed information on potatoes in over 150 countries, which we culled from over 1,500 documents. The information was not only used to secure CIP its future funding, since the project indeed demonstrated empirically that potatoes were important, but it also gave CIP a way to plan and prioritise its own research. For example, until this potato mapping exercise, it was not known that the bulk of potatoes in developing countries are not produced in a few mountainous areas (as argued by the Technical Advisory Committee of the CGIAR based on FAO data) but in the extensive, densely-populated warm summer-cool winter rice-wheat belt (potato is an intercrop) which stretches from the Punjab region into China.

The situation at ICIMOD in some way parallels the International Potato Centre case except that it is ultimately more challenging and, in my opinion, more important for Agenda 21 concerns. In my research at ICIMOD, I was faced with the challenge of providing a critical assessment of sustainable mountain farming systems in the HKH. I have poured over dozens of documents prepared by ICI-

MOD staff and consultants who have been brought in over the years to write state-of-the-art papers and other specific analyses of projects. The richness of data and range of topics covered in these consultancies are indeed impressive. Based on this work, several conceptual papers on the mountain perspective, technologies, and transformed areas have been generated. Without denying the contribution of this work, for there are many impacts, many basic questions remain about the farming systems of the Hindu Kush-Himalayas: where are they located and how much area do they cover? who and how many people live there? what is their ethnicity and social organisation? what is the state of the indigenous knowledge and technology? and what are the change trajectories? In other words, still missing is a systematic database upon which one can make decisions about what is important and not important, about where one should put one's efforts, and about where the gaps in knowledge are. For these data gap reasons, I recommend that ICIMOD develop a major mapping project that is interactive and contains a relational database of maps and information that can be used to give us an overview of the broad patterns of farming systems and their correlates. It is not too late to begin this project, although much time has already been lost. In commenting on the professor's tendency to gather more data when he does not know what to do and the decision-makers problem of having no time to wait for the academician's impossible perfection, Ives and Messerli (1989: 19) wrote: "*if a beginning had been made 30 years ago to collect relevant data on a systematic basis, a required course of action could have been much more readily defined today.*" If this had been done, Thompson and Warburton's (1985) "uncertainty on a Himalayan scale" could at least have been reduced to "uncertainty on a hill scale."

Once created, the Mountain Agricultural Systems and Societies' Information Files (MASSIF) will be an evolving, interactive source of information (not just a map, but a relational database). It will constantly be improved and mined for setting priorities, planning, technology transfer, and systems' extrapolation. If desired, a static, hard copy **Atlas of Himalayan Mountain Agriculture** should

be published. This same atlas can be placed on ICIMOD's World Wide Web which readers can update and improve. If properly done, the atlas will be able to inform the reader (and planners) how many people are affected by a given farming system; what is its impact on natural resources; what is the degree of viability of local knowledge; what are the potential markets; and what are the interests of the local population. One must remember that detail may be sacrificed to some degree in order to get the broad ecoregional overview. Each of the country, district, and agroecological zone files can, in the future and in collaboration with host country institutions, be expanded. However, it must always be kept in mind that data should not be collected randomly and just for the sake of collecting data. There must be a logic, a set of issues, a desire to streamline the data collection, and a process of analysis.

Fortunately, and unlike the circumstances at CIP, ICIMOD has a first-rate GIS unit (MENRIS) and its leaders are keen to take up the Hindu Kush-Himalayan Mountain Farming Systems' Mapping project jointly with the Mountain Farming Systems' Division. MENRIS (Mountain Environment and Natural Resources' Information Service) has been very active in training a large number of regional scientists. MENRIS has produced several atlases and reference works on key indicators based on national district-level data (physiography, climate, demography, socioeconomic characteristics, and agriculture). Information on farming systems *per se*, however, is absent, simply because the delineation of such systems has not been carried out by HKH governments. Without an effort that moves beyond politically-defined boundaries to the study of systems, it will be impossible to speak intelligently about farming systems (or even agriculture) in this globally important ecosystem.

4. The MASSIF Method

How can ICIMOD and its partners develop MASSIF since relevant data are not automatically available in the traditional census or government data formats? I recommend the same approach that I used for mapping and defining potato farming systems, with some modifications.

First, a filing system comprised of storage units of all of the countries and their districts should be established in the Mountain Farming Systems' Division. The files should be numbered and cross-referenced on the MENRIS district map which contains some 400 districts in the HKH region. MENRIS already has developed a district boundary map perfectly suited for the job at hand.

Second, culling of government literature, non-government literature, grey literature, ethnographies, and travel reports should be carried out. Only "factual" data on farming systems should be extracted. The database team should be careful not to include agronomic or other 'recommendations' since such data can reflect the way 'it should be', not 'the way it is'. There needs to be a cross-checking mechanism to cull speculative or wrong data.

We are not as interested in aggregated governmental district data (although it could be informative) as in delineation of the ***farming systems*** within and across them. Suggested categories for the MASSIF working files are: i) History of Farming Systems in Region X; ii) Zones of Production (with climate, altitude, and other physiographic data); iii) Production (seasons, crops, varieties, diseases, etc); iv) The Production System (crop, livestock, forest linkages); v) Farming Knowledge and Technology Base (including local knowledge, social organisation, gender, etc); vi) Post-Production (storage, marketing, consumption); and vii) Significant Aspects of Change (roads, markets, commercialisation). As a result of data analysis, the major farming systems' types will ultimately emerge. For example, it might be hypothesised that some major mountain farming systems will be: i) Specialised Pastoralism (short- and long-distance transhumance types); ii) Mixed Mountain Agriculture (high altitude agro-pastoralism with summer transhumance); iii) Cereal-dominated Hill Farming Systems; iv) Shifting Mountain Cultivation; and v) Alternative or Specialised (horticultural, plantation, special niche, etc). These can be further divided into wet-dry, rice-based, maize-based, or whatever set of dividers is deemed useful. Another system which probably cross-cuts all of these systems is the omnipresent household garden or the spice/medicinal economy.

Third, the data collection process will ultimately gen-

erate a working topology of the farming systems which will form the basis of initial mapping. A keyed topology should be defined and, in some cases where districts or zones have mixed systems, it may be desirable to note where no one system predominates (cf. Metz 1989). But, district by district (unless the districts cut across several altitudinal zones and need to be desegregated further), the predominate systems can be delineated and digitised by MENRIS. This exercise will provide a ***working map***, such as the one shown on page 76, which is designed to elicit a response from anyone knowledgeable about a region who reviews the map. For this exercise, we will be especially interested in the ideas and information of field specialists who know a given mountain area intimately. Slowly, the working map (which should be in hard copy and computer form) can be corrected and further refined. In the meantime, a specialised database which goes with the map will be entered into a relational database programme. The team must be careful not to 'drown' in data, a natural tendency in projects like these. They must always be data stingy, demanding, and careful about the quality of the data that finally make it into the files. The database is not rigid; it should be like the Himalayas and the Himalayan people — always changing, shifting, and adapting.

The importance of feasibility and operational aspects of an exercise like MASSIF clearly needs to be understood and examined. As an anonymous reviewer of an earlier draft of this book noted: "*data collection is a costly affair and, unless the potential use of data is clearly defined, the returns from the exercise may not be commensurate to the cost.*" The same reviewer recommends operationalisation of MASSIF through the following steps.

1 Initiate a systematic effort in compilation of **existing** spatial and socioeconomic data at macro-, meso-, and micro-levels available from official and non-official sources, instead of embarking upon collection of fresh data on all conceivable aspects (this is the essence of Murdock's approach).
2 Identify data gaps from the viewpoint of the analysis required to examine the sustainability of agricultural and general development.

3 Build comprehensive and purposeful databases for selected areas as illustrative models for wider adoption by other agencies, as ICIMOD may not be able to cover all areas of the HKH region.

5. Farming Systems in the Hindu Kush-Himalayan Region: A Suggested Prototype

The purpose of MASSIF is not to collect data for their own sake, but to arrive at scaled farming system types which then can be used to set priorities, design programmes, trace system linkages, and generate technologies.

Map 1 (page 76) outlines a prototype of what such a farming system distribution might look like. It should be noted that, without the benefit of a systematic data base (MASSIF), I am merely able to provide the roughest outlines as an illustration of the drift of my thinking.

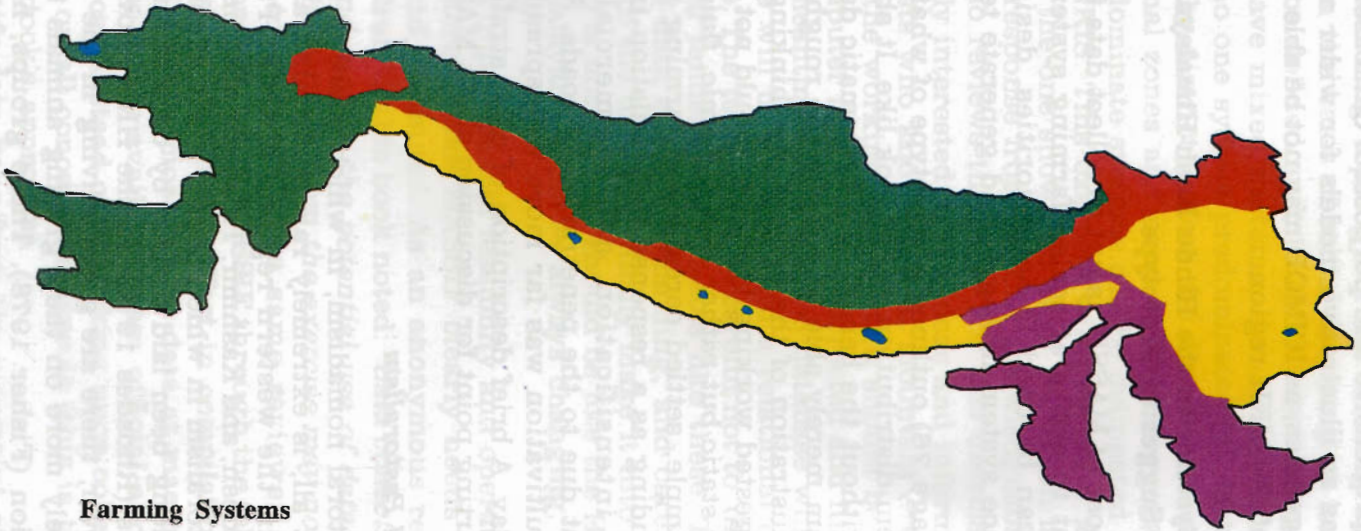
This suggested working typology should not be seen as something static but rather as a dynamic, fluid prototype. For example, settled cereal-based farming systems may be expanding as a response to population increase, agricultural intensification, and commercialisation brought about due to the penetration of roads. Swidden or shifting cultivation was far more widespread in the past than today. A brief description of each strategy can serve as a starting point for discussion about MASSIF.

A. Specialised Pastoralism

Pure pastoral nomadism, in which there is no crop cultivation at all, is extremely rare and found among a few groups in the western regions of Uttar Pradesh, Himachal Pradesh, and Kashmir. This long-standing myth of "pure" pastoralism in which people rely exclusively on animals has long been laid to rest by careful anthropological studies (Rhoades 1979). In the HKH above 4,000 metres, however, there are groups living in the pasture zone which rely more on their grazing animals than on food production (Fisher 1978). These groups, however, engage in long-distance trade and commerce (Miller and Schaller 1996; Miller 1995). The numbers of these groups

Farming Systems in the Hindu Kush-Himalayan Region

The Development of a Prototype



Farming Systems

- Specialised Pastoralism
- Mixed Mountain Agro-pastoralism
- Cereal-based Hill Farming Systems
- Shifting Cultivation
- Specialised Commercial System

Created By:
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are small, but the total area covered with grasslands in the HKH is extensive.

B. Mixed Mountain Agro-pastoralism

Stevens (1993) distinguishes two types of agro-pastoralist in Nepal, western India, and Tibet: middle altitude agro-pastoralism is centered on activities in main villages below 3,000 metres; high-altitude agro-pastoralists have villages above 3,000 metres. The former have crop bases at lower altitudes (below 2,500 metres) where rice, wheat, maize, and millet serve as staples and year-round production is possible. The pastoralism of the middle-altitude agro-pastoralists focusses on cattle, water buffalo, sheep, and goats which provide manure and other products. They are moved through seasonal transhumance from zone to zone. High-altitude agro-pastoralism is found typically in inner valleys and trans-Himalayan valleys where cultivation is restricted to summer production (see Rhoades and Thompson 1975 and Stevens 1993 for more detailed descriptions). Population increases in these systems have not been as dramatic as at lower elevations.

Cattle - *D. Miller*

Sheep - *D. Miller*

The pastoralism of the middle-altitude agro-pastoralists - animals are moved through seasonal transhumnance from zone to zone

C. Cereal-Based Hill Farming Systems

These are systems located below 2,500 metres characterised by a diversity of production types. Localised herding and forest use are common, although cereal-based

production forms the backbone of these economies. Typically, there is irrigated rice (*khet*) production, often multicropped or cultivated in rotation with other grains or fallow grazing. There is also the *bari* (rainfed zone) which is characterised by its own unique set of terracing, cropping cycles, and crop populations. Most farmers have both *khet* and *bari* production systems. These zones are densely populated and increasingly face shortened or non-existent fallow cycles.

Lowland *Khet* in the Trans-Himalayas (Mustang)

Shifting Cultivation - *both plates, P. Tulachan*

Cereal-based production forms the backbone of these economies.

D. Shifting Cultivation

Swidden or shifting cultivation was far more widespread across the HKH in the past than today. Presently, it is more common in the lower lying, higher rainfall areas of Bangladesh (Chittigong Hill Tracts), Bhutan, Nepal, and the Eastern Indian Himalayas. Pockets of shifting cultivation exist above 2,500 metres, but these are dispersed within agro-pastoral systems. Formerly, shifting cultivators practised long fallow periods of 20 years or more but, with increasing populations (natural growth and in-migration) and government settlement schemes, the fallow periods have been shortened to two to three years. The major sustainability issue will undoubtedly focus on how these historic low-population, sustainable agroforestry systems can make the transition to more intensive, permanent patterns.

E. Specialised Commercial Systems

Building on comparative niche advantage and regional-international marketing outlets, certain geographically confined areas have evolved specialised commercial production systems. The more notable of these are cardamon (Sikkim), tea (Darjeeling and Ilam), fruit (Himachal Pradesh), and vegetable/seed (pockets throughout Nepal's mid- to high hills). These regions tend to be more prosperous and developed, although more vulnerable to market fluctuations and other problems of commercial production. Other alternative mountain farming systems, such as household gardens, medicinals, and floriculture, should be included as well in this category.

6. Relevance of the Himalayan Mountain Mapping Project for the Global Mountain Initiative

There is now a rush of development agencies towards the mountains, as a result of the approval of Chapter 13 of Agenda 21 by the UNCED (Earth Summit) at which a Mountain Agenda was launched, thanks to the campaigning efforts of a handful of dedicated mountain scientists. Since then, numerous international meetings have been held and even organisations formally indifferent to the mountains (such as the CGIAR) have jumped on the funding bandwagon. NGOs are popping up across the landscape, making sure they have some reference to mountains in their titles. As a result, a perfectly legitimate issue (sustainable mountain development) gets elevated to the status of a global buzz word which stimulates the calling of conferences, workshops, and international consultancies to further discuss the meaning of the buzz word. Many developers, scientists, and bureaucrats who have not done their homework are getting on board and, therefore, a great deal of unfounded declarations are flying off the walls of donor offices.

I argue that before we rush too far along the mountain conferencing circuit—however pleasant it may be—we need to create this database or at least the framework for its creation (see also Metz 1989 for an attempt to classify subsistence production types in Nepal). Mountain

peoples and their lives have been thoroughly researched over the past century or more by every conceivable discipline. There are archives that tell us far more about the mountains than any hastily called workshop could ever discover. But it means digging into the existing files instead of indulging in shop talk over cocktails.

ICIMOD, like the International Potato Centre with its potatoes, is the only internationally organised institute which has the history, focus, and critical mass of personnel to provide the leadership for Chapter 13 of Agenda 21. However, it must show how, in the HKH, a systematic approach to the collection of relevant information can lead to a macro understanding of what is happening in this region. From this database, decisions can be made about representative watersheds, landscapes, or "planning areas" where micro-level research can be conducted as a model for extrapolation of research, technologies, and improved farming systems (Papola 1996). The same Mountain Farming Systems' Mapping project can and should be replicated in the Andes, East African Highlands, and other mountainous regions of the world.