Chapter 3

Eco-Regional Approach to Rehabilitation of Degraded Lands in Mountain Ecosystems of the Hindu Kush-Himalayas

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Introduction

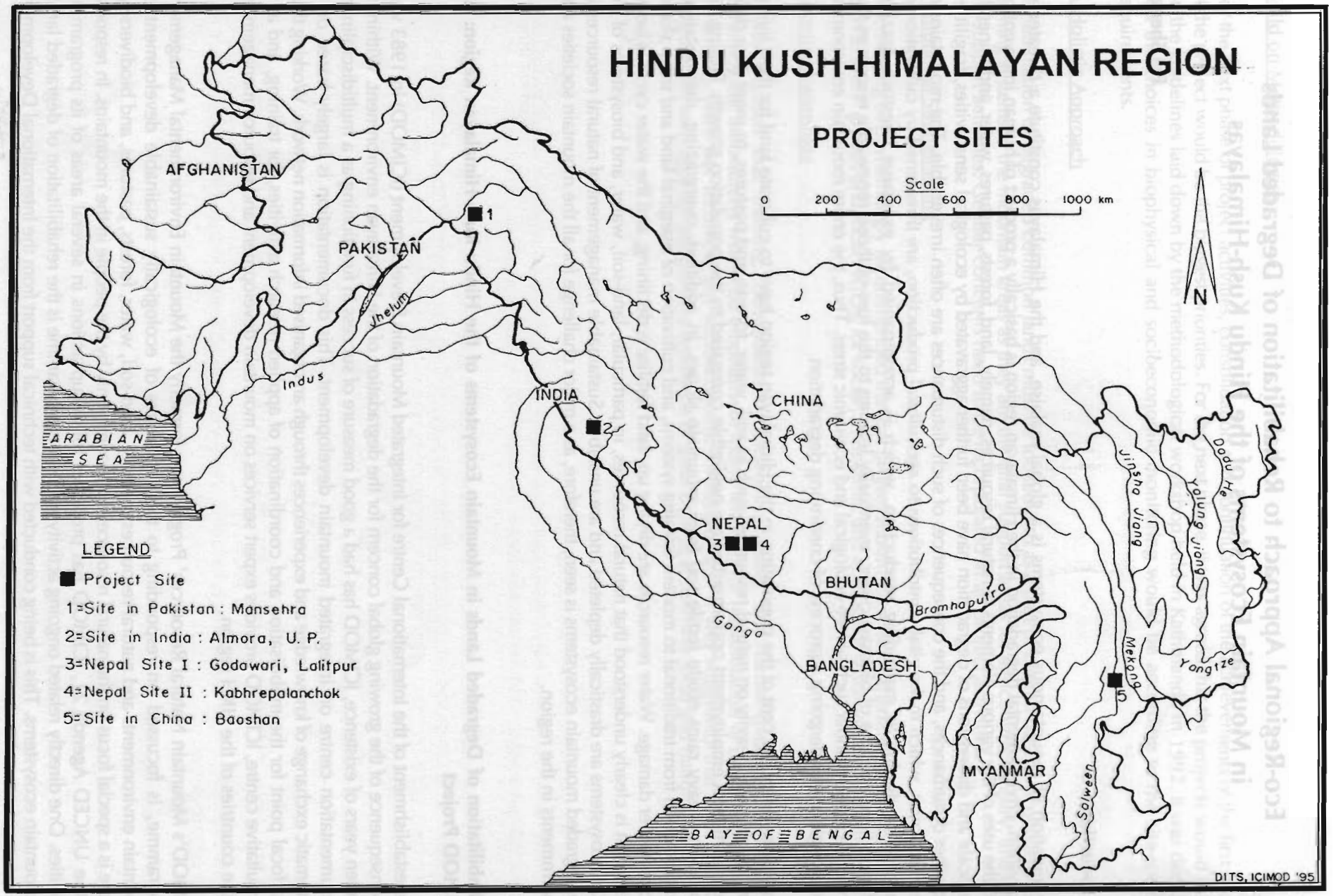
Degradation of mountainous ecosystems is a global malaise, and the Himalayas constitute a threatened ecosystem. Environmental degradation in the Himalayan region is basically a product of human intervention into the uses of the various elements of natural resources, namely, land, forests, pastures, water, and minerals. The scale and dimensions of degradation have been further aggravated by ecological sensitivities, fragilities, and other disturbances, and the consequences of such disturbances are often irreversible. The mountains of the Himalayas, which make vital contributions to agricultural production, are threatened by cultivation of marginal lands due to expanding production, which is accompanied by excessive livestock grazing, deforestation, and loss of biomass cover, eventually leading to the loss of those renewable resources that cannot be revived under such severe ecological and economic stress. Thus, the entire mountain environment in our region is undergoing a process of continuing degradation.

More than ninety per cent of the population in the Himalayan region have to cultivate land for their living. Rural people rely heavily on natural resources, such as soil, water, forests, and pastures, to meet their daily needs. Off-farm employment opportunities are negligible compared to the population growth. During the monsoon, heavy rains erode fertile soil from mountain slopes. In addition, overgrazing, deforestation, transformation from traditional to modern farming systems, and cultivation of marginal land and steep slopes evoke further damage. Water resources are drying up, land fertility is declining, and the water cycle is being affected. It is clearly understood that natural resources, in particular, land-soil, water, and biosystems of the HKH ecosystems are drastically depleted and are unstable. Sustainable management of natural resources in the degraded mountain ecosystems is seen, therefore, as a major challenge for all the mountain societies and governments in the region.

Rehabilitation of Degraded Lands in Mountain Ecosystems of the Hindu Kush-Himalayan Region: An ICIMOD Project

The establishment of the International Centre for Integrated Mountain Development (ICIMOD) in 1983 was a consequence of the growing global concern for the degradation of the Himalayan environment. Within its first ten years of existence, ICIMOD has had a good measure of success in functioning as a multidisciplinary documentation centre on integrated mountain development. This documentation is largely based on a systematic exchange of knowledge and experiences through an organised information network. Working thus as a focal point for the mobilisation and coordination of applied research activities, for training, and as a consultative centre, ICIMOD provides expert services on mountain development and resource management to the countries of the HKH region.

ICIMOD's Mountain Natural Resources' Programme, formerly the Mountain Environmental Management Programme, is focussed on responding to the challenges of ecologically sustainable development of mountain environments and natural resources, namely, land-soil, water, forests, pastures, and biodiversity. There is a special focus on the natural resources used commonly by the people in the mountains. In response to the UNCED Agenda 21, ICIMOD has proposed follow-up actions in several areas of its programme activities. One directly related ongoing activity under the programme is the rehabilitation of degraded lands in mountain ecosystems. This is being conducted with technical support from the International Development



Location map of field sites: ICIMOD Project on Rehabilitation of Degraded Lands in Mountain Ecosystems in the HKH Region

Research Centre (IDRC), Canada. This programme has direct relevance to Agenda 21 in the context of an integrated approach to planning and management of land use, as well as combatting deforestation with enhanced protection, sustainable management, and rehabilitation of degraded forest lands.

This project was designed to examine comprehensively the problem of degraded lands in different mountain ecosystems of the HKH region. Its main objectives are:

- to develop a better understanding of the extent, forces, and processes underlying land degradation; and
- to identify measures for restoring and developing degraded lands in different mountain ecosystems by using options that are field-tested and found to be economically, environmentally, and socially viable.

Regional countries participating in the implementation of the project are China, India, Nepal, and Pakistan and the collaborating institutions in those countries are as follow.

China
- Kunming Institute of Botany, CAS
- Kunming Institute of Ecology, CAS
- Chengdu Institute of Biology, CAS

India
- G.B. Pant Institute of Himalayan Environment and Development

Pakistan
- Pakistan Forest Institute

Nepal
- Department of Forests, Ministry of Agriculture and Forests, Government of Nepal
- Forest Users' Groups of two village VDCs, Kavrepalanchok district, and the District Forest Office

A principal focus of this project is to systematically identify and document land degradation, to make a comparative study of farmers' options, and to identify land rehabilitation alternatives in different mountain ecosystems through field case studies in the region. The search for viable solutions must, therefore, begin with an understanding of the land users' group in relation to allocation of resources in the project areas. This is to be achieved by developing and implementing community action plans in close consultation with the collaborative institutions and local people through on-site activities in all participating countries of the project in the HKH region. Thus, five field sites were chosen in four countries for this action-oriented project (Report of ICIMOD Workshop, 1993).

Objectives

The Methodology Workshop on Rehabilitation of Degraded Lands in Mountain Ecosystems of the HKH Region was conducted in May 1993 in Kathmandu, Nepal. It was organised as an initiating activity, prior to project implementation, to orient collaborating agencies on methodologies to rehabilitate degraded mountain lands in different mountain ecosystems in the region.

The second of the series of workshops was held in Baoshan, Yunnan province, China. Discussions were held to explore alternative approaches for rehabilitating degraded lands in mountain ecosystems of the HKH region. The choice of the Baoshan site for the workshop was to demonstrate the success of the ICIMOD project and also to give participants from collaborating institutions from other participating countries a chance to visit the field site in Baoshan. The site is located 45km from the city on the Sino-Burmese highway in the upper Salween River Valley. The objectives of the workshop were:

- to examine the major output generated so far from the implementation of the ICIMOD project;
- to discuss the important findings from field-based case studies of the project being implemented in all participating countries and other relevant studies from the region, including action research, field demonstrations, and extensions;

- to discuss the type of training materials that could be prepared by collaborating institutions, including future follow-up in the field studies; and
- to discuss and identify priority programme activities for the future, including the necessity and scope of the next phase of the project.

Country	Location of Site	Project Land Area	Land Tenure	Started
China	Damay village, in Pupiao sub district of Baoshan, Yunnan.	- 45ha denuded forest land - 7.5ha farming land. Alt. 1370-1750m	Community forest land. 136 house- holds involved	- Field survey and PRA training, Sept. 1992 - Planting July, 1993
India	Arah village in Kature Valley, Almora, U.P.	- 9.5ha abandoned farming land Alt. 1,490m	86 Individual households involved under village forest panchayat management	- Field survey Feb. 1993 - Planting & water harvesting, fencing July , 1993
Nepal	Site I: Godawari in Lalitpur District of Central Nepal	- 3ha degraded forest land with bushes. Alt 1,600m	ICIMOD Field Demonstration site. Land was given by the government	- Field survey February, 1993 - Site development March , 1993
	Site II: Bajrapare and Dhaireni in two villages in Kavrepalanchok District of Central Nepal	- Bajrapare 6.76ha - Dhaireni 15.93ha Alt. 8,900-1,000m All denuded forest land	Community forest land under two users' groups	- Field survey March 1993 - Site development July, 1993
Pakistan	Sinkari Valley in Manshra District of Abottobad Hill Division	- 15ha. abandoned farming land in Tarbela and Mangla catchment. Alt: 1,400-1,550m	Individual land- 18 households involved	- Field survey Aug. 1993 - Site development October, 1993

Eco-Regional Approach in the Himalayan Context

Rehabilitation of ecosystems and their sustainable development, more specifically the sustainable management of natural resources, are closely interlinked. The interplay of ecology, sociology, economics, anthropology, and culture needs to be consolidated for a comprehensive rehabilitation strategy. The ultimate objective of rehabilitating the ecosystem is to manage natural resources in a manner that satisfies current needs, as well as allowing for a variety of options for the future.

There is a great deal of research being undertaken in the Himalayan region. Ives and Messerli (1989) pointed out that most of the existing research projects are "too narrowly defined" and "too local" and "limited in duration." "They reflect specific interests and often a process of one-way thinking .....,"without any real correlation to the broad regional-scale problems." They further suggest that what is needed is " a systematic and more nearly interdisciplinary approach tilted at seeking to understand the magnitude and intensity of key processes and [it] should fit into a regional concept." It is, therefore, imperative to develop a regional approach for rehabilitation of degraded ecosystems in the Himalayan region.

Approach

An eco-regional approach for rehabilitation of degraded lands of the Himalayan mountain ecosystems was then identified through project implementation. This approach was based on the following fundamental facts in the context of Himalayan environmental degradation.

1. Human interventions influencing land use in mountain areas are many. Population growth is often cited as a prime cause of land mismanagement. Changing farming practice with intensive crop production by means of modern technology is seen as another cause of land degradation. In the middle hills of the Himalayan region not only is the population density very high, but commercialisation of agriculture is also a rapidly developing process. Thus, considering the regional scale problem of the project and that the nature of ecosystem rehabilitation and management is site specific, the middle hills (from 1,000-1,600masl) were chosen as the bioregional area for the project.
2. An understanding of the ownership and use patterns of natural resources, such as private, common, public, or any combination of these three patterns, is critical for elaborating and defining rehabilitation strategies; which may require different rehabilitation tactics. This project focussed on common lands (degraded community forest land), but in the region land could often be under a combination of three ownerships which could not be practically separated from each other for resources' management.
3. The impact of land degradation extends deeply into the economy and the environment. Rehabilitation ecology has to effectively integrate ecological, economic, sociocultural, and political dimensions of the setting in which it is attempted. In this vein, ecological concepts and processes should be adapted to social processes and perceptions. In order to achieve long-term environmental benefits and goals, short-term economic benefits to local villages must be prioritised in project implementation.
4. Community participation is crucial for rehabilitation of degraded lands, building-up community/users' group institutions with support from local governments is the key to success.
5. Ecosystem rehabilitation and management are part of a dynamic process and should be monitored continuously and, therefore, should be designed to be flexible and responsive to modification. Baseline survey and monitoring systems should be established at all field sites from the very beginning.

Methodology

The specific methodological components of the ecoregional approach to the rehabilitation of degraded lands in the Himalayan ecosystems being implemented in the field case studies of the project are the following.

1. Integrated biomass development and water-soil management technologies are being employed as the major technical components for rehabilitation. Use of fast growing and nitrogen-fixing tree species (native and exotic) adapted to degraded sites can accelerate forest rehabilitation and improve soil fertility. While native species may be the best option (such as *Alnus nepalensis, Tephrosia candida*), exotics can be used as facilitators after careful evaluation (such as *Robinia pseudoacacia* and *Flemingia macrophylla*). Since soil and water conservation and management are crucial for ecosystem rehabilitation, integrated indigenous water harvesting and mud-rock check-dams, improved mini-water tanks, and other water-soil erosion control methods, such as hedgerow planting and cost-efficient checkdam constructions, are being tested at field level.
2. In order to integrate the components, effective linkages amongst the local people, their institutions, government agencies, NGOs, and scientists involved in project implementation are essential. The peoples' active participation in the site villages is seen as the central issue for the success of the project. While rehabilitation work should provide a wide range of benefits to various stakeholders, the socioeconomic needs of the local communities and user groups should be a major consideration. The project, therefore, introduces and promotes high-value crops and high-production fodder species into the site areas, while introducing rehabilitation of water harvesting and irrigation systems, providing better opportunities for villagers to improve their farming and daily life.
3. Environmental monitoring is seen as the basis for systematic study at the ecosystem level. The monitoring network has to be maintained and data collection at all sites has to be a continuous process

in order to acquire long-term data on precipitation, runoff, erosion, soil fertility, biomass, and socioeconomic conditions. Thus, all measurements of rainfall, discharge, sediment transport through storms, soil erosion on erosion plots, and biomass recovery on site areas, will be available during the project. Changes in land use, soil fertility, population, and socioeconomic conditions are to be measured by conducting an up-dated survey in the next phase, if possible.

4. Data evaluation and watershed management during the second phase of project implementation, if applicable.
   The GIS database will be expanded and models will be superimposed on it to arrive at scenarios for watershed management. With sufficient information on rates of change in population, resources, fertility, land use, and production we will be able to forecast the possible consequences induced by development efforts. A watershed management plan will be developed in collaboration with the local community. This should include components of forest management, water distribution for irrigation and consumption, soil fertility, crop rotation, biomass production, and socioeconomic conditions. All of these should be integrated, but individual sub-models will be developed with those community groups most affected or most intimately involved in the management of the resource (e.g., women's groups in forest management for firewood and animal feed).
5. Socioeconomics and community-based initiatives for soil-water conservation and fodder-fuelwood production from site areas.
   Maintaining sufficient and healthy soil-water resources in the site area of the watershed is clearly the most important issue in sustaining the mountain population. The rehabilitation trials on improving soil fertility through nitrogen fixers, promoting changes in fodder supplies to generate more manure, altering the crop rotation sequence, and introducing trickle-irrigation are all aimed at improving the conditions and production capacity of the watershed.These approaches also prevent damage from erosion and sedimentation in downstream systems. To bring about such changes, it is necessary to examine the socioeconomic conditions and community-based initiatives. The fodder tree initiatives and rehabilitation of degraded lands are to be carried out with women's groups. This will be initiated by conducting a socioeconomic survey to document perceptions and concerns about animal feed and firewood production. The trials are being carried out in collaboration with user groups on degraded slopes and marginal lands since these sites are the most vulnerable.

Progress Summary of Project Activities (1992-94)

The focus of the regional project has been to improve the condition of degraded lands through the mobilisation of local people and institutions. It has been carried out in four countries in the Himalayan region and initial results and efforts, both in participatory management and performance of trial treatments, have been very encouraging and promising.

Progress, however, in research and development activities (1992-94) at different sites, was uneven due to the different dates of actual commencement of the project. The China Site started on September 23, 1992; the India Site started on January 6th, 1993; Nepal Site I started on March 1st, 1993; Nepal Site II started on April 19, 1993; and the Pakistan Site started on October 23rd, 1993 (all these are the dates on which MOUs with country collaborative institutions were signed).

To date, some of the most important project milestones are summarised as below.

1) Institutional collaboration and local mechanisms for project implementation have been established. A Methodology Workshop on Rehabilitation of Degraded Lands in Mountain Ecosystems of the Hindu Kush-Himalayan Region was held in 1993 at ICIMOD to develop guidelines for project implementation.
2) An interdisciplinary research team was established to examine resource problems in cases where local community user groups are an integral part of the research programme.
3) Baseline information has been developed for understanding key environmental processes that lead to degradation. The main concerns are water deficiencies during the dry season, declining soil fertility, and excessive use of forests. Cheap water-harvesting tanks with plastic sheet lining have been introduced

to promote biomass development on degraded lands, thereby improving the site condition. Biogas technology has been promoted for recycling organic wastes into high quality manure and gas fuel to relieve the pressure exerted on forest lands.

4) A very intensive monitoring network was established to document environmental processes. Monitoring includes hydrology, soil erosion, soil fertility changes, rate of biomass recovery, and changes in socioeconomic conditions. The quantitative data generated are now advanced on key environmental variables that influence degradation processes.
5) On-site training and education were major focuses of this research programme. ICIMOD professional team members were exposed to advanced GIS techniques and database management. Local farmers and community user groups were trained on the uses of A-frames (Sloping Agricultural Land Technology) to establish contour lines for hedgerow plantations. Besides, local user groups were exposed to appropriate technologies on nursery establishment, gully management and control, construction of inexpensive check-dams, and simple water storage and management systems for smooth running of the project.
6) Attempts have been made to translate the research results into development in collaboration with local farmers at the several demonstration sites. Initial results have been very promising. Rehabilitation techniques, such as hedgerow planting, the use of pioneer species that are native nitrogen-fixing, exotic species as facilitators, soil amendments, planting leguminous crops and grasses, and intercropping with species with low nutrient demand, have had a positive impact on the restoration process and biomass development. Tree nursery establishments to regenerate a pool of all the native nitrogen-fixing fodder trees have enhanced local biodiversity and assured the community of a constant supply of local species.
7) It is anticipated that short-term economic benefits will be enjoyed by the local community through sustainable biomass development and conservation methods which improve the ecological restoration processes.

Future Follow-up in Perspective

Rehabilitation has to operate in various socioeconomic conditions and biophysical environments. The objectives of rehabilitation may differ. Therefore, one may have to consider different time-frames, for instance short-term (up to 10 years) or long-term (over 10 years).

The project activities initiated in the past two years or more have already built up the necessary foundations for better development of alternative approaches and technologies at field level. Furthermore, there is a critical need for follow-up actions for the success of the project. As biomass management, soil and water conservation, community participation, and better understanding of micro- and meso-level biophysical processes are important for rehabilitation, and to further promote sustainable use of mountain resources and management of sloping lands, these processes need to be continuously tested, refined, and developed. Any work on biomass restoration and soil-water conservation with community participation requires a long-term perspective, the shortest time-frame of such projects ought to be six years at least. Therefore, we propose a three-year extension for the second phase of the project that is being implemented, for the donor agency to consider and support.

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