

Land Policies, Land Management and Land Degradation in the Hindu Kush-Himalayas

India Study Report

T. N. Dhar

**International Centre for Integrated
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2000**

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Preface

This study, commissioned by the International Centre for Integrated Mountain Development (ICIMOD) as a part of the Global Mountain Initiative is broadly concerned with understanding and evaluating the land policies, the land management practices, and land degradation that have resulted over time in the Hindu Kush–Himalayas. For India, two studies have been planned: one for the northeastern and one for the northwestern Himalayan regions. The Society for Himalayan Environmental Rehabilitation and People's Action (SHERPA) has been entrusted with the northwestern Himalayan region that, geographically, covers Jammu and Kashmir, Himachal Pradesh, and the northern hill areas of Uttar Pradesh in India. The scope, agenda, and methodology of the research include land and land-related policy evolution and implementation by government or other institutions; gaps between policies and ground realities; stakeholders' perceptions; interdepartmental, interinstitutional, and interagency conflicts and their resolution; and desirable changes in ways that policies are formulated and implemented. The study will also examine other policies that have impacts on land use, problems of land degradation, access to land resources, links between policies and their environmental impacts, and required areas of research.

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Abstract

The present study on land policies, land management and land degradation in the north western Himalayan region of India is a part of an overall effort by ICIMOD to assess the impact of land policies on land management and land degradation in the Hindu Kush Himalayan region. The study geographically covers states of Jammu and Kashmir, Himachal Pradesh and hilly region of Uttar Pradesh.

The study has touched upon a variety of research issues related to land policy, management and state of degradation. These include, land and land related policies evolved and implemented by the state governments and the Federal government. The policy area scope of the study included all land policies pertaining to environment, forests, agriculture land use, land reforms, common property land management, biodiversity, wild life, and agricultural policies. Gaps between policies and ground realities have been analysed and highlighted in appropriate areas. The study also looked at processes and evolution of various land policies in this region and interesting facts have come to light in different states.

Study has indicated that stakeholders' perceptions about sustainable land use may differ much from the land use plans of governments. Similarly, study also highlights the differences about land use approaches among various agencies and governments. Consequently, policies and land use planning for water, energy, demography, industrial development, tourism prepared by different departments/agencies show marked differences. The diversity of policies and land use approaches have led to the evolution of a mosaic of land degradation problems and contributing factors.

ACRONYMS

AISLUS	All-India Soil and Land Use Survey Organization
BR	Biosphere Reserve
CCF	Chief Conservator of Forests
CPCB	Central Pollution Control Board
CPLR	Common Property Land Resources
CSWCRTI	Central Soil and Water Conservation Research and Training Institute (Dehradun)
DDP	Desert Development Programme
DFO	Divisional Forest Officer
DPF	Demarcated Protected Forest
DPAP	Drought Prone Areas Programme
EEC	European Economic Community
EIA	Environment Impact Assessment
EIC	East India Company
FD	Forest Department
FSI	Forest Survey of India
GAREMA	Gramin Resource Management Association
GHNP	Great Himalayan National Park
GIS	Geographic Information System
GOHP	Government of Himachal Pradesh
GOI	Government of India
GOUP	Government of Uttar Pradesh
HKH	Hindu Kush-Himalaya
HP	Himachal Pradesh
HYV	High Yielding Variety
IBP	International Biological Programme
ICAR	Indian Council of Agricultural Research
ICIMOD	International Centre for Integrated Mountain Development
IGFRI	Indian Grassland and Fodder Research Institute
IPM	Integrated Post Management
IPNM	Integrated Plant Nutrition Management
IRs	Indian Rupees
IUCN	International Union for Conservation of Nature and Natural Resources
J&K	Jammu and Kashmir
JFM	Joint Forest Management

KFGC	Kumaon Forest Grievance Committee
MAB	Man and Biosphere Programme
ME&F	Ministry of Environment and Forests (New Delhi)
MPF	Minor Forest Produce
NBPGR	National Bureau of Plant Genetic Resources
NFCTCR	National Facility of Plant Tissue Culture Repository
NFP	National Forestry Policy
NGO	Non-governmental Organization
NRRC	National Resources and Research Centre (Mussoorie)
NTFP	Non-Timber Forest Produce
NTP	National Tourism Policy
NWDB	National Wasteland Development Board
NWDPPRA	National Watershed Development Programme for Rainfed Areas
NWHRI	North Western Himalayan Region of India
PCB	Pollution Control Board (Central)
PFM	Participative Forest Management
PRA	Participatory Rural Appraisal
RF	Reserved Forest
RNP	Rajaji National Park
S&T	Science and Technology
SHERPA	Society of Himalayan Environmental Rehabilitation and People's Action
SHG	Self Help Group
SLUB	State Land Use Board
SPBC	State Pollution Control Board
SPWD	Society for Promotion of Watershed Development
SWOT	Strengths, Weaknesses, Opportunities and Threats Analysis
SWS	Sub-Watersheds
TOR	Terms of Reference
UP	Uttar Pradesh
UPF	Unprotected Forests
VFC	Village Forest Committee
VFDC	Villae Forest Development Committee
VIPKAS	Vivekananda Parvatiya Krishi Anusandhan Shala, Almora
VP	Van Panchayat
WTO	World Tourism Organization
WWF	World-wide Fund for Nature and Wildlife

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Chapter 1

Introduction

Mountains are characterised by fragility, inaccessibility, and marginality. The cost of mismanagement and neglect in such areas is severe. In terms of highland–lowland relationships, mountain communities suffer from political and economic marginality with respect to lowland areas and centres of power. The needs and concerns of mountain people are not adequately reflected in policies and laws, particularly if such regions are part of a larger country.

The Hindu Kush–Himalayan region has a diversity of environments ranging from the subtropical to the arctic. The region is characterised by remoteness, isolation, fragility of environments, poverty, and shrinking resource bases. What is true of the Hindu Kush–Himalayan region is almost equally true of the Northwestern Himalayan Region of India (NWHRI), an area that constitute the States of Jammu and Kashmir, Himachal Pradesh and the hill areas of Uttar Pradesh. This is a region where industrial and commercial activities have a limited presence. More than three-quarters of the population depend on primary occupations for employment and

subsistence, most of which are directly or indirectly land-based. Therefore, land is an important resource. However, usually in mountain regions, most land is snow-covered, rocky, barren, uncultivable and non-usable. The remainder has to be shared by forests, grasslands, agriculture, horticulture and non-agricultural uses, e.g., urban settlements, roads, dams, industries, etc. In 1991, the NWHRI per capita availability of agricultural land was only 0.1 ha, while that of forest land was 0.3 ha. By the end of the decade, it will have fallen by nearly a further 20 per cent.

The issues addressed in this study relate to the evolution, implementation and impact of land policies in the mountain areas of NWHRI. Land management practices and responses to policy on resource quality and sustainability are examined. An attempt is made to quantify the symptoms of land degradation and diagnose its causes.

Choice of Issues for the Study

Land use and management depend on land policies. In the Himalayan region,

degradation of land is common. The present study is concerned with the links between policy, management, and degradation. The most important uses of land in the NWHRI are forestry, agriculture (with its allied sectors), grazing, foraging, and the setting up of special areas for the protection of biodiversity including flora and fauna (wildlife). There are also non-agricultural uses such as urbanisation, roads, and industries, but land needs for these purposes are, as yet, comparatively low. There are region-specific uses that can vary in importance from area to area. Another aspect of land use and management is control over and access to resources. Land can be government-owned; it can belong to communities; it can be possessed by individuals. Tenure titling, granting of access/usufruct rights and common-property land resource uses can affect sustainable land management. Therefore, the choice of issues for the study is as follows.

- Forestry
- Agriculture
- Land, property regimes (tenure, titling reforms and common property land resource management)
- Biodiversity (national parks and wildlife)
- In addition, the following region specificities have been chosen.
- Water resources (development, management and uses)
- Tourism

These policy areas have tremendous impacts on the livelihoods of people living in the NWHRI; their standards of living, quality of life, and their subsistence. They also have an important bearing on the well-being and sustainability of mountain lands and environments.

While this study has, to a large extent, been based on secondary data and discussions with experts in the NWHRI, it was

considered expedient to elicit the opinions and views of government officials, experts, NGOs, research institutions, and others working in the fields of land and water management, soil conservation, forest management, and protection of the environment. To facilitate this, a structured questionnaire was sent to selected individuals, organizations, and officials. The questionnaire, although structured, provided ample scope for giving free and frank views. Replies were obtained from a number of knowledgeable respondents—including academicians, foresters, administrators, research institutions, land/water scientists, and NGOs. The questionnaire was divided into five parts: general, forest, land holdings, common lands, and water. A brief summing up of the responses can be found in Annex 1.

National Conservation Strategy

Concern over the need to integrate environmental and developmental issues is a phenomenon only a little over two decades old. The quest for achieving a balance between the needs of growth and sustainability in the context of structural changes that will bring about a shift from an agricultural/rural economy to an industrial one demands overall policy guidelines. As a consequence, the National Conservation Strategy was published in India by the Union Ministry of Environment and Forests in 1992. The primary purpose of the policy statement was ‘to reinforce our traditional ethos and to build up a conservation society living in harmony with nature and making frugal and efficient use of resources guided by the best available scientific knowledge’.

The document examines environmental problems highlighting the fast-increasing demand on resources, poorly planned development, severe impacts on the health and integrity of natural resources, and the need to fulfill basic human needs. Severe

population pressures (human and animal), degradation of land and forest, loss of habitats, mounting water problems, urban sprawl and stress, rising pollution levels, and overall environmental degradation are emphasised in unambiguous terms. Recognition is given to the complexity of the problems and that it is 'difficult to delineate clearly the causes and consequences of environmental degradation in terms of simple one-to-one relationships. The causes and effects are often interwoven in complex webs of social, technological, and environmental factors'. Development has to be sustainable and models followed earlier need to be reviewed.

The policy statement lists various regulatory and promotional measures that have already been taken: laws relating to wildlife, water and air pollution, forest conservation, and environmental protection; and, establishment of various institutions (Departments of Environment, Science and Technology, central and state Pollution Control Boards, Forestry Board, Indian Grassland and Fodder Research Institute, Forest Survey of India, National Wasteland Development Board, etc.). It states that a new forest policy was adopted in 1988. Various programmes for land and soil improvement have been initiated. Environmental impact assessment procedures have been prescribed. Research and training have been intensified and awareness campaigns launched.

It outlines the agenda for achieving sustainable and equitable use of resources, preventing future deterioration of life-support systems, restoring ecologically degraded areas, minimising adverse environmental impacts of development projects, conserving and nurturing biological diversity, and protecting scenic landscapes, wildlife habitats, and areas of cultural heritage. It underlines 'participation of people in programmes for environmental

improvement', prior environmental clearance for projects that are large or located in ecologically sensitive areas, and incorporation of safeguards in 'policies', planning, site selection, choice of technology and development, industry, mineral extraction, and processing, energy, forestry, transport, and human settlement. Priorities for action include population control, integrated land and water management, pollution control, conservation of biodiversity, meeting biomass requirements of the rural poor, etc.

The statement concedes that the 'objectives of conservation and sustainable development will require integration and internalisation of environmental consideration in policies and programmes of development in various sectors'. It lists in some detail the measures required to be taken in the following sectors: agriculture, irrigation, animal husbandry, forestry, energy generation and use, industrial development, mining and quarrying, tourism, transportation, and human settlements. International cooperation has been stressed and so has the need for strengthening institutions and legislation. Training, research, environmental education, role of NGOs, and resource-accounting have been identified as important inputs. It has also been stated that women at the grass root level should be actively involved in conservation programmes and constructive partnerships established between the central and state governments.

Since agriculture, forestry, biodiversity, land and water resources, and tourism are the themes of this study, the main strategies for these sectors are listed here.

Agriculture

- Sustainable farming (including animal husbandry)
- Plant protection policies (use of biofertilizers and biopesticides)

- Integrated nutrient supply
- Restrictions on diversion of prime agricultural lands to other uses
- Land use according to land capability
- Upgrading animal stock, restoration and protection of grazing lands, encouragement of stall-feeding and rotational grazing, regulation of animal population
- Conservation of water and energy in agriculture
- Encouragement of appropriate crop-rotation patterns
- Strengthening of rural local bodies to ensure decentralization and optimal resource management

Forestry

- Preservation and restoration of forests
- Increase in forest/tree cover through social forestry and afforestation programmes
- Increase in productivity of forests
- Meeting of fuelwood, fodder, wood products, and small timber needs of rural/tribal populations in consonance with carrying capacity of forests
- Restriction of non-forest uses on forest land; and, where unavoidable, insistence on compensatory afforestation
- Afforestation of common-property land resources by local communities
- Encouragement of tree-farming
- Involvement of local communities/NGOs in afforestation

National Parks and Wildlife

- Formation of National Wildlife Action Plan
- Forty-five per cent coverage of the country by national parks and sanctuaries
- Establishment of biosphere reserves and protected areas

Water Resources

- Efficiency increases in water use, water conservation, and recycling
- Provision of drainage as an integral component of irrigation
- Watershed management through catchment treatment
- Focus on a decentralized network of small irrigation projects
- Formulation of a National River Action Plan
- Conjunctive use of water

Tourism

- Promotion of sustainable growth of tourism based on carrying capacity
- Development of tourism in harmony with the environment without affecting the lifestyles of local people
- Strict regulation in sensitive areas such as hill slopes, islands, coastal stretches, national parks, and sanctuaries

In developing the national policy statement it seems care has been taken, by and large, to incorporate and integrate objectives and strategies of other sectoral policies developed at the national level. Even so, some priority areas have been missed. For example, there is little mention of land reform or management of common-property resource lands within villages. The joint forest management concept has not been referred to, although policy guidelines in this regard were issued in 1990. Similarly, reduction of non-productive cattle is not included. Discouragement of monocultures should have been underlined. Deconcentration of tourist locations, especially in the hills, could have received attention. That environment as a subject be intrinsically included in the general educational curricula should have been clearly stated. There is no emphasis on the need for reducing the population growth rate.

Important deficiencies are effective implementation of policies, enforcement of laws and regulations, and inadequacy of public-hearing systems. The legal framework has been considerably strengthened and, in recent years, judicial interventions have had a salutary effect on compliance with environmental laws and regulations. The public interest litigation system, which has expanded in scope, has resulted in interventions in favour of land, forests, environmental protection, and pollution abatement. In the 1990s, the government issued a comprehensive Policy Statement on Abatement of Pollution that emphasized the setting up of stricter standards for pollution levels, integration of environmental concerns across the board in various sectors, departments, agencies and levels, the addressing of non-point pollution issues (e.g., runoff of agricultural inputs such as pesticides and fertilizers), biomass production enhancement, environmental audit and public partnerships.

The Ministry of Environment and Forests was set up in 1980 as a focal agency for environmental policies and programmes. Objectives of the ministry encompass environmental law and policy, pollution monitoring and control, conservation of natural resources, management of forests and wildlife protection, environmental awareness and education, and promotion of research. There are six regional offices. Every state has a Pollution Control Board and there is a Central Pollution Control Board. However, there are severe implementation and compliance gaps. This is partly because there is a shortage of manpower and resources and partly because of lack of cooperation and coordination with other departments, agencies, and organizations at both central and state levels.

Area Definition and Statistical Profiles

The northwestern Himalayan region of India (NWHRI) consists of the States of Jammu and Kashmir, Himachal Pradesh and the Uttar Pradesh hills—an area of 331,495 sq.km. Its population, according to the census of 1991, was 11.9 million people. Relevant statistical indicators for India can be found in Annex 2.

Jammu and Kashmir is one of eight special-category states that, on account of geographical and economic considerations, have been given this status for development funding and other purposes. The state's economy is largely agricultural. The industrial base is extremely narrow. Most mass consumption items are imported. Apart from agriculture, the main economic activities are carpet/s hawl weaving and production of handicrafts, horticulture, and tourism. The state has experienced militant activities during the last decade. Unemployment is high. Tourist traffic to the Kashmir Valley has dwindled sharply, although it has risen in Jammu Division. Horticulture is doing well and so is production of handicrafts and woollen goods. Forests have suffered from illegal felling in recent years. There is considerable potential for hydro-electric energy that has remained largely untapped.

Himachal Pradesh has a predominantly agro-horti-pastoral economy. Geographic and climatic conditions are suitable for growing a wide variety of fruit and cash crops such as disease-free seed potato, off-season vegetables, ginger, vegetable/flower seed, mushrooms, and other high-value crops. The increase in fruit production has been remarkable. Tourism, woollen goods, and crafts are important components of the economy. Forest cover is inadequate and of low quality. The state has an immense potential for hydel power—estimated at 20,000MW.

The hills of Uttar Pradesh are part of India's most populated state. The economy of the region is agrarian with industry contributing marginally. Forest cover is about 44 per cent of the area and a little less than one-third is 'open forest with canopy cover of less than 40 per cent'. Pressure on forests is severe from both human activities and animal grazing. Agriculture in the uplands is marginal. The area under horticulture is on the increase. Tourism is an important economic activity.

Table 1 gives socioeconomic details of the NWHRI.

Administration, Policy and Stakeholders

Before independence, the bureaucracy of the country enjoyed a great deal of authority and power in policy-making and implementation. After independence, especially from the mid-1960s on, the role of bureaucracy in policy formulation declined sharply. People, including political, social, and academic thinkers and policy-makers, are now inclined to acknowledge that voluntary associations, non-governmental initiatives, and decentralized, democratic institutions provide important alternatives and supplementary means to state action for empowering the citizen. For this purpose, community mobilisation and community coalitions are necessary. In 1992, amendments to the Indian Constitution provided for empowered, democratic institutions of self-governance at village, block, town, city, and district levels. This indicates a determination to move towards decentralized public arenas for deliberation and decision-making so that people gain greater control over their lives. The most difficult task is to operationalise these intentions. There are numerous stakeholders—central and state governments, political parties, social collectives, entrepreneurs and investors, external donors, scientific and research

organizations, NGOs, and the common man. Policy planning and implementation become a series of interactions to be managed with care, and carried out with openness, width and depth of discourse, and honesty of purpose so that governance becomes transparent, responsive, and accountable and results in higher levels of satisfaction and better quality of life for all those who comprise the nation.

Politics and administration play a role in both policy formation and execution. Policy-planning mechanisms or institutions are needed to enable the political executive to formulate policy with knowledge and competence. In India, policy planning on a continuous basis remains to be institutionalised; *ad hoc* arrangements exist. The Planning Commission plays some role, and, from time to time, policy documents do emerge through the setting up of *ad hoc* expert groups. Some ministries have policy-planning cells but these, scholars say, act more as research units. Some non-governmental initiatives in policy analysis and research have also emerged. Many policies develop from political considerations: the imperatives of elections, and the compulsions of coalition governments. Many are responses to the demands of populism. There is a powerful need for institutionalising policy formulation. This is now a priority area for reform in governance and administration.

The gap between formulation and implementation of policies is another problem. No amount of good policy-making can or does survive the transition through bad implementation. This is where decentralization, intermediation, and institutional community partnerships can help to make the transition smooth and successful. Successful policy planning and execution demand a two-fold approach: building capacities and motivation for constructive group dynamics and dialogue amongst stakeholders; and, empowering

Table 1: Selective Statistical Profiles of the NWHRI

	Jammu and Kashmir	Himachal Pradesh	Uttar Pradesh hills
Geographical area (sq.km.)	222,240	55,670	53,585
Reporting area (sq.km.)	45,045	33,675	53,585
Average annual rainfall (mm)	Varies from year to year and location to location. Range of 100–2,750mm.		
Population (1990-91)			
total population	7,719,000	5,171,000	5,926,000
density (persons/km. ²)	171	93	116
decennial growth (1981-91) (%)	28.9	20.8	22.5
sex ratio (per thousand)	925	974	955
urban population (%)	21.1	8.6	21.74
rural population (%)	78.9	91.4	78.30
Literacy rate			
total (%)	27 (1981)	64 (1991)	50(1991)
male (%)	34 (1981)	75(1991)	76 (1991)
female (%)	16 (1981)	52 (1991)	44 (1991)
State income (million IRs)	52867 (1995-96)	40251(1995-96)	n/a
Per capita income (IRs)	6181 (1995-96)	7784(1994-95)	5874 (1995-96) (for the whole of UP)
Worker distribution			
main workers (%)	33	n/a	42
agricultural (%)	17	n/a	23
household, industries, services, manufacturing (%)	2	n/a	0.3
other (%)	48	n/a	34
Land use			
legally recorded area under forest (1997) (sq.km.)	20,182	37,591	34,249
actual area under forest (1997) (sq.km.)	20,440	12,520	22,660
net sown area (1990-91) (ha)	731,000	582,800	669,100
area under non-agricultural uses (1990-91) (ha)	303,000	193,200	136,500
net irrigated area (1990-91) (ha)	298,000	99,500	233,600
cropping intensity (1990-91)	146	169	164
smallholdings (less than one ha) (1990-91) (%)	34	64	70
total livestock population	8,700,000 (1992)	5,080,000 (1992)	4,240,000 (1988)
number of cattle	3,050,000 (1992)	2,150,000 (1992)	1,920,000 (1988)
number of sheep/goats	4,710,000 (1992)	1,190,000 (1992)	1,260,000 (1988)
area under horticulture (ha)	180,300 (1991-92)	170,800 (1991-92)	179,200 (1993-94)
production of fruit (tonnes??)	780,000 (1991-92)	460,000 (1991-92)	470,000 (1993-94)
Power (electricity)			
installed capacity (MW)	394 (1996-97)	n/a	n/a
villages electrified (%)	96 (1996-97)	100	77 (1995-96)
consumption per capita (kVA)	n/a	n/a	228 (1992-93)
Food production			
total food grains (tonnes)	1,508 (1996-97)	1,340,000 (1991-92)	1,515,000 (1993-94)
productivity of wheat (kg/ha)	1,699 (1996-97)	1,540 (1996-97)	1,758 (1993-94)
productivity of rice (kg/ha)	1577 (1996-97)	1,610 (1993-94)	2,004 (1993-94)
productivity of maize (kg/ha)	1,490 (1996-97)	2,110 (1993-94)	1,254 (1993-94)
No. of districts	14	12	12
No. of tehsils*	50	24	34
No. of development blocks	92	69	89
No. of villages	6758	16,916	15,117
Motorable roads (km.)	12,981 (1995-96)	16,213 (1992-93)	15,000 (1995-96)

Sources: Government of Jammu and Kashmir, n.d.; Government of Himachal Pradesh, n.d.; Government of Uttar Pradesh, n.d., 1996; FSI, 1997; Ministry of Agriculture, n.d.

* A *tehsil* is a sub-district

communities through broad-based, participatory local organizations capable of accessing local resources and taking on management functions.

Chapter 2

Land Policy and Uses

In India, national-level policies have been developed for land use. These policies cover mountain areas broadly. Naturally, in regional terms, they lack specificity and sharp focus. It is at the state level that policy applications undergo adaptations in details that keep in mind the national framework on one hand and the local situation on the other.

National Land-use Policy

In 1974, the national government asked the states to establish land-use boards. The Central Land-Use Board was set up in 1983. The National Land-Use Policy was released in 1998. Its objectives include allocating land for various purposes based upon capability criteria, increasing productivity, preventing land deterioration, enlisting community participation in land management, providing technological and extension support for optimal, integrated land use, encouraging mixed farming systems, carrying out land and soil surveys with a view to developing reliable data, adjusting livestock production to sustainable feed and fodder resources, and coordinating water and forest policies and urban planning with

overall land use. To achieve the goals of the policy, some of the initiatives recommended were

- development of a reliable land database,
- a national awareness campaign for integrated, sustainable land use,
- establishment of legal and administrative structures,
- protection of community rights and encouragement of community participation,
- development and adoption of appropriate cropping patterns,
- adoption of stall-feeding and improvement of grazing land in a fodder development programme,
- increasing the coverage of land under fuel and fodder tree species,
- protection of catchments and efficient use of water through a review of irrigation management,
- establishment of environmental protection laws and their strict enforcement,
- harnessing of technology for better land management through adopting the

concept of total treatment of watersheds,

- treatment of wasteland problems on an emergency basis, and
- decentralization of land-use planning to state, district, and block levels.

The policy document suggested a programme for providing vegetative cover to 40 million ha of degraded forest land and 94 million ha of degraded land outside the forest area.

This policy statement is comprehensive but little action has resulted. Targets for restoration of degraded lands and afforestation have not been achieved. The Central Board meets infrequently, and the situation is the same at state level. This is particularly true of the NWHRI. In Jammu and Kashmir, the abnormal situation has made the board practically moribund. In Himachal Pradesh, management issues remain unresolved. In Uttar Pradesh, the State Land-Use Board has organized some important interactions concerning land use in the hills but the conclusions and recommendations have not been reflected in the state's policy or actions.

National Policy on Wastelands

A draft policy paper on common-property land resources was brought out by the National Wasteland Development Board in the early 1990s. According to it, common lands in the form of grazing grounds, village woodlands, catchment areas, and other village wastelands provide income and employment to rural communities, especially the poor. These are community, forest, or government lands. About one-tenth of the country's land area falls into this category. Productivity of these lands is declining. There is a need to manage such lands using a watershed approach. Policy intentions are gradually being realised in the NWHRI. Many social forestry, watershed management, and joint forest management pro-

grammes have been launched in the last decade with the help of the central government and external agencies (e.g., World Bank, European Union, etc). However, institutional mechanisms to enlist adequate community support and involvement at the field level are yet to gather the strength and credibility required to enable them to take up these responsibilities effectively. Studies have shown that, even where greening of the commons has taken place, once a project is withdrawn, maintenance poses problems. In seven villages of the Uttar Pradesh hills, tree plantations undertaken on wastelands were successful in four villages while only partly so in the remaining three (SHERPA Survey, 1993).

Land-use Trends in the NWHRI

Table 2 gives details of land-use trends of the three subregions of the NWHRI from 1975-76 to 1990-91. A brief analysis of the table reveals the following.

- Recorded forest areas are different from actual forest cover as observed by satellite imagery.
- Area under non-agricultural uses has declined in Jammu and Kashmir and increased in the Uttar Pradesh hills.
- Barren and uncultivable land has increased substantially in all three subregions, while cultivable waste has gone up in Himachal Pradesh and the Uttar Pradesh hills. Area under pastures has remained almost static with only a small increase in the Uttar Pradesh hills.
- Current fallows have decreased in all subregions, while 'other fallow' has sharply increased in the Uttar Pradesh hills.
- Net sown area has increased both in Jammu and Kashmir and Himachal Pradesh, while it has decreased in the Uttar Pradesh hills.
- Cropping intensities have gone up across the board in the NWHRI.

Table 2: Land-use Trends in the NWHRI ('00 ha)

Category of land use	Jammu and Kashmir			Himachal Pradesh			Uttar Pradesh hills		
	1975-76*	1980-81	1990-91	1975-76	1980-81	1990-91	1975-76	1980-81	1990-91
Area under forest	6490	29187	27470	6375	8068	10389	34330	34434	34249
Area under non-agricultural uses	3514	3334	3030	1922	1618	1932	1051	1181	1365
Barren and uncultivable land	2274	2308	2950	1245	1413	1838	2310	2896	2955
Area under pastures	1265	1244	1270	11522	9858	11354	1980	2172	2274
Land under miscellaneous trees, etc.	1059	1028	730	429	395	482	1959	1856	2166
Cultivable waste	1512	1469	1380	799	2237	1251	2919	3159	3170
Current fallow	1052	942	970	546	414	447	264	206	82
Other fallow	93	80	60	33	126	154	288	320	634
Net area sown	6940	7163	7310	5578	5721	5828	6709	7042	6691
Total cropped area	9228	9739	10660	9236	9464	9836	10859	11477	10993
Cropping intensity	133	136	146	157	166	169	161	163	164
Net irrigated area	3018	3035	2980	901	918	995	1537	2016	2336

Note: * The figures for 1975-76 are based on village records of the Revenue Department, and do not cover all the reporting area.

Sources: LBS National Academy of Administration, 1998; Ministry of Agriculture, n.d.; SHERPA Survey, 1993

- Net irrigated area has declined marginally in Jammu and Kashmir, risen in Himachal Pradesh, and sharply increased in the Uttar Pradesh hills.
- There has been considerable diversion of land to horticulture and non-agricultural uses.

Actual forest cover in the NWHRI is only 16.7 per cent while the National Forest Policy lays down a norm of two-thirds for hill regions. Productivity of forests is around 0.7 m³/ha against a world average of 2 m³/ha.

Land Holding Patterns

Tables 3, 4, and 5 indicate the number and area of operational land holdings by size and class. The average holding sizes are small (1.2 ha in Himachal Pradesh, 0.94 ha in the Uttar Pradesh hills, and 0.83 ha in Jammu and Kashmir). In 1990-91, the percentage of marginal holdings (below 1 ha) was 74 per cent in Jammu and Kashmir, 71 per cent in the Uttar Pradesh hills, and 64 per cent in Himachal Pradesh. Land fragmentation continues and this has been steadily increasing the numbers and per-

Table 3: Number and Area of Operational Holdings by Size and Class (Jammu and Kashmir)

Size	Number of holdings ('000)		Holding percentage (%)		Area ('000 ha)		Percentage of area (%)	
	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91	1980-81	1990-91
Less than 1ha (marginal)	7.27	9.01	70.2	74.0	3.05	3.47	29.6	34.2
1-2ha (small)	1.76	1.97	17.0	16.2	2.47	2.72	24.0	26.8
2-4ha (semi-medium)	1.04	98	10.1	8.1	2.83	2.64	27.5	26.0
4-10ha (medium)	27	20	2.6	1.6	1.51	1.08	14.6	10.7
10ha and above (large)	1	1	0.1	0.1	44	23	4.3	2.3
Total	10.35	12.17	100.0	100.0	10.30	10.14	100.0	100.0

Source: Ministry of Agriculture, n.d.

Table 4: Number and Area of Operational Holdings by Size and Class (Himachal Pradesh)

Size	Number of holdings		Holding percentage (%)		Area (ha)		Area percentage (%)		Average holding size (ha)	
	85-86	90-91	85-86	90-91	85-86	90-91	85-86	90-91	85-86	90-91
Less than 1ha (marginal)	463,403	538,000	61.55	63.8	200,584	218,000	20.46	21.5	0.43	0.4
1-2ha (small)	155,311	16,800	20.63	19.9	222,589	228,500	22.71	22.5	1.43	1.4
2 to 4ha (semi-medium)	92,173	96,100	12.24	11.4	264,562	261,100	25.97	25.7	2.87	2.7
4 to 10ha (medium)	36,353	36,600	4.83	4.3	207,648	206,900	21.19	20.4	5.72	5.7
10ha and above (large)	5743	5500	0.75	0.6	94,850	100,100	9.67	9.99	16.5	18.1
Total*	752,888	844,200	100	100	980,240	1,014,600	100	100	1.30	1.20

Note: *During the period of five years preceding 1985-86, the total number of holdings had already increased by 114,801.

Source: Government of Himachal Pradesh n.d.; SHERPA 1992

Table 5: Number and Area of Operational Holdings by Size and Class (Uttar Pradesh Hills)

Size	Number of holdings		Holding percentage		Area (ha)		Area percentage		Average holding size (ha)	
	80-81	90-91	80-81	90-91	80-81	90-91	85-86	90-91	85-86	90-91
Less than 1ha (marginal)	515,319	537,121	69.85	71.19	175,264	199,564	24.1	28.07	.34	.37
1-2ha (small)	126,264	127,022	17.12	16.84	174,181	177,478	23.8	24.96	1.38	1.40
2 to 4ha (semi-medium)	68,910	68,064	9.34	9.02	187,915	184,428	25.7	25.94	2.73	2.71
4 to 10ha (medium)	24,683	20,520	3.34	2.72	138,352	113,933	18.9	16.03	5.61	5.55
10 to above (large)	2605	1771	0.35	0.23	54,676	35,569	7.5	5.00	20.99	20.08
Total	737,781	754,498	100.00	100.00	730,388	710,972	100.00	100.00	0.99	0.94

centages of marginal holdings. Of more concern is that, on average, each holding is comprised of many parcels of land that may be scattered. In some areas of the Uttar Pradesh hills, the number of such parcels varies between six and ten.

Main Crops

The main crops are rice, wheat, maize, barley, ragi (finger millet), oilseeds, and pulses. In addition, potato is an important crop. Area under horticulture

has been steadily increasing. In the early 1950s, less than 20,000 ha were under horticulture; now there are 500,000 ha. Substantial productivity gains have been made in food crops. Wheat productivity has nearly doubled in Himachal Pradesh and Jammu and Kashmir. Rice productivity has increased by 25–35 per cent. However, all three subregions remain food deficient and are covered by extensive public distribution systems. For example, in Jammu and Kashmir, food-grain imports (rice and wheat) rose from 39,000 tonnes in 1960-61 to 375,000 in 1991-92 (Jammu and Kashmir State Land-Use Board, 1995). Jammu and Kashmir per capita annual food-grain production was only 182 kg in 1991-92. Per capita net sown area is only about

0.09 ha in Jammu and Kashmir. Net irrigated area as a percentage of net sown area is about 40 per cent in Jammu and Kashmir, 17 per cent in Himachal Pradesh, and 34.9 per cent in the Uttar Pradesh hills.

Land Quality

The terrain is steep and mountainous, and availability of fertile, arable land is limited. Net sown area covers 19,829 sq.km., about 15 per cent of the reporting area. Actual forest cover (including dense and open forests) is 55,620 sq.km. (17 per cent of the geographical area). Large areas are rocky and glaciated or constitute treelands, grasslands, pastures, and barren lands (excluding urbanised areas). The following figures indicate the amount of degraded lands in Jammu and Kashmir (Jammu and Kashmir State Land-Use Board 1995): degraded agricultural lands 331,000 ha; degraded forest lands 790,000 ha; cultivated wastelands 151,000 ha; and non-cultivated wastelands (including snow-covered and glaciated areas) 134,000 ha. In Himachal Pradesh, against a geographical area of 55,670 sq.km., the area surveyed cadastrally was only 33,675 sq.km. in 1992-93. The remaining area was unsurveyed and, hence, does not appear in the revenue records. Forest Department statistics report an area of 37,591 sq.km. under forests. This figure is obviously related only to the legal definition. Actual forest cover as assessed by satellite imagery is only 12,520 sq.km. (FSI 1997). Problems of land degradation are severe and 73 per cent of the watersheds are affected (National Land-Use Board 1995). In the Uttar Pradesh hills, the entire geographical area is the reporting area. While the recorded forest area is 34,249 sq.km., the actual cover is only 22,660 sq.km. In 1991, an area of 6,125 sq.km. was categorised as barren, uncultivable, and wasteland. If the difference between the recorded and actual forest cover is added to barren/uncultivable/wasteland, nearly one-third of the Uttar

Pradesh hills is either rocky/snow-covered/glaciated or, otherwise, unproductive, degraded land. In addition, there are other degraded forest and agricultural lands.

Land Property: Tenure and Titling

Hill societies in the NWHRI are largely agrarian. About four-fifths of the people depend on land resources directly or indirectly. Various forms of land-use titling are utilised for privately operated land holdings as well as for common property resources. Governments have realised that land-use rights and land-tenure titling in an equitable manner (or granting of usufruct rights) are essential measures for appropriate, optimal, and sustainable management of land resources. It is recognised that exclusivity and security of tenure increase the holder's stake in the land and provide a strong incentive for maintaining and improving it.

Jammu and Kashmir

During the nineteenth century, land tenure was insecure and exploitative while taxation was heavy. In 1889, settlement work began. There was some reform but, in overall terms, the system was loaded against long-term land improvement. Productivity levels remained extremely low. After Independence came laws that made sweeping land reforms. In 1950, the Big Landed Estates' Abolition Act was adopted through which the right of ownership of land beyond 22.75 acres (9.2 ha) was expropriated and it stood transferred to the tillers of such land to the extent of their actual possession. If no tiller was in possession of the large landholder's land it was vested in the state without encumbrance and was to be transferred to tillers. Another important piece of legislation was the Jammu and Kashmir Agrarian Reform Act of 1976. The new law stipulated that all 'rights, title and interest in land of any person not cultivating it per

sonally in 1971 would be deemed to have extinguished with effect from 1 May 1973'. This act also imposed a land ceiling of 12.5 acres (5 ha) for a family. The land thus declared surplus was to be allotted to tillers having less than 2.5 acres (1 ha), refugees, and landless agricultural labourers. Through the implementation of these reforms, absentee landlordism was abolished, and cultivators were allowed to acquire proprietorship of land they tilled.

For land replenishment, the Jammu and Kashmir Land Improvement Scheme Act was adopted in 1972 'to provide for the making and execution of land improvement schemes for soil conservation, improvement of soil resources, prevention or mitigation of soil erosion, protection of land against damage by floods, farm drainage or other works incidental to, or connected with, such purposes'. Provision was made for the setting up of district land improvement committees that could direct the preparation of a scheme. The owner of land who benefitted from the scheme was required to pay for it.

A comprehensive land revenue law was passed in Jammu and Kashmir in 1939. It repealed earlier land regulations and replaced these, making provisions for the maintenance of proper record of rights, for updating these records, for surveys and demarcation of boundaries, and for assessment and recovery of land revenue. The Land Grant Act 1960 provides for the grant of land by the government for building purposes on payment of premium and ground rent. The leased land cannot be sold without government permission.

Himachal Pradesh

Before Independence, agrarian relations in the area that now constitutes Himachal Pradesh were based on exploitative, feudal practices that were characterised by tenancy and sharecropping arrangements. Typically,

there were no village common lands excepting village sites and grazing grounds. All uncultivated land was the property of the ruler and, wasteland, where broken, was put to use by the person who broke it. Land revenue was collected in cash and kind.

The Himachal Pradesh Abolition of Big Landed Estates' Land Reforms' Act was promulgated in 1953. This was followed by the Tenancy and Land Reforms' Law 1972, the Land Ceilings' Act 1972 and the Common Lands' Vesting and Utilisation Act 1974. The land ceiling was set at two hectares for irrigated land, three hectares for unirrigated land, and six hectares for orchards. Land nationalised was redistributed to the landless or smallholders. Village common lands were vested in the state. A system of allowing landless farmers to cultivate government land was established and such allocation had the possibility of being converted into a secure tenure. This system has been suspended and new policy, in this regard, is yet to emerge. Under the provision of the Village Common Land Vesting and Utilisation Act 1974, common lands were vested in the state with a few exceptions. However, government wastelands, grazing lands and unprotected and class III forests are widely treated as open-access resources (Gulati 1998). Over time, more areas have been brought into the category of Demarcated Protected Forest and placed under cultivation. The result is reduction in land available for grazing. Fuel problems have also become acute.

Land reforms in Himachal Pradesh have been implemented successfully. Most land holdings are wholly owned or self-operated. Landlessness is, comparatively, uncommon. Current problems are smallness of holdings and fragmentation. The average land holding size is only 1.2 ha and decreasing. Often, it is in several parcels. Another problem is the incompleteness of cadastral survey and demarcation.

Uttar Pradesh Hills

In the Uttar Pradesh hills, the land-tenancy system was inequitable and loaded against the poor. The sovereign could give away a piece of land as a grant to anyone for services rendered at the expense of an existing right. Although the British started land settlements in 1815, for a long time the Uttar Pradesh hills continued with the traditional village proprietary system based on custom and case law. Measured land was private property and did not present serious problems; unmeasured land did. After Independence, in response to incessant public pressure, the Nayabad Grant Act of Kumaon liberalised the access of people to unmeasured lands which made it possible for villagers to extend their agricultural holdings. The negative environmental consequences of this law were so severe that it had to be repealed in 1973. The Kumaon and Uttarakhand *Zemindari Abolition and Land Reforms Act* was promulgated in 1960. It replaced the multiplicity of tenures to just three.

Policies, Rationale and Impacts

In Table 6, an attempt is made to list a few typical policy initiatives, their apparent rationale, and their impacts.

Case Study on Consolidation of Land Holdings in the Hills of Uttar Pradesh: Beef Village Experiment

Consolidation of Land Holdings' law was enacted in Uttar Pradesh in 1993. It was a village development measure that was meant to boost agriculture through the compaction of plots comprising of land holdings. The scheme was resisted in hill areas where agricultural plots are extremely small, and smallholdings can consist of multiple tiny parcels of land at different altitudes, the management of which is difficult, expensive, inefficient, and time-consuming. In Beef Village (Badkot *Tehsil*, Uttarkashi

District) the initiative was taken by Rajendra Singh Rawat, the Block *Pramukh* (CDS 1996). The total area of the village is 167 ha of which only 50 ha could be consolidated legally under the Land Reforms' Act. The rest of the land was mostly barren, paths, drains, government land, etc. The village has 88 families. The total number of plots was 3,131 recorded in the names of 55 landholders. Under voluntary consolidation, only 40 landholders took part and their holdings were consolidated into 49 *chaks* (consolidated parcels of land). One-fourth of the total plots remained outside the consolidation process. The 49 formed *chaks* now have only 36 landholders. The advantages that accrued to landholders were

- parcels of land were drastically reduced making agricultural operations easier, less time-consuming, less expensive, and more efficient;
- fencing, where required, became easier;
- women, who perform most of the agricultural operations, obtained relief in terms of time and physical effort; and
- in consolidated plots, agriculture, horticulture, and animal husbandry could be practised in an integrated manner.

Many difficulties also were experienced. Nearly one-fourth of landholders opted out. Holders of tiny parcels could not benefit. Physical possession of lands changed but the title problem remained. By and large, the experiment was deemed to be an indicator of future success. The desirability of encouraging such voluntary programmes has been emphasised.

Case Study on Soil Erosion Incidence Following Change in Land Use: Pranmati Watershed

In Pranmati watershed (area 94 sq.km. encompassing nine villages), rainfed agriculture, pasture and forest were the three broad land uses in 1993 (18.5, 7.5, and

Table 6: Typical Land-related Policies, Rationale and Impacts in the NWHRI

Policies/Laws	Rationale	Impacts
Country-wide Land Survey (19th century)	Fix territorial identities Demarcate boundaries Improve revenues Plan road, rail and communication systems	Political and economic management improved Infrastructural development took place Boundary disputes reduced
Land laws and land settlements (19th and early 20th century)	Provide some kind of tenurial security to landholders Facilitate imposition and recovery of government taxation	Tenure systems continued to be hierarchical and multiple with actual tillers often becoming tenants at will; intermediaries continued to exploit the tillers
Forest Act 1878	Improve management of forests Delineate forest lands Conservation	Forest settlements initiated User claims accommodated to some extent Unmeasured lands remained unregulated and were often overdrawn to almost exhaustion
Policy enunciated in 1893 (in Uttar Pradesh hills) declaring unmeasured lands as 'district protected forests' and Forest Policy 1895	Prevent over-use of unmeasured land Regulate access	Resentment against authorities Efforts were made to increase the area of reserved forests Commercial use of forests became a policy priority affecting resource access of people People burned forests
Policy accepting recommendations of Kumaon Grievance Committee (1921) in the Uttar Pradesh hills	Contain disaffection and dissatisfaction Address needs of local communities for forest resources to which they had historically had access	Level of people's dissatisfaction came down but shift towards industrial and commercial afforestation and use of contractor system created problems Forest degradation continued
Land reform legislation enacted soon after Independence	Secure land tenures and eliminate intermediaries Empower tillers to have greater control over their lives and resources	Positively helped small landholders. Land productivity improved gradually for long-term investment now became possible Fragmentation of land continued and created problems of land management
Land ceiling legislation	Reduce social disparities Distribute surplus land amongst the landless or small landholders	Small landholders and many landless persons benefitted However, many people managed to retain large holdings under false names and groupings
National Forest Policies (1952 and 1988) and recommendations of National Agricultural Commission 1976	Emphasise increase in supply of fuelwood and grazing needs and mobilise people for tree growing (1952 policy) Shift emphasis to production forestry (NAC 1976) Stress protection and environmental functions of forest and designate community needs for fuel/fodder as first priority (1988 policy)	Changing policies created problems in management and quality of forests People did not identify with forests Community forests deteriorated Plantation programmes became industry-oriented rather than people-oriented or environment-friendly
Forest Conservation Act 1980	Prevent loss of forest land to non-forest uses	Diversion of forest lands to non-forest uses came down sharply Many development projects for which forest land was the only available land were delayed Obtaining clearances from central government took too long resulting in public protests; so much so, that, in 1988, a Fell-the-Trees movement was launched in the Uttar Pradesh hills
In 1981, orders issued banning green felling of trees above 1,000 m in the Uttar Pradesh hills	Response to the intensity of protests especially by the Chipko movement	Helped in improving the green cover at higher altitudes but scientific silviculture also stopped, which might affect long-term health of high hill forests

Joint Forest Management Policy 1990	Emphasise community participation in forest management Extend principle of participation to government forests with provision for benefit-sharing by communities	The joint forest management initiative has started giving results but institution-building remains a problem
Biodiversity, wildlife laws and policies (setting up of biospheres, parks and sanctuaries)	Provide a long-term scientific measures Provide aesthetic, environmental and economic benefits Maintain ecological balance	People's access drastically reduced For affected communities, it amounted to a challenge to their survival Friction between park/sanctuary/reserve managements and affected communities has developed

64.5% respectively) (Sen *et al.* 1997). The altitude range is 1,120–4,070 m. Farm holdings were small (average 1 ha) and fragmented (6–8 locations). About 25 per cent of cultivated land was highly sloping terraces, 32 per cent medium-sloping terraces, and 43 per cent low-sloping terraces. All terraces were outward-sloping. Potato was the dominant crop (50%) followed by *Amaranthus* (23%). Soil loss increased with steepness of slope. This effect was most pronounced for potato for which soil loss from moderately and highly sloping terraces was 12.6 and 106 times higher, respectively, than in low-sloping terraces. Soil loss for potato was 7.65T/ha/yr on moderate slopes and 64.4T/ha/yr on high

slopes. As much as 85.4 per cent of total soil loss was accounted for by potato cultivation. Potato fields received the highest amounts of manure (28.5T/ha). By-products of potato did not have any fodder value unlike traditional crops. Farmers' decisions on choice of crops are guided largely by market demand and profitability. Although traditional crops result in low levels of soil loss (0.3–13.4T/ha/yr), the area under potato cultivation was found to be rapidly increasing because of growing emphasis on the monetary economy. The study concludes that soil erosion, resulting in unsustainability of upland agriculture, was increasing because of the shift in land use to potato cultivation.

Chapter 3

Land Degradation

Causes

It is well known that the most serious forms of land degradation in the NWHRI are accelerated wind and water erosion, soil loss, high runoffs, depletion in the quality and productivity of lands, and land uses that are removed from land-capability optimalities. The underlying causes can be traced to a complex web of social, economic, and institutional problems that arise both from within the mountain regions and outside. They include the combined effects of the meeting of their subsistence needs by hill people, land distribution, fragmentation, tenure/titling problems, low productivity, rising human and animal population pressures, and severe competing demands from users of land. The competing uses, apart from forestry, agriculture, and grazing, can be urbanisation, industries, roads, multipurpose projects, rural settlements, tourism, etc. Land shortages and difficulties experienced by mountain communities in meeting their subsistence needs lead to non-sustainable management practices. By and large, a typical hill farmer is aware of the causes, processes, and results of resource degradation

through erosion. However, restoration efforts often involve long-term measures that do not add to the upland farmer's immediate income (Dent 1996). A broad listing of the causes of land degradation follows.

- Rapid increase in human and animal populations
- Extension of cultivation to marginal and steeply sloping lands that are easily erodible
- Overgrazing of pastures and forest floors (maintenance of livestock is blended with farming and other agro-based activities)
- Unconsolidated, fragmented land holdings that make conservation management difficult.
- Defective terracing
- Soil problems: hill soils are formed by various kinds rocks under sharply ranging temperatures. These soils are, generally, shallow and gravelly. Deeper soils are uncommon and occupy a small percentage of hill areas. Hill soils' main limitations 'are their highly porous nature, low retention of moisture and

nutrients, acidic quality and moderate to severe erodibility.’

- Absentee landownership
- Indiscriminate mining and quarrying, and absence of conservation measures in such areas
- Unscientific construction of roads, dams, buildings and other engineering projects
- Urban expansion
- Deforestation and degradation of forests and diversion of forest lands for non-forest purposes (This distorts the forest–agricultural land ratio, which is often already adverse.)
- High fuelwood demand
- Improper agronomic practices and unsuitable crop rotations
- Conflicts between tenancy and open-access resources
- Forest fires
- Erosion and scouring caused by fast-flowing rivers and streams
- Landslides and land creeps
- Floods, fires and earthquakes

There can be other causes, too: militancy in Kashmir has led to large-scale deforestation; increasing tourist/pilgrim traffic and mounting number of expeditions and group treks; illegal tree-felling accompanied by wood-smuggling; over-extraction of herbs and medicinal plants; and multistoreyed building construction on steep and unstable slopes.

Land degradation is a serious problem in all three subregions of the NWHRI. The Jammu and Kashmir Land-Use Board estimates that 1.4 million ha are degraded. In Himachal Pradesh, 35–40 per cent of the geographical area is degraded. In the Uttar Pradesh hills, nearly 30 per cent is degraded. These figures may vary by percentage points, but they convey the dimension of the problem.

Degradation is not a universal phenomena in the NWHRI. Many areas have retained

their protected form; many have been recovered through human endeavour. However, these lands are by nature fragile and marginal. The incidence of degradation is substantial and, in many places, it is certainly on the rise. What is more, even in those areas where signs of damage are absent or marginal, multiple and rising pressures are at play and, unless due care is exercised and interventions are mobilised in time, damage may become acute, even irreversible. What is needed is a set of long-term programmes backed by sound land-use policies and strategies. Such programmes must be centred on community participation. Ultimately, land and water resources can be conserved and rehabilitated only by those who make their living from them.

In 1986, Sunder Lal Bahuguna, an environmentalist, walked 2,500 km across Jammu and Kashmir, Himachal Pradesh, and the Uttar Pradesh hills. He writes (Bahuguna 1986):

‘in the Chenab Valley in Doda district of Jammu and Kashmir we had seen a large number of dead and snow-damaged trees... Though there has been some restraint on green fellings in Himachal Pradesh, the demand for apple packing cases is so high that, everywhere, on the roadside, logs could be seen. The number of dead and dying trees must be very high as heaps of sleepers were seen. In Uttar Pradesh, while a moratorium on felling of green trees stands imposed, heaps of sleepers near Thadujab and other places on the banks of Tons tell the tale of organized plunder of forests a common feature in the catchments of Bhagirathi, Alaknanda, Pindar, Ramganga and Kosi. In remote areas, where nobody is to check, the plunder continues unabated’.

In Jammu and Kashmir, in connection with the preparation of an integrated watershed project, the common-property land resources’ situation in two small watersheds

was studied (Development Alternatives 1989). Both watersheds exhibited land degradation, heavy soil erosion, and soil depletion. In slopy areas, signs of excessive runoff were visible in the form of rills and gullies. Common lands were highly eroded, and degraded areas were scattered all over. Fuelwood deficiency was marked. Overgrazing, poor management, and overexploitation had resulted in heavy pressure on common-property land resources. As a result people had begun to use reserve forests for meeting their requirements.

Erosivity and Runoff

The All-India Soil and Land Use Survey Organization has been carrying out rapid reconnaissance surveys of river catchments for more than two and half decades—including important watersheds in the NWHRI drained by rivers such as the Sutlej, Beas, Thein, Ghaggar, Giri-Bata, Upper Yamuna, Pohru, Alaknanda, Bhagirathi and Ramganga. An analysis of their findings shows that, of 3,033 subwatersheds surveyed in the NWHRI, 1,643 (54%) were found to fall in very high or high priority categories where urgent soil and water conservation measures were considered necessary. The area covered by highly erosive subwatersheds was found to be 52 per cent of the total area surveyed (AISLUS1997).

Sedimentation

There are many projects in the NWHRI for generation of power and creation of irrigation facilities. Valdiya says:

‘The reservoirs formed behind the dams are being filled at a rate three to five times faster than estimated by the planners so that their effective lives are considerably reduced. The faster rate of sedimentation implies a quickened pace of erosion in the catchment area—about 100 cm per 1,000 years on average, compared to 21 cm per 1,000

years in the past 40 million years’.

In the Bhakra dam, actual sedimentation rates were nearly 50 per cent higher than had been assumed. In the Kalagarh dam in the Uttar Pradesh hills (completed in 1976), assumed sedimentation rate was 4.2 ha m/100 sq.km while the observed rate in 1979 was 18.29 ha m/100 sq.km.

Water Springs

A consequence of deforestation and attendant erosion is the damage done to undergroundwater resources. A survey of the Gaula River catchment in Nainital district carried out in the 1980s revealed that 45 per cent of the springs had reduced yields or gone dry, the extent of decrease in discharge ranging from 25 to 75 per cent (Bartarya 1988). Another feature in Nainital district is the number of drinking-water schemes (about 60–70) that have become defunct because of the drying up of the source or reduction in discharge.

Mining/Quarrying

Severe damage is caused by mining and quarrying in hill areas. The mining of slates in the Dharamsala areas of Himachal Pradesh has caused much degradation. Mountain slopes have been defaced. The hills surrounding the Khanigra mines have been scarified and are covered with slate debris. The entire area is barren and rugged. There is no vegetation to support local livestock. Debris falls into local streams and disrupts the flow of water. On the Mussoorie hillface, before 1947, only four areas had been leased for limestone quarrying. By the 1980s, the number was up to 104. Damage to hill slopes was extensive. Water regimes were seriously affected. Debris and dust made life for people living in the Doon Valley miserable.

In 1984, a public interest litigation petition was filed by an NGO and it took four years before the Supreme Court finally put a stop to all mining in this area.

Landslides

The Himalayan slopes are unstable, and landslides are a major problem. Each year, large-scale damage to life and property is caused by rockfalls, slides, and creeps. In Nainital district, 0.73 landslips occur on each kilometre of land (Sharma 1996). Each year 550 cubic metres of debris per km of road was being produced by landslides and rockfalls in the central Himalayas (Singh 1992). In 1998, high rainfall in the Uttar Pradesh hills caused extensive landslides in Kumaon and Garhwal. Twenty-three villages were wholly or partially destroyed by landslides, and this resulted in over 100 deaths. A large landslide dammed the Madhmaheshwari River creating danger for downstream areas.

Impacts on Water Bodies

There are many examples of serious deterioration of water bodies in the NWHRI. The Dal Lake of Kashmir has suffered drastic shrinkage in area, eutrophication, and ecological degradation. The lake shrunk from 35.2 sq.km. at the end of the eighteenth century to 15.4 sq.km. in 1990. Among the causes of depletion are large-scale encroachment, high level of sedimentation, and the rising incidence of 'floating islands'—small bodies of soil and vegetation floating on the lake—that have been converted into land. Silt from Telbal Nala is said to have converted 9.5 sq.km. into land in the last few decades. Another example is Nainital Lake in Kumaon where sedimentation has adversely affected ecology. Nainital has a history of unstable slopes and massive landslides.

Deforestation and Changes in Forest Cover

Deforestation has occurred in the entire NWHRI. The 'oceans of forests' observed by travellers in the nineteenth century are seen no more. During colonial times, forests were used ruthlessly for commercial and revenue purposes. The need for quick-growing industrial species gave rise to monocultures. Diversity was reduced. People's access was restricted. This caused resentment and resulted in large-scale incineration in Kumaon. The contractor system inflicted severe damage. The pressure of human and animal population took its toll. Diversion of forest lands to non-forest uses was high until the Forest Conservation Act 1980 put a stop to it. Encroachments also increased. Undemarcated and community forests suffered for want of good management. All these factors, which have a bias in favour of industrial/commercial uses rather than protective ones, aimed at meeting the fuel, fodder, timber, and non-timber forest product needs of the hill people, have contributed to deforestation, degradation, and qualitative changes in forest cover.

Roads and Buildings

Unscientific construction of roads has caused extensive landslides and contributed to deforestation and degradation of mountain gradients. For each linear kilometre of mountain road, ten small to medium landslides occur as a direct result of slope instability caused by road construction (Tejwani 1987). Along the Tanakpur–Tawaghat highway in the central Himalayas, 411 cubic metres of debris was produced per linear kilometre of road per year (Messerli and Ives 1989). Construction of buildings, especially large multistoreyed structures (these can be seen prominently in Shimla, Mussoorie,

Nainital, etc) also create severe impacts. Excavation debris poses serious environmental problems. It destroys vegetative cover, prevents regeneration, damages vegetative slopes, and accelerates erosion.

Forest Fires

Forest fires, which may be natural or deliberate (or accidental), are extremely harmful. They cause accelerated erosion, hamper plant regeneration, destroy valuable vegetative growth and decimate wildlife. In Uttarakhand alone, the incidence of forest fires is quite substantial. In 1995, 2,272 fires affected 937 sq.km. of forest under the control of the Forest Department (Mehta 1996). If *van panchayat/gram panchayat* forests were included the number of fires would be greater. A tendency that is both remarkable and worrisome is that public cooperation in the prevention and control of fires is on the decline. This is perhaps a reflection of the recent alienation of local people from forests. This 'estrangement' is sought to be reversed with the adoption of the joint forest management policy.

Overgrazing

Tremendous biotic pressure on pastures and forest floors is caused by overgrazing. In the NWHRI, grazing loads exceed yield levels by factors ranging from two to four. Overgrazing has many adverse impacts: gully formation on cattle tracks, inhibition of growth of grasses, and declining productivity.

Natural Causes

There are also natural causes of land degradation such as floods, earthquakes, glaciers, and snow avalanches.

Backward Linkages

In Table 7, an attempt has been made to identify the backward linkages to causes of some types of land degradation common in the NWHRI: natural, policy related, and non-policy related.

Table 7: Land Degradation and Backward Causative Linkages

Types of degradation	Backward linkages		
	Natural causes	Policy-related causes	Non-policy-related causes
DEFORESTATION AND DEGRADATION OF FOREST LANDS	<p>Earthquakes</p> <p>Landslides caused naturally</p> <p>Floods</p> <p>Natural forest fires</p>	<p>Historical policies of colonial times</p> <p>Emphasis on revenue earning</p> <p>Forest declared as public lands</p> <p>People's access restricted</p> <p>Contractor system</p> <p>Shift to utilisation of forests to meet industrial and commercial needs</p> <p>Grow more food campaigns that diverted forest lands to agriculture</p>	<p>Increasing human population that increased demand for fuel, fodder, timber and non-timber forest products</p> <p>Increasing animal population</p> <p>Overgrazing</p> <p>Tourism</p> <p>Transhumance</p> <p>Demand of more land for agriculture</p> <p>Encroachment</p> <p>Landslides caused by mining, road construction, etc</p>
RANGELAND DETERIORATION (DEGRADATION OF PASTURES AND FOREST FLOORS)	<p>Natural disasters</p> <p>Long-term climate deterioration</p> <p>Lowering of fertility levels</p> <p>Low herd diversity</p>	<p>Uncertain grazing policies</p> <p>Unregulated transhumance</p> <p>Lack of policies for controlling animal pressures and cattle numbers</p> <p>Poor support of research</p> <p>Contradictions between privately-owned livestock and communal lands (rangelands)</p> <p>Non-participatory rangeland and forest floor management</p>	<p>Overgrazing and 'free riding', high stocking densities</p> <p>Non-compliance of closure rotations</p> <p>Inter-state movement of pastoralists without limitation on animal numbers</p> <p>Non-adoption of stall-feeding</p> <p>Transhumance</p> <p>Pastures are commons; seeding, fertilizing and weeding need proper institutional arrangements that are missing.</p> <p>Trekking in large groups</p> <p>Increase in human and animal populations</p> <p>Over-exploitation of herbs/ medicinal plants as well as fuel/fodder trees</p>
SOIL EROSION	<p>Operation of tectonic and gradational forces</p> <p>Reduced biomass cover and forest degradation</p> <p>Flash floods and rushing water courses</p> <p>Scouring by river action</p> <p>Landslides</p>	<p>Absence of scientific and appropriate land-use policies</p> <p>Non-participatory land/water management</p> <p>Non-enforcement of policies and laws</p> <p>Subsidising of faulty land use, e.g., soil conservation subsidies even for steep-slope unterraced agriculture</p>	<p>Faulty land-use practices</p> <p>Steep-slope agriculture</p> <p>Unscientific agronomic practices, e.g., planting of crops along slopes</p> <p>Faulty terracing</p> <p>Use of unlined water courses for draining or transporting water</p> <p>Unscientific road construction</p> <p>Disposal of excavation debris</p> <p>Minining and quarrying</p> <p>Overgrazing</p> <p>Shifting cultivation</p>
SPRING WATER DEPLETION	<p>Reduction in biomass cover</p> <p>Exotic afforestation activities</p>	<p>Faulty pricing of water: scarcity value not reflected in price</p> <p>Community participation in water management inadequate or missing</p>	<p>Poor land-management practices</p> <p>Deforestation, illegal felling</p> <p>Reduction in broad-leaved tree cover</p>

Chapter 4

Forestry

History of Forestry Policy-making

Land and forest policies in the past were simply used for generating revenue for governments and bestowing political favours. In both upland and lowland areas of India, the traditional rights of rural people were, in a considerable measure, 'nationalised' by colonial governments, which introduced top-down, centralized, uniform policies and programmes. Forests were declared public lands. Indigenous cultures were viewed as inferior; local knowledge and experience undervalued.

In 1894, the first national-level forest policy was enunciated. It outlined forest use for public benefit and regulated users' rights. It offered a four-fold classification: preserved forests, timber-supply forests, minor forests, and pasture lands. Forests on hilltops were to be protected on climatic and physical grounds. Where demand for cultivable land within forests existed, areas were to be relinquished without honeycombing or reducing the minimum required forest area. Timber forests were to be managed commercially or as sources of revenue for the state.

Forests yielding fuel/fodder/inferior timber or being used for grazing were to be managed in the interests of the people.

In 1928, the Royal Commission of Agriculture proposed reclassification of forests on the basis of suitability for timber, fuelwood, and fodder. It suggested that forests should be given up for agricultural use. It recommended grass-cutting instead of grazing, raising of grazing fees, and determination of optimum grazing capacities. It also added that Forest Departments should manage only timber forests while the other two categories should be managed by village *panchayat(s)*. It also emphasised friendly relations between people and foresters. Under the Government of India Act 1935, forest as a subject was transferred from the centre to the states.

In 1952, national forest policy was revised. Classification was now defined as protection forests, national forests, village forests, and treelands. The policy urged balanced and complementary land use, increase in supply of fuelwood and grazing needs,

discouragement of diversion of forest lands for cultivation, improvements in treelands, regulation of grazing, and mobilisation of people for tree-planting. Importantly, the policy laid down for the first time that 33 per cent of land in the country should be under forest cover (66 per cent in the hills and 20 per cent in the plains).

The National Agricultural Commission of 1976, surprisingly, advocated a distinct departure from conservation to production forestry. Of the two major points it made, the first was to meet existing and future requirements of industrial wood from production forests. The second was to ensure that present and future demands for protective and recreative functions of forests were met. Felling in protected forest was not allowed. Social forests would cover village commons, wastelands, land on rail- and roadsides, canal banks, etc. Free supply of forest produce was not a sustainable practice and needed to be reversed. Forest grazing should be allowed in a regulated and controlled manner. The essential aim of the policy should be to check denudation and erosion, and maximise forest productivity to meet demands for industrial wood, fuelwood, and grazing.

Following amendment of the Indian Constitution, forestry was made a concurrent subject; the centre could now enact forestry laws. The Forest Conservation Act 1980 was promulgated to check deforestation. The law made the prior approval of the government obligatory for dereservation of forests or for use of forest land for non-forest purposes. It also banned green felling above 1,000 m in the Uttar Pradesh hills.

Environmental awareness increased in the 1970s and 1980s. Sustainability was the new watchword. A comprehensive environmental law was enacted nationally in 1986 and, in 1988, a new forest policy was formulated. The new policy assigned top pri-

ority to the environmental role of forests. The basic objectives enunciated were:

- maintenance of environmental stability through preservation and restoration of forests,
- conservation of natural heritage by preserving natural forests and checking soil erosion,
- increasing of forest cover through afforestation and social forestry programmes and increased productivity,
- meeting of requirements for fuel/fodder/non-timber forest products/small timber of rural and tribal populations,
- creation of a people's movement for achieving the above objectives, and
- involvement of women in forest resource management.

The policy proposed that one-third of the country should be under forest cover; in hill areas the cover should be two-thirds. Rights and concessions should remain related to carrying capacity. Domestic requirements of tribals and poor people living near forests 'should be the first charge on forest production'. Monocultures were discouraged and mixed forestry stressed. Industry's needs were to be met from farm forestry and not natural forests. Stall-feeding was encouraged, wildlife preserved, the contractor system ended, and shifting cultivation was discouraged. Research, education, creation of employment, and forest protection were all emphasised.

This marked change in approach to forestry provides insights into how social, economic, and political construction of public policies affects stakeholders and into how governments respond to articulation of dissatisfaction by policy shifts. The idea grew that local people can and should be partners in the management of forests and common property land resources. A new initiative

was taken in 1990 when the government supplemented the 1988 policy directive with a memorandum to all states asking them to adopt joint forest management of degraded state-owned forest lands.

Joint Forest Management

The intention of joint forest management is for management of public forest lands to be shared by village communities and State Forest Departments to ensure soil and water conservation, improve land productivity, and create opportunities for additional employment and incomes for villagers. The objective is to strengthen villagers' control over their livelihoods through helpful partnerships, better access to forest lands, and a greater voice in resource management. Access and rights will benefit local communities and persuade them to think in longer time-frames and use resources accordingly. Lastly, it will promote people's autonomy and decision-making power in line with amendments made in the Indian Constitution aimed at decentralization. In Jammu and Kashmir, the Rehabilitation of Degraded Forests and Village Plantation Rules were promulgated in 1992, giving legal status to village forest committees; Himachal Pradesh issued a notification about Participatory Forest Management in 1993; in Uttar Pradesh, joint forest management rules were promulgated in 1997.

While the three states in the NWHR have begun to set up village forest committees, many issues remain to be addressed before policy intentions become ground realities. Village-level institutions responsible for joint forest management have to be brought into consonance with local government bodies. Many joint forest management arrangements have become linked to specific projects funded by external agencies or the central government. When such projects are completed and support is withdrawn, it becomes difficult to sustain the gains

achieved during the project. Attitudes and orientation of government officials, particularly forest officials, have to undergo basic transformation to become people and resource-friendly. Another issue of critical importance is the problems created by establishing protected areas within forests (sanctuaries, national parks, biospheres). Present practice is to exclude people from such areas, although this can be unsatisfactory. Research and training are two other areas that demand attention.

Gender and Equity Issues

The 1988 national forest policy clearly states that a 'massive people's movement with involvement of women' be generated to achieve objectives in the development, management, and use of forest resources. In mountainous regions, women have been major gatherers and users of forest produce. Yet their access to membership of joint forest management institutions and to decision-making or benefit-sharing is still in many ways inadequate or limited (Table 8).

Other equity issues remain to be solved. Although joint forest management programmes aim to ensure that the needs of the village poor for fodder, fuel, and small timber are met, it is often timber plantation that initially interests management committees. Timber benefits take years to mature and then accrue to the community. Current access for the poor is put at risk. Also, pastoralists remain almost invisible in the joint forest management process.

Forestry in Jammu and Kashmir

According to the State of Forest Report (FSI 1997), forest cover in Jammu and Kashmir was 20,905 sq.km. in 1987. By 1995, cover had come down to 20,433 sq.km. Forest cover as a percentage of geographical area is highly uneven from district to district varying from 0.02 per cent in Ladakh to 41.31 per cent in Riasi. The state government has

Table 8: Women's Role in Joint Forest Management Institutions

Region	Eligibility for general body membership	Women's representation in management	Entitlement to benefit-sharing	Access to information or decision-making
Jammu and Kashmir	One female or male per household	Minimum two women out of 11 members	Community institution to decide on benefit-sharing in consultation with all members	No quorum or presence of women specified for general body committee
Himachal Pradesh	One male and one female per household	Minimum of five village representatives out of a total of 9-12 management committee members. Of village representatives, 50 per cent to be women. <i>Mahila Mandal</i> representative also to be on managing committee	25 per cent of income from 'final felling' to go to the village development fund; Existing rights to be protected	For general body and management committee, a 50 per cent quorum required; women's presence for completing quorum not specified
Uttar Pradesh hills	One representative per household (male or female); no minimum membership of women indicated	One-third of members elected plus five nominated	Only for non-timber forest products, 25 per cent of net proceeds to go to the local institution and 25 per cent to be shared among members based on their contribution	66 per cent quorum for general body meeting for management committee elections

Source: Sarin et al. 1998.

introduced stringent laws to curb timber smuggling and upgrade forests. Colluding forest officials are dealt with sternly.

The total growing stock of timber from all sources is estimated at 143.7 million cubic metres, and that of fuelwood is 163.4 million tonnes. Per capita forest area was 0.45 ha in 1971 and down to 0.25 ha in 1991. It is still higher than the national average of 0.11 ha. The animal population exceeds eight million. According to a study carried out by the Solan University of Horticulture and Forestry, the intensity of grazing is 'more than six times the maximum permissible intensity and forest areas are particularly under stress from nomadic grazing' (Khosla *et al.* 1992). The area under alpine pastures and other grazing lands is 419,000 ha, but this does not include the high altitude vegetation of Ladakh. Demand for fuelwood is estimated to reach 3.37 million tonnes by 2000 (per capita consumption of 430

kg/yr); natural forests can supply only 1.92 million tonnes at current rates of extraction. This indicates sustained pressure on already shrinking forests and demands a massive fuelwood plantation programme or a planned shift to alternative energy sources.

Forest Policy

In 1990, the Jammu and Kashmir Government announced a policy that said, 'Forest must be managed so as to ensure environmental stability and ecological balance. The derivation of direct economic benefit must be subordinated to this principal aim'. This was in conformity with the broad aims of the National Forest Policy 1988. It placed emphasis on social forestry, people's participation, and the enlisting of NGO cooperation. It decided upon more stringent restrictions on transportation of timber out of the Kashmir Valley. In 1990-91, annual timber extraction was limited to 0.2 million

cubic metres, brought down to 0.17 million cubic metres in 1991-92, and further reduced to 0.14 million cubic metres in 1992-93. In 1990, commercial felling had been fully or partially banned in 24 forest divisions. Use of wood for electricity poles was prohibited.

Joint Forest Management

Villagers had traditionally been given some participatory role in forest management but this was limited. The Jammu and Kashmir Government promulgated the Rehabilitation of Degraded Forests and Village Plantation Rules in 1992. By 1996, 580 village forest committees, enjoying legal status, had been constituted and over 12,000 ha of community wastelands re-habilitated on a benefit-sharing basis. Village forest committees operate both in village commons and degraded departmental forest areas. From 1981-82 to 1991-92, plantation through social forestry programmes covered 82,000 ha. In the last five years, 8,000–10,000 ha/yr have been planted.

An eco-taskforce is engaged with the assistance of the Army in greening some severely degraded areas in Jammu region. Non-timber forest products are important to Jammu and Kashmir's economy, especially resin (3,000MT/yr) and medicinal plants (110MT/yr).

Case Study on Managing the Forest Herdsman's Way

This is the story of Bashir Khan Bakerwal, a migratory herdsman of Jammu and Kashmir (Rizvi 1994). He winters in Jammu and migrates in the summer with his herd to the alpine pastures of Kashmir and Rangdum in Zaskar (Ladakh). In 1989, he had 1,300 animals (mostly sheep and goats). The herd size was too large to be sustained on the forest area allotted to him. The consequence, inevitably, was forest degradation.

The stock, too, deteriorated; productivity fell. The social status of herdsman being determined by flock size, Bashir was reluctant to reduce his stock. Rizvi, a former Forest Secretary, explained to Bashir that if he culled unproductive animals each year and sold them as meat that he would yield a cash income and also improve stock quality. Bashir saw the logic of the alternative management practice and adopted the suggestion. The forest compartment allotted to him for grazing revived, providing better nutrition for the reduced herd. By 1992, Bashir had reduced his stock to around 700 animals. He had sold the culled animals and put his money in the bank (Rs 500,000). Rizvi recalls that it is not the bank balance that was the main cause of Bashir's happiness but the remarkably improved condition of his herd. The reduction in stock had yielded both positive economic and environmental results. The Bakerwals have a system of clans, and, consequently, the example of Bashir was adopted by twenty other families without the help of extension efforts.

Forestry in Himachal Pradesh

In Himachal Pradesh, the cadastral survey is only partially complete. This means that accurate information about forests is hard to find. By legal definition, the forest area is 37,591 sq.km, while revenue records quote a figure of 33,575 sq.km. However, satellite data interpretation (FSI 1997) reveals that actual forest cover is only 12,521 sq.km. Actual forest area is 22.5 per cent of the geographical area. Between 1995 and 1997, there was a net increase of 20 sq.km. Reserved forests covered 1896 sq.km., protected forests 31,473 sq.km., and unclassified forests 2,038 sq.km.. Most forests are either understocked, rocky or blanks (Gulati, 1998). Alpine pastures cover 29.4 per cent of the forest area, permanent snow covers 17.6 per cent, while 38.1 per cent has some sort of forest cover. The first cycle of satel-

lite-based estimation put forest cover in 1981-83 at 12,480 sq.km. In 1993-95, cover was estimated at 12,521 sq.km. Thus, in 12 years, increase in cover was 0.32 per cent, which can probably be accounted for by experimental error.

There is a situation of stagnancy. Growing stock is estimated by the state at 102.5 million cubic metres (this estimation covers only 58 per cent of the forest area). According to FSI, the total growing stock of all forests is 212 million cubic metres (FSI 1995). In the 20 years from 1975, the stock of commercially important species increased by 2.6 per cent. According to Gulati, annual removal of timber has been below prescribed yield levels reflecting the approach taken by the state in the utilisation of forest resources (Gulati 1998).

Forest Settlement

In 1873, forests were classified into three categories: reserved, protected, and village. Permanent demarcation commenced in 1884. In 1952, all forest lands were brought under state ownership. The legal classification at present is reserved forest, demarcated protected forest, and un-demarcated protected forest.

Forest Policy

Himachal Pradesh followed the National Forest Policy of 1952 until 1980 when it formulated its own policy. The salient features of this policy are as follow.

- Forest policy to become an integral part of overall land management
- All surplus lands (under ceiling law) and vested village commons handed over to Forest Department for management
- Rapid afforestation programme (50 per cent of land under forest cover by 2000)
- Four-year moratorium on commercial felling
- Abolition of *nautor* (freshly broken

land) grants

- Enlistment of people's participation
- Pasture improvement
- Nationalisation of sale of trees from private lands

The 1980 policy needs to be revised in the light of the National Forest Policy 1988, the joint forest management guidelines of 1990, and the new state Panchayati Raj laws of 1992 that have given many forestry-related functions to village *panchayat*(s).

Grazing Policy

Grazing pressure is heavy with an animal population exceeding five million. The 'grazing incidence is estimated to be more than three times the carrying capacity of the pastures' (Gulati 1998). Average biomass availability from pastures varies from 1.74MT/ha in 2,100–3,500m altitude range to 0.50MT/ha in alpine areas above 4,000m (Misri 1995). Grazing pressure overflows to forest floors with attendant adverse impacts. The State Government constituted a Grazing Advisory Committee in 1968. In 1970, it recommended reduction of goat and buffalo numbers, control of migratory herds, registration of flocks and establishment of their routes, levying of a uniform grazing fee, and rotational closures. However, these measures have not been enforced effectively. The population of animals rose from 4.2 million in 1966 to 5.2 million in 1987. The state is deficient in dry and green fodder (32% and 62%, respectively) (Sood *et al.* 1995).

Forest Code

Laws and regulations pertaining to use and management of forests are scattered over a large number of enactments, rules, notifications, policy documents, and government orders. 'As a result, the law is not a coherent body of provisions but a contradictory body of conflicting objectives, modalities, and provisions' (Gulati 1998). The existing

legal framework is a deterrent to the implementation of joint forest management.

Non-timber Forest Products

Non-timber forest products play an important role in the rural economy of the state. They include b habar grass (used for paper production), *kat ha*, resin, medicinal herbs, etc. B habar grass is taken by a paper mill on a royalty basis. *Acacia* (the source of *kat ha*) is grown on forest and private land. All resin has to be sold to the Himachal Pradesh Forest Corporation. It is reported that 4,750 MT of medicinal herbs were exported in 1992-93 (value Rs 23.5 million). The general impression is that utilisation of non-timber forest products has been 'unregulated and indiscriminate'.

Joint Forest Management

In 1993, the Himachal Pradesh Government issued a notification constituting village forest development committees for participatory forest management as non-political bodies. The duties of village forest development committees include persuading villages to 'give available areas for plantation' and assisting Forest Departments in planning, protection, afforestation, and 'judicious use of existing rights' and 'equitable sharing of usufructs'. The Forest Department explains the joint forest management plan, gives weightage to village forest development committees' recommendations and provides technical know-how. One-fourth of net sale proceeds are given to the village forest development committee to be retained as a common fund to be utilised for village development works. The shift from a top-down, authority-based, regulatory system to a participatory, decentralized one in which people can take decisions themselves was somewhat half-hearted. According to Gulati, from 1990 to 1993, that is, before the 1993 notification was issued, 'more than 4,000 such village forest development committees were formed most remained non-starters and be-

came defunct' (Gulati 1998). The effort was resumed in 1993; from 1994-95 to 1996-97, 1,095 village forest development committees were constituted, and 439 resource management plans formulated. The effort is still, to a major extent, 'donor-driven' and methods/techniques of participation adopted differ. Traditional rights and concessions are household-based while surpluses from 'final felling' will accrue to the community collectively. This may create conflict. The legal framework is still restrictive; there are many inhibiting laws that need to be modified to bring about consistency and simplicity. There is a need to concentrate on capacity-building of forest officials and village forest development committee members. Village forest development committees as institutions have to be strengthened, gender issues to be addressed, and the full support of the Forest Department in philosophy and action ensured. Another issue that needs addressing is the interface between village forest development committees that are concerned with management and forest resources in a limited context and village *panchayats* that have been assigned wider functions, including forest-related tasks such as social/farm forestry, utilisation of non-timber forest products, fuel and fodder, and soil conservation.

Forestry in the Uttar Pradesh Hills

In hill areas of India, recommended forest cover is 66 per cent. In the Uttar Pradesh hills, the recorded cover is 63.9 per cent but this is a legal-status figure. Actual cover is only 44.5 per cent and, of this, only 77.7 per cent constitutes dense cover while the rest is open forest. Satellite observations made in 1987 showed actual cover to be 22,536 sq.km (FSI 1991) and, in 1995, 22,658 sq.km (FSI 1997). This means that, in a period of eight years, the growth of forest cover was 0.54 per cent (probably accountable for by experimental error). Per capita forest cover is about 0.32 ha (on a rough projection of 1997 population). The quality of cover is highly uneven. There are

some areas classified as forest that are mostly treeless. For Uttar Pradesh as a whole, growing stock is estimated at 334 million cubic metres of which roughly 266 million cubic metres are in the Himalayan hill regions (FSI 1993). The volume/ha varies from 97.6 cubic metres in Garhwal forests to 185.4 cubic metres in Alak-nanda catchment forests (SHERPA Survey 1993). One-fourth of the hill forest area is located below 600m in Bhabar-Terai, lower Siwalik and Dun Valley areas where considerable deforestation has taken place. This is a belt where human settlements abound and tourism is an important activity. Consequently there are severe biotic pressures that threaten it from both an ecological and conservation point of view.

It has been calculated that, in Dehradun district, between 1880 and 1980 the area under forest was reduced by 34,739 ha (Ives and Messerli 1989); the major diversion having taken place for agricultural and human uses. Available arable land declined from 0.3 ha per capita to 0.1 ha per capita, and access to natural vegetation from 1.8 ha per capita to 0.4 ha per capita. Annual timber export in the early years of this century was over 6,000 cubic metres and over 27,000 cubic metres was consumed each year for fuelwood and charcoal. According to Uttar Pradesh's forest statistics (FSI 1997), from 1951 to 1980 forest areas lost to other uses was 230,005 ha. Following the promulgation of the Forest Conservation Act 1980 this diversion has come down. It stood at 20,407 ha from 1981 to 1992, and reduced to 3,171 ha between 1992 and 1997 (Ghildiyal and Banerji 1998). This does not take into account illegal diversions.

Chipko Movement

Frequently, it is issues of land degradation, deforestation, and water resource management that inform the struggle for a voice and a right in the use of local resources. This is what gave rise to the widely known

Chipko Movement in Garhwal. It demonstrated a form of community and gender strength against the destruction of forest by contractors. In 1975, the felling of trees and destruction of mountains were resisted near Reni. Women successfully confronted lumbermen, crying, 'Embrace the life of the living trees and streams, clasp them to your hearts'. Chipko created awareness; the message was spread. It evoked responses in terms of policies and laws. It served to bring forests, particularly mountain forests, to the focus of public concern. However, the movement became too conservationist in its bearing and the needs of local communities were not reflected; 'the forest that women tried to protect has been converted into the Nanda Devi Biosphere and women cannot take a blade of grass or pick a herb' (Rodda 1991). More than two decades after the Reni protest, another protest has been initiated demanding traditional access for villagers living on the edge of Nanda Devi Biosphere.

Fell-the-Trees Movement

Felling of green trees above 1,000m has been banned in the Uttar Pradesh hills. The Forest Conservation Act 1980 put a severe break on diversion of forest lands for non-forest purposes. Such diversion required prior permission from the Central Government. Many development projects, for which forest land was required, were stalled or delayed. There was public resentment. Activists, who had earlier supported the Chipko Movement, felled a large number of trees in Kumaon and Garhwal during 1988-89 flouting the Forest Conservation Act. This 'Fell the Trees' Movement was a protest against inordinate delays or rejection of making forest lands available for projects such roads, buildings, pipe-laying, hospitals, schools, public conveniences, etc. It is obvious that while hill people want trees they also want development (Rawat 1998).

Legal Framework

The Forest Act 1927 is still an important law valid at present and being considered for revision. Under this act, village forests can be created within reserve forests or any other land owned by government. *Van Panchayat* Rules were formulated in 1931. In 1935, the National Park Act was enacted and the first national park in the country (Corbett National Park in the Uttar Pradesh hills) came into existence. In 1948, the Kumaon Nayabad Grant and Wastelands Act came into force by which the rights of villagers were restored over unmeasured or government lands, subject to certain conditions. However, it gave rise to uncontrolled grazing and extension of agricultural holdings. In 1973, this law was repealed. The last land settlement commenced in the 1950s and all land was measured. In 1974, the State Forest Development Corporation was set up to departmentalise commercial forestry. The Tree Protection Act was promulgated in 1976. Forest, as a subject, was shifted to the Concurrent List of the Indian Constitution through an amendment in the 1970s and, in 1980, the Forest Conservation Act was promulgated by the Central Government prohibiting use of forest lands for non-forest purposes without its approval. In 1981, the felling of green trees above 1,000m was banned. The ban excluded trees felled for meeting the demands of rights- and concession-holders. In 1988, a new National Forest Policy was announced which was followed, in 1990, by the Joint Forest Management Guidelines. It took nearly seven years before Uttar Pradesh Village Forest Joint Forest Management Rules were promulgated in 1998. In 1972 and, again in 1976, the *Van Panchayat* Rules were amended. Revision is again under consideration.

Grazing Problems

Hill people have rights in respect of grazing and fodder collection in almost all categories of forests. However, an increase in ani-

mal population had led to excessive demands for fodder. For example, in the current working plan of Garhwal Forest Division, the animal population was estimated at 473,200. In terms of standard cow units, it was 359,900. According to the Forest Department, 0.41 cow units can subsist on one ha of forest. In Garhwal Forest Division, suitable forest area is only 263,000 ha. This means that grazing incidence is 1.37 cow units/ha which is over three times the sustainable capacity (Ghildiyal and Banerji 1998). Forest floors are under pressure and the situation in alpine pastures is also bad. Overall productivity is low and this accentuates the fodder problem. Stall feeding has not caught on and current animal feeding practices are wasteful.

Van Panchayats

Joint forest management may be a comparatively new slogan yet it has a distant echo in the history of forestry in the Uttar Pradesh hills. To an extent community cooperation has its root in the cultural traditions of Uttarakhand which reflect a closely knit social structure. When demand on resources increased to fulfill the needs of regions outside the hill areas, the people of the Uttar Pradesh hills felt threatened. Their survival was put in danger because of new policies that, in the name of conservancy, sharply curtailed their access to traditional resources. They protested with vehemence, even violence. The State Government responded by setting up a Grievance Committee that suggested people's participation in the management of community forests through *van panchayat(s)*. The *Van Panchayat* Rules were instituted in 1931. They were modified in 1972 and, then again, in 1976. By early 1998, 4867 *van panchayat(s)* had been set up (3,056 in Kumaon and 1,811 in Garhwal) covering about seven per cent of hill forests. *Van panchayat(s)* were intended to be grass root institutions but they were not supported genuinely or allowed to grow and acquire

credibility. There was dual control by the Revenue and Forest Departments that hindered their becoming effective local institutions. Barring exceptions, most *van panchayat(s)* remained organizationally weak and economically poor. The *Van Panchayat Rules 1976*, while devolving upon them responsibility for management of village forests, denied them the authority needed to do so. For example, a *van panchayat* cannot appoint paid staff without the approval of the Deputy Commissioner. It cannot compound cases beyond a value of Rs 50 or sell produce without approval of the Forest Department. For commercial sale of trees, approvals from both Forest and Revenue Departments are required. The *Van Panchayat Rules* are under revision. It is learned informally that the new rules will arm *van panchayat(s)* with greater powers—legal, financial, and managerial. These institutions, given a chance, can bring about community-based, village-level resource management that could be self-regulatory, sustainable and suited to villagers' needs. An important issue to be addressed would be the development of a constructive and working interface between village *panchayat(s)* established under the sanction of the Constitution (which have a much broader range of functions) and *van panchayat(s)* that have forest resource management as their principal task.

Joint Forest Management

Another important initiative in the area of localised resource management is the concept of joint forest management. The Central Government issued directions in this respect in 1990. However, it took until 1998 for the Uttar Pradesh Government to issue its own guidelines. Their main features are as follows.

- Larger, feasible, viable, and compact blocks of 250–300 ha will be taken up for community management.
- Blocks selected will be in the proximity of villages and can include reserved or unreserved forest areas, i.e., both government and community forest areas.
- Villagers will prepare, execute, and monitor microplans.
- Joint forest management will include afforestation, biomass production, water regeneration, protection of forest, non-conventional energy-resource generation, animal husbandry, and agri-horticulture.
- Emp hasis will be given to training and orientation and appropriate accounting.
- Fifty per cent of project surplus will accrue to the village community: half to individual beneficiaries and half for community works.
- Non-forest development works will be dovetailed with joint forest management programmes.

Chapter 5

Agriculture

Although cultivated land is only 15.5 per cent of the reporting area in the NWHRI (the geographical area being much larger), agriculture and its allied activities constitute the occupations of the major component of people living in the region. Statistics regarding distribution of workers show that between 65 and 75 per cent depend on agriculture for sustenance. Between 80 and 90 per cent of the population lives in rural areas. The total net sown area was about 1.98 million ha in 1991, which means that per capita availability of cultivated land was about 0.1 ha. Between 64 and 74 per cent of the land holdings were below one ha, the average being about 0.4 ha. These tiny holdings are often spread over many scattered parcels. A study in the Uttar Pradesh hills showed that usually four to eight scattered parcels constituted a holding. Hardly any attempts at consolidation of holdings have been made. The existing land tenure and titling laws or their implementation are not conducive to putting a stop to fragmentation. Land-use figures combined with satellite-imagery assessments show that actual forest cover is 5.56 million ha, which means that the ratio between forest and cultivated

land is 2.8:1. It is the view of experts that five to seven hectares of forest land are required to support each hectare of mountain agriculture effectively.

Problems of Mountain Agriculture

Mountain agriculture faces multiple problems. It has limitations imposed on it by differing land forms, diverse micro-climates, changing elevations, and generally poor soil types. These conditions can support a great variety of vegetation varying from tropical to alpine. Agriculture in mountain regions does not mean only cereals, pulses, oilseeds, and commercial crops. It includes not only food crops but tree-farming, horticulture, pasture/grassland development, fodder cultivation and floriculture; and it also has a close relationship with animal husbandry and forestry. Use depends on the endowments of each parcel of land in each small watershed. The strategy that is suggested by experts lays stress on integrated, scientific land use and is partial specialisation (niche–advantage approach) aimed at topo-sequencing of crops with appropriate technology for raising production and pro-

ductivity, enhancing economic returns, and achieving sustainability. This should be attempted keeping in mind the needs of local people, requirements of environmental security, and competing demands on land.

Agriculture and allied land-based activities have a close interdependence. Each farming system is an ecosystem that encompasses several subsystems. The ecosystems are diverse, highly varied, and differentiated. Therefore, local adaptations become necessary. This approach encourages both diversification and optimisation. In recent years, the range of diversity has been reduced. This is particularly true of the flat valleys and *Terai* areas in the NWHRI. The Green Revolution has, by and large, bypassed high hills and slopy lands (terraced or unterraced). However, its impacts on broad valleys and foothill flats are conspicuously visible. In these areas, many sharp gains in agricultural production and productivity have been made but, in the process, crop diversity has been reduced by limiting production to a small number of high-yielding varieties with a specified package of practices and high input intensity. In high hill areas, the effect of high-yielding varieties is limited. Biodiverse agriculture is still common. Agriculture in the NWHRI is practised under several constraints.

- Topographical and climatic factors mean that only a small percentage of the geographical area is available for cultivation (6%). Much of this land is slopy or steep and unterraced.
- Land use does not have a meaningful relationship in terms of optimality and sustainability with land capability. For example, slopy lands (over 30%), which are mainly suitable for silvi-pastoral or horticultural uses, are used for cropping. This practice is conducive to soil erosion and consequent degradation.
- The size of land holdings is extremely small and their fragmented nature creates difficulties in land management.

- Changes in land use, particularly on marginal and subsistence private lands, to more sustainable utilisation are difficult to achieve. Often they result in loss of income, and it can take several years before returns from alternative uses mature (e.g., change from cropping to horticulture or tree-farming).
- As land as a resource is inelastic, incessantly increasing demographic pressures put severe strains on its limited base. This amounts to exhaustion of capital rather than the utilisation of interest for subsistence.
- Additions to cropped areas have come from marginal, slopy lands with poor soil cover and moisture-holding capacity.
- Highland farmers are not willing to take risks because of the uncertainty of results, vagaries of weather, lack of research/technology support, and inadequacy of infrastructure.
- There is a lack of appropriate technology for mountain agriculture. Even where good research results have been obtained, their extension and adoption at the field level have not materialised. Area-specific packages of practices are not easily available and their successful 'proving' in actual field conditions is wanting. Inputs, credit, and services are difficult to procure.
- From some areas outmigration of young people has left old people and women to manage farming.
- It has not been possible for niche advantage to lead to economic returns. Market forces do not easily allow this to happen. Special institutional effort and targetting of resources for services, facilities, processing, and marketing support are needed to press the niche advantage and convert it into tangible benefits for producers.
- There is a lack of group action on private lands. In mountain watersheds, individual acts by farmers, graziers, and

animal rearers can result in adverse impacts. Similar negative impacts follow the lack of coordination, in time and space, between work done on government lands and on private lands that are in the same watershed.

- Costs of production are higher.
- There is an inadequacy of research in hill agriculture. For example, enough new varieties have not been evolved to withstand strong acid, low phosphorous, droughty soils, and highly variable temperature conditions so common in hill lands. Rainfed agriculture needs special attention where the gaps between potential and existing levels of productivity are substantial.
- Local knowledge and practices need to be built upon and improved through scientific and efficient applications. This desirable fusion has not materialised.

Agriculture in Jammu and Kashmir

The Jammu and Kashmir economy is largely primary-sector based in terms of employment, if not in terms of its contribution to the state's domestic product—which fell marginally from 47.4 per cent to 45.9 per cent in 1995-96. Nearly two-thirds of the work force depends on the primary sector for employment, out of which 99.75 per cent is engaged in agriculture and allied sectors. Highland population zones are areas with lower levels of work participation. Land-use data for the state show that, of the reporting area of 45,045 sq.km, only 16.2 per cent is net sown, and per capita cultivated land availability is less than 0.1 ha. During the last four decades, the net sown area has increased by about 19 per cent (118,000 ha) while there has been a sharp reduction in current/other fallows. The area of barren and uncultivable land has shot up since 1980-81 from 231,000 ha to 291,000 ha in 1996-97, i.e., by 26 per cent. Area under pasture lands has declined from 132,000 ha to 126,000 ha, while cultivable

waste has gone up. Reported forest area has also shown a decline since 1980-81. Forests and some fallow lands have been partially converted to agriculture and horticulture. Land holdings are small; 74 per cent are below one hectare. If net sown area (731,000 ha) and total number of holdings (1.22 million) are combined, the average holding size is 0.6 ha. Agricultural production and productivity changes in the last four decades are shown in Table 9.

There has been a substantial rise in the gross cropped area under food grains since 1955-56 (27.5%). Total food production has gone up by about 153 per cent, while overall productivity has nearly doubled. However, crop-wise, the gains have been uneven. Rice production was 1,897 kg/ha in 1964-65, rose to 2,211 kg/ha in 1985-86, and fell to 1,742 kg/ha in 1996-97. Maize productivity was 1,511 kg/ha in 1964-65, rose to 1,871 kg/ha in 1993-94, and fell to 1,490 kg/ha in 1996-97. Wheat productivity rose sharply from 645 kg/ha in 1964-65 to a high point of 1,907 kg/ha in 1994-95 and then fell marginally to 1,671 kg/ha in 1996-97 (Jammu and Kashmir Directorate of Economics and Statistics 1996-97). Non-food crop production has declined considerably in the case of oilseeds, sugar cane, and potato in recent years. The per capita availability of food grains rose from 146 kg/year in 1955-56 to 170 kg/year in 1995-96. However, the food deficit has continued, and the import of food grains has risen from 40,000 tonnes in 1955-56 to 487,000 tonnes in 1996-97. Productivity of rice and maize is near national averages, but for wheat is over 40 per cent lower. The consumption of NPK fertilizers was 53 kg/ha in 1995-96 (much less than the national average), but nutrient application was highly skewed, the proportion being 16:5:1 for NPK, respectively. The net irrigated area was 47.2 per cent of the net sown area in 1996-97 and most irrigation (over 90 per cent) came from canals. Irrigation intensity is 141.

Table 9: Area, Production and Productivity of Food Crops in Jammu and Kashmir

Year	Total area sown under food crops ('000ha)	Total production of food grains ('000 T)	Productivity (kg/ha)
1955-56	689	n/a	n/a
1965-66	747	583	780
1974-75	833	1010	1212
1985-86	918	1244	1355
1995-96	956	1474	1542
1996-97	878	1324	1508

Source: Jammu and Kashmir Directorate of Economics and Statistics (1996-97)

Horticulture is an important sector. The area under fruit cultivation has increased from 12,400 ha in the 1950s to about 180,000 ha in the 1990s. Production in 1991-92 was reported at around 700,000 tonnes, mostly apple and walnut. Production of vegetable and flower seed is big business. Overall productivity of fruits was 5.88 T/ha in 1991-92, which was much higher than in Himachal Pradesh and the Uttar Pradesh hills. Value additions to horticultural crops are nominal. Floriculture has started doing well. Saffron and mushroom are specialties that command premium prices and can produce lucrative returns. Sericulture is an important activity that provides income and employment to a considerable number of people.

Jammu and Kashmir has a large animal population that has more than doubled in the last three decades. In 1992 (last animal census held), total livestock numbered 8.7 million of which nearly 30 per cent was cattle, 8.4 per cent buffaloes, 30 per cent sheep, and about 20 per cent goats. Livestock-rearing constitutes an important economic activity in the high hills characterised by transhumance. Increasing animal population has been putting forest floors and rangelands under severe pressure. The grazing intensity is reported to be more than three cow units/ha, which is six times higher than the recommended grazing intensity of

one large ruminant for every two hectares (NRRC 1997). Nearly 40,000 people depend on fisheries for their living.

Agriculture in Jammu and Kashmir is a slow-moving sector. Possibilities for any substantial additions to cultivated land are extremely limited. Therefore, gains in production have to come largely from increases in productivity. Nearly one-fourth of food requirements has to be imported and dependence on supplies from outside extends to edible oils and pulses.

Agriculture in Himachal Pradesh

Himachal Pradesh has three physiographic regions: Siwaliks, the Middle Himalayas, and the great Himalayas. It is, cadastrally, a partially surveyed state, the reporting area being only about 60 per cent of the geographical area. Actual forest cover is 22.5 per cent of the land area. The state has extensive pasture lands that cover nearly 20 per cent. The net sown area was 583,000 ha in 1990-91 (10.4% of the total area) and has not changed much since then. Himachal Pradesh has the highest cropping intensity in the NWHRI at 169 (1990-91 figure). Most of the state's agriculture is rainfed; irrigated areas are about 17.5 per cent of the net area. Irrigation intensity is fairly high at around 170. The difference between the irrigation potential created and that utilised is about 40 per cent. Soils are generally thin and young except in valleys and gently sloped areas. Land holdings are small, average size being 1.2 ha (1990-91 figure). Nearly two-thirds of these holdings (64%) are below one hectare. About 70 per cent of the main workers are in the primary sector, most having occupations related to agriculture and its allied activities. Historically, there has been a steady decline in the proportion of workers in the primary sector, which is indicative of the limitations imposed by the resource base. Income from agriculture and allied sectors accounts for 36.4 per cent of the state's domestic prod-

uct. Agroclimatic conditions are suitable for growing cash crops such as potato, ginger, mushrooms, and off-season vegetables. While, in the past, emphasis was placed on increasing the production of traditional food crops, in recent years, a gradual but steady trend towards diversification is noticeable. Trends of area, production, and productivity in agriculture are reflected in Table 10.

In the last decade, area under food crops has declined by nearly 6.5 per cent but food production has gone up by 13.25 per cent. This is because substantial productivity gains have been achieved (21.3%). Productivity of wheat has gone up by 75 per cent, of rice by 20 per cent, of maize by 11 per cent, and of barley by 11 per cent in the last four decades. However, since 1993-94, productivity for all main food crops has declined.

Land-use changes from 1975-76 to 1990-91 show that reporting area has increased, indicating that more land has been surveyed. There is a nearly 50 per cent increase in the category of barren and uncultivated land, and the area of cultivable wasteland has also risen. The net area sown is almost the same with an increase of 4.4 per cent in a decade and a half, while there has been hardly any increase in gross cropped area. Current fallow is down by nearly 20 per cent. Use of chemical fertilizers has nearly trebled since 1980-81 at 40,000 tonnes in 1992-93, meaning a consumption level of 40 kg/ha. The NPK proportion is skewed at about 6:1:1. A Training and Visit Programme has been implemented for improving extension services. Easy credit flow is wanting and input availability is often difficult for remoter areas. Two universities at Palampur (agriculture) and Solan (forestry and horticulture) provide research support.

Himachal Pradesh has become a major producer of temperate fruit. In 1950-51, area under fruit was 792 ha and production

Table 10: Area, Production and Productivity of Food Crops in Himachal Pradesh

Year	Total area sown under food crops ('000ha)	Total production of food grains ('000 t)	Productivity (kg/ha)
1975-76	844	1129	1340
1980-81	856	1157	1350
1986-87	878	1176	1340
1988-89	881	1137	1290
1996-97	824	1288	1562

Source: Government of Himachal Pradesh, n.d.; Ministry of Agriculture, n.d.

1,200 tonnes; by 1991-92, the area was 170,768 ha and production was 342,303 tonnes. Further gains in both production and productivity have been made since. Estimate of production for 1994-95 was 587,000 tonnes. More than three-quarters of the fruit produced are apples, the other varieties being nuts, citrus, pears, and other pomes. The area under vegetables has risen from 8,000 ha in 1974-75 to 24,000 ha in 1993-94 and production from 90,000 to 385,000 tonnes. Mushroom production has grown (600 tonnes) and, amongst spices, ginger is an important crop (3,200 tonnes). Hops are also grown. Potato is grown in nearly 17,000 ha, production being about 160,000 tonnes.

Post-harvest technology has many gaps. Packing and transport of fruit is problematic. In order to reduce pressure on hill forests, eucalyptus and other types of wood brought from the plains are also now being used in increasing quantities for making packing cases. Corrugated paper-board packaging and transportation in plastic bins are also being adopted. Value additions to horticultural produce are highly inadequate and the potential of off-season vegetable growing and marketing remains to be realised. Efforts are being made to introduce modern methods in orchard management such as drip irrigation, glasshouse technology, and protected cultivation systems. The possibilities of higher production and incomes (and employment) through horticul-

ture are immense.

The high percentage of area under pasture (nearly 20 per cent) is clearly indicative of the importance of pastoral activities. The animal population was 2.7 million in 1961 and, by 1988, had increased to 5.4 million (excluding poultry). In 1992, it had come down to 5.1 million. Grazing pressure is heavy. According to the Department of Forests, Farming, and Conservation, forest floors provide 80–85 per cent of fodder requirements. The rest is obtained as cut and collected grass from farmers' fields, common lands, etc. Stall-feeding is practised only in respect of improved cattle breeds (10–15%). The Forest Department estimates that grazing pressure is about three times the carrying capacity of pastures and forest floors (Gulati 1998). Most animals are indigenous breeds and nondescript with low productivity. Nomadic tribes depend on animal rearing for their livelihood and practise transhumance. About 12,000 families depend on fisheries for sustenance. There is further scope for riverine and lacustrine pisciculture.

Agriculture in the Uttar Pradesh Hills

This subregion of the NWHRI has an area of 53,585 sq.km, all of which is the reporting area. Actual forest cover is about 44 per cent (nearly one-third being open forest). The net sown area is 13.3 per cent of the total area and has recorded a fall of nearly five per cent between 1980-81 and 1993-94. Barren and uncultivated land has registered a rise of about 25 per cent from 23,100 ha in 1975-76 to 29,550 ha in 1990-91. Pasture land is practically stagnant and so is cultivable waste. Current fallow is sharply down by almost 70 per cent while other fallow has nearly doubled. Cropping intensity has increased marginally from 161 in 1975-76 to 164 in 1990-91. Production gains have thus resulted mostly from productivity gains. Seventy-one per cent of land

holdings are below one ha, their average size being 0.37 ha. If all land holdings are taken into account, the average size is 0.94 ha. Fragmentation is common. Net irrigated area has risen to 158,000 ha; irrigation intensity is 167. Net irrigated area is 34.75 per cent of net sown area. Use of chemical fertilizers has doubled from 34 kg/ha in 1980-81 to 70 kg/ha in 1994-95 but there are imbalances. Nearly 97 per cent is utilised in only three of the twelve districts. The NPK ratio was about 6:2:1 in 1981 and had deteriorated to 1:2.5:1 in 1994-95. It is mainly in the *terai* areas that high production and productivity gains have been achieved. For example, in Nainital district in 1993-94, productivity of food grains was 2,767 kg/ha. In 1993-94, yield of rice for the Uttar Pradesh hills as a whole was 2,004 kg/ha, and that of wheat 1,758 kg/ha. Table 11 summarises the area, production, and productivity trends of the main food crops in recent decades.

A typology of the farming systems in the Uttar Pradesh hills that was prepared by the G.B. Pant University in 1989 is outlined in Table 12.

Table 11: Area, Production and Productivity of Food Crops in the Uttar Pradesh Hills

Year	Total area sown under food crops ('000 ha)	Total production of food grains ('000 t)	Productivity (kg/ha)
1980-81	984	1307	1327
1985-86	919	1366	1487
1993-94	895	1497	1685

Source: Statistical Diaries of Uttar Pradesh Hills Government

The areas under rice, finger millet and maize consistently declined between 1980-81 and 1993-94 by 4.6 per cent, 14.5 per cent, and 18 per cent respectively. For wheat, there was an expansion of 63.5 per cent in the same period. Productivity in maize has fallen by 11.8 per cent from 1980-81 to 1993-94. However, in the same period, the

Table 12: Typology of the Farming Systems in the Uttar Pradesh Hills				
Land type and altitude range (m)	Geographical area		Soil type	Principal crops
	Area('000 ha)	Percentage		
Irrigated lower hills (600-1200)	614	12	Alluvial sandy lome	Rice, wheat, onion, potato, chilli, pea, cabbage, radish, cauliflower, citrus, mango
Rainfed lower hills (600-1200)	409	8	Residual sandy loam	Ragi, rice, wheat, citrus, mango
Mid-hills southern aspect (1200-1700)	1841	36	Sandy loam	Rice, ragi, wheat, peach, plum, citrus, potato, tomato
Mid-hills northern aspect (1200-1700)	1227	24	Brown forest soil	Ragi, rice, wheat, tomato, potato, pea, cole crops, peach, plum, apricot, apple
High hills (1700-2500)	614	12	Red to dark black clay loam	Ragi, french bean, pea, cole crops, potato, apple, apricot, pear, walnut
Very high hills (2500-3500)	204	4	Red to dark black clay loam and meadow type	Amaranth, buckwheat, peas, cole crops, potato, apple, almond, apricot
Alpine pastures (3500)	204	4	Heavy textured meadow soil	No crops/trees; only alpine flora

Source: National Agricultural Research Project, G.B. Pant University, 1989

productivity of paddy rose by 25 per cent, of finger millet by 20 per cent, and of wheat by nearly 30 per cent. The per capita availability of food grains is a little over 230 kg/year. However, much wheat and rice is exported from the *terai* region through procurement, commercial sale, or in the form of seeds. The subregion has to depend on an extensive public distribution system to meet its food needs. Agricultural diversification is now taking place through production of basmati/high-grade rice, soyabean, spices, vegetables, fruit, mushrooms, and seeds. Even tea is being reintroduced.

Agricultural extension is insufficient and not well organized. The Training and Visit Programme has not been adopted.

The cooperative structure for credit is weak. In 1991, the per member average loan distributed by primary agricultural cooperative societies was Rs 187. There are many research institutions located in the Uttar Pradesh hills such as the Pantnagar University of Agriculture and Technology, G.B. Pant Institute of Himalayan Environment and Development, National Bureau of Plant Genetic Resources, Central Soil and Water Conservation Research and Training Insti-

tute, Central Potato Research Institute, Forest Research Institute, and many others. The impact of research has been remarkable in the *terai*, but the uplands have not benefitted in any substantial measure.

Horticulture is a growing sector and is of increasing significance to the subregion's agrarian economy. The climatic and altitudinal range and diversity have endowed it with the potential for growing high- and low-chilling temperate fruit, subtropical fruit, and a variety of vegetables (especially off-season ones that can generate high economic returns) in high and low hills as well as valleys. Area under fruit crops was around 2,500 ha in the early 1950s and had risen to 179,200 ha by 1993-94. Production in that year was 470,000 tonnes and productivity was 2.62 T/ha. Area under vegetables is also increasing as Table 13 indicates.

The area cultivated with and production of potatoes have risen; the area from 11,546 ha in 1984-85 to 19,000 ha in 1993-94, and production from 196,000 tonnes to 392,000 tonnes.

Apples are the predominant fruit followed

Table 13: Area, Production and Productivity of Fruits and Vegetables in the Uttar Pradesh Hills in 1993-94

	Area (ha)		Production (tonnes)		Productivity (T/ha)	
	Fruits	Vegetables	Fruits	Vegetables	Fruits	Vegetables
1984-85	141,554	34,141	330,000	1,30,000	2.33	3.8
1989-90	166,231	48,944	397,707	2,38,900	2.39	4.88
1991-92	173,055	57,000	452,000	2,76,000	2.61	4.84
1993-94	179,200	65,000	469,500	3,25,600	2.62	5.01

Source: Government of Uttar Pradesh, n.d.

by citrus, pear, mango, walnut, peach, apricot, and plum. Productivity of fruit, particularly apples, is much lower than in Jammu and Kashmir and Himachal Pradesh. Micro-nutrient deficiencies, poor rootstock, gaps in management, and incidence of diseases are reasons for low productivity. There are hardly any value additions to fruit and vegetables within the subregion. There is a near absence of collection and grading centres, cool houses, processing plants, and marketing support. Progeny orchards need renewal. Research support at the orchard/field level needs to be strengthened.

Niche development has occurred in a few places such as the Garampani area of Nainital district, Chamba in Tehri district, and Mandal in Chamoli district but these are low-scale exceptions. Other issues of priority are varietal improvement, packaging, storage and transportation, value-addition facilities (through industrialisation of horticulture), skill development, easy credit, grower-oriented extension, and strong marketing organization. Apiculture, mushroom-growing, and spices and herbs are other areas of potential growth.

Animal-rearing is inextricably connected with agriculture and land-use systems in the Uttar Pradesh hills. The keeping of livestock is closely related to farm management. There are also pastoralism and transhumance. The population of livestock increased from 3.8 million in 1961 to 4.4 million in 1988. Thereafter, increases have been small. Pasture area is limited and low

yielding. There is grazing pressure on forest floors. Most cattle are nondescript in quality and less than one-tenth are cross-bred. Goats, being browsers, cause a great deal of damage to vegetation. Their number at about a million is nearly three times that of sheep.

Open grazing is practised mostly, and its adverse consequences are visible. Community forests have suffered the most and are extremely degraded. Even reserve forests, where access is somewhat regulated, are subjected to unsustainable grazing pressures. Little stall-feeding is practised. Green fodder deficit is estimated at 40–50 per cent; supplementation of animal nutrition through feeds/concentrates is exceptional. Cattle are kept mainly for manure and draught power but, of late, milk production has begun to increase because dairy and marketing linkages have been provided. Wool productivity is low, and poultry and fishery programmes have yet to pick up pace.

Strategy for Agriculture

A brief look at agriculture in the NWHRI shows that there is scarcity of cultivable land and, except in flats/valleys/gently sloped areas, soil quality is poor and cover is thin. The net sown area of the geographical area is low at around six to seven per cent. If only the reporting area is considered, net sown area is 15 per cent and gross cropped area is 23.1 per cent. The net irrigated area is about one-third of the net sown area. Productivity has been increasing but is still

much lower than national averages, and gains have been made largely in valleys and foothill *terai* areas. The area of forest cover that is required for sustaining mountain agriculture is less than half of what it should be. Human and animal population pressures are acute and increasing. Grazing is 2.5–3 times carrying capacity. In research, technology, inputs, credit, value-addition opportunities, and the evolution of a fair and equal trading system with erogenous markets, the people of the NWHRI are at a clear disadvantage. Socially, most of them are marginalised; politically, their voice does not command numbers and representational strength.

Food self-sufficiency may be an unattainable goal in these subregions, but an integrated agri-silvi-pastoral approach is necessary so that land use approaches land capability in terms of sustainability and niche advantages. Food security has to be ensured through an efficient and fairly-priced public distribution system that is easily and equitably accessible.

Demographic pressure has to be relieved through education (particularly of women) and the upgrading of family welfare and child-care social infrastructure. Off-farm employment opportunities have to be created. Animal numbers have to come down and unproductive cattle have to be replaced by a lesser number of high-quality cross-breeds or suitably improved breeds. In rainfed mountain agriculture, there is distinct productivity slack that can be removed by available technology. Research, extension, and input and credit delivery systems on a decentralized basis need to be in place on the ground.

Fodder and fuel are serious problems. It is possible to resolve these in two ways. Firstly, develop and provide alternative energy sources, e.g., electricity (at affordable prices), liquid petroleum gas, kerosene, solar, wind, biogas, etc. Secondly, improve production

and productivity of biomass (forests, grasslands, farms). This is possible by fully involving hill people in the management of resources. Joint management, community management, empowerment, resource devolution, benefit-sharing, and strengthening of (and trusting) people's institutions seem to be core policy interventions and strategies called for to convert the present situation into a more sustainable, more people-satisfying one that can also be ecologically secure and environmentally friendly. The Indian Constitution has already been amended to facilitate this. Political and administrative will is required to operationalise the amendments effectively.

Other important steps that need to be taken are voluntary consolidation of land holdings, completion of cadastral surveys, and amendments in land laws that can effectively put a stop to fragmentation. Another critical need is to adopt micro-watersheds as local planning area units although implementation would have to be operationalised at the village level. Mobilising NGOs for catalysing decentralised development would be of great advantage. Their functions would be not to replace governmental or *panchayat* agencies but to serve as skilled model-builders, trainers, bridges of communication, motivators and facilitators, and help in monitoring, evaluation, and provision of feedback so that, where necessary, quick corrective action can be taken. A collegial non-hierarchical approach needs to be adopted to bring about dynamic, complementing and constructive interfaces between stakeholders—farmers, growers, pastoralists, research institutions, extension personnel, NGOs, donors, people's institutions, and government departments.

Chapter 6

Biodiversity

It is well known that intensive land-use patterns have adverse impacts on biological diversity of habitats. Agriculture, horticulture, man-made forests and uses of land for livestock development that, undoubtedly, have contributed to improvement in the quality of life for man, have, also, reduced biodiversity over time. Urbanisation, industrialisation and inexorably growing demographic pressures have further contributed to this phenomenon.

The Himalayas fall biogeographically into the boreal zone. The NWHRI subzones are Sino-Siberian (Ladakh), alpine, temperate and subtropical. There is considerable heterogeneity in geology, geography, soils and climates that gives rise to many macro- and micro habitats. Both floral and faunal diversity characterises the region. The Himalayan biota reflects several biogeographical influences: palaeartic, Mediterranean, Sino-Japanese, Indo-Malayan and peninsular Indian (Mackinnon and Mackinnon 1986). There is also considerable endemism.

Fauna

In the country as a whole, of 75,000 species known, 2,500 are fish, 180 amphibians, 2,000 birds and 850 mammals. Of these, 81 species of mammals, 47 of birds, 15 of reptiles, three of amphibians and a large number of butterflies, moths and beetles are listed as endangered (Trivedi and Sudarsan 1994). A separate set of figures for the NWHRI is not available. However, many species in the region are classed as endangered, vulnerable, or rare — including elephant, musk deer, snow leopard, markhor, hangul, the Himalayan tahr, clouded leopard, ibex, flying squirrel, red fox, wild yak, golden langur, swamp deer, brown bear, Himalayan black bear, woolly wolf, Tibetan lynx, tiger, and leopard. Threatened birds include the monal pheasant, snow cock, snow pigeon, chir pheasant, paradise fly catcher, green finch, whistling thrush, red start, red-crowned jay, red-headed tit, Himalayan eagle, Himalayan falcon, Himalayan chakor, Himalayan vulture, spotted folktil, mallard duck, and Western tragopan. Among aquatic forms of

life, many species are under challenge. The golden mahaseer and the snow trout have already become rare. Animal habitats in the NWHRI have shrunk or have been changed to the detriment of many species. Avifauna have been under assault by trappers, poachers, netters, and gun-hunters. The largest volumes of illegal trade involve musk deer, parrots, reptiles, lizards, and large animal skins and bones. Many animal skins and furs fetch extremely high prices.

Flora

India has 7,000 endemic floral species of which about 3,000 are to be found in the Himalayan regions and Khasi Hills. Khoshoo (1992) states that the 'Himalayan region has been the source of several species of cereals, pulses, fruit, oil-yielding plants, spices, tuberous vegetables, and sugar-yielding plants and their wild relatives. Added to these is a whole range of medicinal and aromatic plants.

Faulty policies on land, agriculture and forestry, grazing, animal husbandry, fishing, wildlife and tourism have resulted in habitat loss leading in turn to the loss of biodiversity. Equally important has been the lack of trained manpower, public awareness and lack of financial support.'

In the NWHRI, diversity has narrowed. Sixty-five species of fern are threatened, common species have become rarer, and rare ones have been eradicated from some areas (Bir 1993). Gaur *et al.* (1993) carried out an extensive survey in the Garhwal Himalayas and listed 32 plant species of vulnerable nature that had not been noted to be so before. Around 98 Himalayan species have been listed as endangered (Trivedi and Sudarshan 1994). Many plants have suffered from over-extraction. Natural recession processes have brought substantial floristic modifications sometimes changing the whole composition of a forest type. One example is the conversion of *banj* (*Quercus*

incana) forest into chir pine (*Pinus roxburghii*) forest in which a multi-use species has been supplanted by a coloniser.

The NWHRI has rich floral endemism. There are 125 plant species that have wild relatives covering crops such as cereals, legumes, fruit, vegetables, oilseeds, spices, etc. These cultivars have many possible uses. Floristic variation is enormous. The region is a storehouse of diversity in food, fodder, vegetables, fruit, and medicinal plants growing in valleys, hill terraces, and on mountain tops — mostly under rainfed conditions (Arora 1993).

Laws, Rules and Conventions

Management of biodiversity is based on international, national and state policies, statutes, regulations, executive orders, treaties, conventions, and other international agreements. In India, the history of such laws goes back to the nineteenth century. The Wild Birds and Animal Protection Act was brought into effect in 1887 but repealed in 1912. The Forest Act 1927 provided for game protection. The Indian Board of Wildlife was established in 1952. In 1972, a specific Wild Life Protection Act was promulgated that regulated and controlled possession, trapping or shooting of wild animals, and their transport for export. Threatened species are absolutely protected and the rest offered graded protection. The 1972 law was amended in 1991 to improve conservation practices. A total ban on the hunting of all wild animals was imposed. Search and arrest powers were given to wildlife officials and punishment for infractions of law enhanced. Wild plants were brought within the definitional purview of wildlife. The Central Government has made it obligatory for state governments to give representation to tribals on the State Wildlife Advisory Boards to ensure that their interests are taken into account. Even a private individual can now file a complaint in a court of law in case of any infraction of the amended wildlife law.

Honorary wildlife wardens are required to be appointed in all districts. The message of the law is that effective wildlife protection needs public involvement, public acceptance, and public participation.

Protection Programmes

Wildlife protection has concerned the international community since the late 1940s. In 1979, India began preliminary work. After the Minsk Conference on Biospheres in 1983, an action plan was drawn up and 13 potential biosphere reserves were identified. Three biosphere reserves were set up in the Himalayan region, of which one, at Nanda Devi, is located in the NWHRI. In 1973, India became a signatory to the Convention of International Trade in Endangered Species of Wild Fauna and Flora. In the course of time, the Botanical Survey of India set up Germplasm and Gene Sanctuaries. A National Bureau of Plant Genetic Resources was established under the Indian Council of Agricultural Research with a network of 10 centres, three of which are located in the NWHRI. There is also the National Facility of Plant Tissue Culture Repository. At both these facilities, the number of seed and tissue samples exceeds 150,000.

Biosphere Reserves, National Parks and Sanctuaries

India has 80 national parks and 441 sanctuaries, covering 4.5 per cent of its land mass. The percentage is higher for the Himalayan region as a whole (about 8.5 per cent according to Rodgers and Panwar

1988). For the NWHRI, protected areas (biosphere reserves, national parks and sanctuaries) cover an area of 27,202 sq.km., that is, 8.2 per cent of the landmass (Table 14).

Wildlife populations are found in areas where their basic needs—shelter, reproduction, food, water, and movement—are satisfied. It is against this background that protected areas have been set up in India in the form of sanctuaries, parks and biosphere reserves. National parks have legal status and are created exclusively for conservation of wildlife (faunal and floral) in their natural environment. Human settlements are not allowed. Grazing and forestry operations are prohibited. Tourism is controlled. Management is essentially compensatory and improving in nature. Sanctuaries also enjoy legal status with strong but not exclusively wildlife-oriented management. Grazing is restricted and subordinated to the requirements of wildlife. Tourism may exist. Sanctuaries may be upgraded to national parks.

The concept of biosphere reserves is claimed to be a significant step towards the conservation and sustainable management of unique and representative ecosystems. In it, the approach is broadened to include man as an integral part of the environment. A system of zoning is adopted to achieve multiple objectives. Unique and undisturbed ecosystems are given full protection by including them in the core zone. The buffer zone—a sufficiently large surrounding area—permits human activity at a level at which the renewability of basic life-sup-

Table 14: Protected Areas in the NWHRI

State/hill region	National parks		Wildlife sanctuaries	
	Number	Area (sq.km.)	Number	Area (sq.km.)
Jammu and Kashmir	4	3810	16	10,164
Himachal Pradesh	2	1295	29	4577
Uttar Pradesh hills*	6	4920	6	2436
Total	12	10,025	51	17,177

Note:* In Uttar Pradesh hills, Nanda Devi National Park became a biosphere reserve in 1988 with a core zone of 625 sq.km and a buffer zone of 1,612 sq.km.

port systems is not undermined. Even in some national parks, core-buffer management is adopted, e.g., Corbett National Park in the Uttar Pradesh hills. Extension buffering and social buffering can both be used. People-orientation is a basic tenet of biosphere management.

Impact of Protected Areas on People

Conservation of biodiversity involves protection, control, regulation, and some restrictions on access. In a country or region where demographic pressures are intense, human needs also have to be addressed. The issue of conservation, therefore, becomes complex and often contentious. An apparently simple issue of protecting wild animals and plants becomes a conflict: human rights versus the protection of animals and forests, the exclusion of all humans from protected areas versus the possibility of human coexistence with wildlife, and exclusive state control versus increased local participation in protected area management. Some wilderness management examples from the NWHRI can be used to draw lessons on how conflicts between stakeholders have arisen and how they might be addressed.

Nanda Devi Biosphere (Uttar Pradesh Hills)

This high-altitude biosphere is located in the districts of Chamoli, Almora, and Pithoragarh in the Uttar Pradesh hills. The Rishiganga basin, which forms the core zone of the reserve, was declared a sanctuary in 1939. In 1982, it was upgraded and became a national park. Then, under the UN's Man and Biosphere Programme, it became a biosphere reserve in 1988 (it is also listed as a World Heritage Site). Its core area is 624 sq.km., while the buffer zone is 1,612 sq.km. It has about 600 plant species, and 18 species of mammals, of which seven are endangered. There are about 200 bird species, eight of which are endangered.

While the core zone has no habitation, 17 villages are located in the buffer zone and are inhabited by 2,385 people (1991 census) and 7,404 head of cattle. The villagers practise marginal subsistence agriculture, rear cattle for milk, and sheep for wool. Management activities in the reserve include database preparation, ecorestoration, ecocodevelopment, protection, education, awareness training programmes, and introduction of improved stoves and solar lights. Emphasis is on active participation of local people, sustainable agriculture and allied activities, development of cottage industries, cultivation of medicinal plants, apiculture, and eco-friendly tourism. However, the project/people interface has started to sour. According to recent press reports, the residents of Lata, Reni and other villages have initiated a campaign for restoration of their traditional rights and privileges. The biosphere concept is based squarely on the premise of people's involvement in management and protection functions. While the core zone has to be a natural, undisturbed, or minimally disturbed area, the buffer is a multiple-use area where people can carry out their traditional occupations. Reports of simmering protest are a sign that mutuality between people and wilderness has not evolved, although a decade has passed since the reserve came into being.

Great Himalayan National Park (Himachal Pradesh)

This park covers 765 sq.km. and is located in Kullu district of Himachal Pradesh. Its vegetational diversity is complemented by its faunal diversity, and many species are threatened. Pastures provide forage for sheep and goats. Under a system of grazing runs, flocks are sent to the area by turns from May to October. Seasonal vegetation includes about 50 species of medicinal plants that are commercially important. Villagers also collect mushrooms.

In 1984, the park was notified; a ten-year management plan was prepared in 1987. Although grazing and foraging are not permitted in national parks, it has not been possible to stop it here (Baviskar 1998). Village communities are hostile to restrictions. It has not been possible to bring about participatory management of resources because it appears that affected people feel that they have been treated as 'objects of social engineering' rather than 'sharing, caring' actors. Hence, the flouting of laws.

Rajaji National Park (Uttar Pradesh Hills)

This national park (notified in 1985) includes three former sanctuaries: Rajaji, Motichur, and Chilla. The park falls in the districts of Dehradun, Hardwar, Bijnor, and Pauri Garhwal. Spread over 820 sq.km., it has a rich ecosystem comprised of forest types such as riverine, broad-leaved mixed stands, chir pine, scrubland, and grassy pastureland. It protects 23 species of mammals and 315 of avifauna, many of which are threatened. There are 56 village *panchayat*(s) adjoining the park. There are also four *taungya* villages and over 500 resident Gujjar (nomad) families.

The Gujjar have long been transhumant dwellers of the area. According to the Chief Wildlife Warden, 150 of these families have been relocated outside the park, following a decision made by the Supreme Court in 1997.

Residents within the park and people living in nearby villages consider that they have traditional rights and concessions related to grazing, fuelwood, fodder, b habar grass, timber, grass for thatch-making, and access to water. The national park has given rise to conflict between park authorities, affected communities, and some NGOs. Reconciliation of stakeholders' interests still remains an unachieved task. Conflict continues with

political overtones, protests by the affected communities, and voices raised by NGOs.

The situation in and around Rajaji National Park is not singular or unique. It is found in and around many sanctuaries and national parks in the country and in the NWHRI to varying degrees. In 1993, social activists and institutions from all over India met in Dehradun at a workshop to discuss protected areas and community issues. They produced the Doon Declaration on People and Parks. The declaration asked the Central Government to take steps to ensure that conservation of flora and fauna in the country is based upon clear recognition of the customary rights of local people, including nomads, living inside and immediately around these natural resource areas. It further urged that the Wildlife Protection Law should be modified to conform with the stated objectives of the National Forest Policy 1988 which, unambiguously, recognises the rights of tribals, nomads, and forest dwellers.

This is a typical dilemma that accompanies the exercise of choices and trade-offs between conservation and development. Communities have to be convinced that protection and development can go together, but that it needs discipline, education, and decision-making partnerships. In the larger interest of the country, protection areas are required. If this affects access of some people, suitable, viable, and acceptable compensatory measures and alternatives must be provided to ensure that the communities affected are fully protected. The following are steps that need to be taken in this context.

- Develop reliable databases of protected areas and update them.
- Improve management practices by providing skilled manpower, technology, and resources.
- Take people on board by adopting a

joint protected area management policy as has been done in the case of forests.

- Launch intensive awareness and educational programmes for both managers of protected areas and the 'partner' communities.

It is a combination of participatory management approaches, use of science and technology, and social mobilisation that can address serious ecological concerns that have to be the focus of any effective biodiversity protection policy.

Chapter 7

Water Resources

Water sustains life. Its efficient and cost-effective management is critical for meeting the growing demands of population, navigation, irrigation, energy generation, recreation, fishing, urbanisation, and industrialisation. The Himalayas, which are characterised by a great diversity of micro-meteorological conditions, need careful study of geographic, climatic, hydrological, and ecological aspects in different drainage basins and sub-basins, at different locations, and altitudes and in the cascades of nesting micro-, meso-, and macro-watersheds in order to ensure balanced and optimal use of water. Local, regional, and international factors come into play while considering the development and management of the Himalayan river systems in a manner that would meet the competing, multiple needs and demands of different stakeholders in a fair and equitable manner, and at the same time ensure the environmental integrity of this important resource in a sustainable way.

National Water Policy 1987

The National Water Policy document was published in 1987. It underlines the impor-

tance of water for human and animal life. It understands that water is critical for maintaining the ecological balance and essential for economic activities and development. The increasing scarcity of water is recognised. Water is to be treated holistically as a part of the larger ecological system. It is important to develop, conserve, and utilise it efficiently and economically.

Stress has been laid on evolving a well-developed information system (databanks, networking, and info-exchange). The strategy advocates maximising retention and minimising losses. Water planning is to be basin or sub-basin based. Recycling and reuse are emphasised. It is suggested that water projects should provide for drinking water first and, then, irrigation, flood mitigation, hydropower generation, pisciculture, recreation, and industrial and other purposes. During implementation of such projects the 'preservation of the quality of environment and ecological balance should be a primary consideration'.

An integrated approach should be used to address issues of catchment treatment,

rehabilitation of the affected people, and command-area development. The document further states:

'The planning of projects in hilly areas should take into account the need to provide assured drinking water, possibilities of hydropower development, and proper approaches to irrigation in such areas in the context of physical features and constraints such as steep slopes, rapid runoff, and incidence of soil erosion'.

It spells out that there should be 'close integration of water-use and land-use policies' and, that:

'water rates should be such as to convey the scarcity value of the resource to the users and foster motivation for economy in water use'.

Every effort should be made to involve farmers in water management at the field level. Waterzoning should guide economic activities. Conservation must be promoted through education, regulation, incentives, and disincentives. For mitigating severe flood impacts, soil conservation, catchment area treatment, increased afforestation, and building of checkdams have been suggested. Training and use of the latest technologies are listed as important needs for scientific water development and utilisation. The document has not attempted a benchmark evaluation nor has it laid down any quantitative targets for the future.

Water (except for interstate rivers, river valleys, and national waterways) is a state subject under the constitutional division of powers and, therefore, most action in its management is taken at the state level and below. Many of the prescriptions listed in the national policy remain unimplemented. Interstate water disputes exist in the absence of effective mechanisms to resolve them. Water rates have not been rationalised, giving rise to a heavy and mounting burden

of subsidising irrigation, on the one hand, and promoting waste, on the other. A volumetric approach to pricing water for irrigation is missing. Water conveyance losses are heavy. Drainage problems continue. Appropriate policies for rehabilitation of displaced persons in large multipurpose projects are required to overcome public resistance to such projects. Some progress has been made in enlisting community participation in the distribution of water. In mountain areas, traditionally, communities have performed this role. Water-harvesting in hill regions is yet to become a wide-based programme. Similarly, drip and sprinkler irrigation in water-scarce areas has yet to make headway, particularly in the NWHRI.

Water Resources in the NWHRI

Land in the hills cannot be considered as a resource in isolation from water. Rivers represent vital drainage paths in the NWHRI. The region is drained by many river systems, the most important being the Indus, the Yamuna, the Ganges, and the Kosi. The Indus has a catchment area of 468,068 sq.km. up to the Indo-Pakistan border. Consequent upon its flow in steep-sided deep valleys, its erosive activity is extremely high, and it carries about one million tonnes of suspended matter each day (Spate and Learmouth 1984). All the major rivers flowing in Jammu and Kashmir are tributaries of the Indus—two important ones being the Jehlum and the Chenab. The average annual flow of water is 207.8 billion cubic metres for the Jehlum, and 29 billion cubic metres for the Chenab. Some rivers of Himachal Pradesh also finally join the Indus: the Beas and Sutlej, that pass through Himachal Pradesh before flowing down the plains of the Punjab, finally flow into the Indus. The Yamuna originates at Yamunotri glacier in the Uttar Pradesh hills, flows into Himachal Pradesh, debauches from the hills near Tajewala, and then follows a longish passage touching Delhi, Mathura, and Agra before finally confluencing with the Gan-

ges at Triveni, Alla habad. Its catchment area in the hills is 2,320 sq.km.; its main tributaries are the Tons, Giri, and Bata. In the NWHRI, the Ganges mainly drains the Garhwal Division of the Uttar Pradesh hills. Its two main tributaries, the Alaknanda and B hagirathi, rise from opposite sides of Chauk hamba peak and meet at Dev Prayag to form the Ganges. The Ganges has many other tributaries such as the Pindar, Mandakini, and Nandakini. The Kosi system is small and drains the eastern part of Kumaon Division. It is not snow-fed and, therefore, its flow fluctuations from month to month are severe. In addition to the river systems, the NWHRI is endowed with many glaciers (Gangotri, Milam, Pindari, Siachin, etc) and lakes (Hemkund, Rupkund, Vasuki, Kedarnath, Satopanth, Wullar, Dal, Mansar, Surinsar, Pagong, and the Kumaon lakes). The region also has a large number of perennial springs and, in some areas, artesian wells. Table 15 gives information about the potential and usable water resources for important basins and sub-basins in the NWHRI and India.

Since total availability normally oscillates in

Table 15: Potential and Usable Water Resources in the NWHRI and India

	Indus Basin	Ganges Sub-basin	All-India Total
Water resources potential (cubic km)	73.5	525.0	1869.3
Utilisable surface water (cubic km)	46.0	250.0	690.0
Groundwater (cubic km)	25.5	171.7	452.2
Per capita water (m ³)	1757	1473	2214

Source: Central Water Commission of India 1993.

a narrow range, there is a limit to the potential that can be realised. Water flows in mountain areas have characteristics of sharp seasonality and rapid flows. Availability remains limited. Thus, irrigation is limited and, even for fulfilling other water needs, costs are high. The NWHRI, in theory, has sufficient fresh water but there are problems such

as unequal distribution, pollution, erosion, and land degradation. Water, in the past, was freely and plentifully available as needs were much lower than they are now. By tradition, water has been an open access resource. It was used and misused with little concern for its intrinsic cost or for its contribution to value-addition. As it becomes increasingly scarce, it goes mainly to those who have political power and economic capital to appropriate it by controlling its source. Unfortunately, water is also grossly under-priced and this tends to encourage misuse and waste. It needs to be priced reasonably so that it becomes accessible but not wastefully so. It also needs to be placed under the control of local communities.

Management Issues and Strategies

In the NWHRI, incremental additions to irrigation are possible through the setting up of environmentally safe water storage, water-harvesting, extension of gravity-flow systems, use of hydrams, and pump irrigation (expensive). Another approach would be water conservation, although there are water-related environmental issues. It is true that not much can be done about geomorphological factors such as rugged terrain, steep slopes, etc. However, to a limited extent, terrain can be managed by measures such as terracing or impounding of water. Infiltration can be encouraged. Water runoff can be reduced by creating biotic as well as engineering impediments to the free flow of water. Other steps are also possible such as increasing biomass cover, adopting agronomic and silvicultural practices and cropping patterns that are less water intensive, reducing water conveyance losses, setting up simple water-harvesting structures (e.g., polythene-lined shallow tanks), use of hydrams, and adoption of drip/sprinkler irrigation systems where possible.

Water has many competitive uses in mountain areas. It is required for drinking, domestic use, animals, agriculture, forestry,

horticulture, all other biomass growth, energy production, and industrial and other purposes. Therefore, policy for its management and use has to be carefully worked out and balanced. A protective and regenerative approach is necessary. Pricing must address both accessibility and the need to conserve water and eliminate waste. Any successful planning of water use should ensure optimal percolation and subsurface flow with a view to achieving recharging of groundwater and regeneration of water springs and water points to improve year-round availability. When water resources are harnessed, the hydrological cycle is manipulated through various structures and means to divert water, distribute it, clean it, and, then, to carry it away for its return to the natural system. These steps can be problematic in the mountains. These areas often have enhanced precipitation, greater incidence of clouds, high runoff efficiency (which can be both an advantage and a disadvantage), and high production of sediment. This hydrological heterogeneity attracts people but it is also the source of a great number of hazards such as erosion, flooding, loss of life and property, and land loss.

Of late, mountain areas in the NWHRI have been subjected to intensive pressures from human activities: rise in human and animal populations, expanding agricultural activities, establishment of transportation corridors, mining of minerals and gravel, construction of storage, multipurpose projects and artificial channels, heavy tourist/pilgrim traffic, increasing urbanisation, and deforestation and overgrazing. Most of these pressures act on the hydrological cycle to change both the quality and quantity of water yields in adverse ways. A strategy is needed to ensure the health of water regimes and this demands an integrated watershed management approach. The core strategy has to be a combination of protection, regeneration, and production. In hill areas, a watershed is a natural physio-geo-

graphic unit that can also be an effective unit of integrated planning. The geography of mountains is such, that, if the integrity of a watershed is lost or neglected, there is a strong possibility of advantages of development being cancelled out if programmes do not have a 'spatial fit' with the catchment. Most mountain areas are rainfed and integrated area development should focus on balanced and sustained use of resources in a growth mode. It should include production from individual holdings, regeneration of common-property land resources, and promotion of household production systems.

People's Participation

The adoption of an integrated watershed management strategy often means changes in the use of land, water, trees, animals, technology, skills, and economic relations. Hill societies are usually traditional in outlook. Hill farmers generally try to produce their own needs. Change may mean moving away from this 'wholeness'. Also, the cycle of subsistence may be disrupted if new (more profitable) land use causes returns to flow in a longer time-frame. Scientific land use involves rotational closures of forests or grazing lands which is often not acceptable to local people. Change may be viewed, especially by the rural poor, as an attempt to deprive people of current access to resources in the hope of better returns in some distant, uncertain future. These are problems that can be resolved only by education, persuasion through informed discourse, social mobilisation, and compensation where change may involve temporary loss of income or curtailment of resource use. The need, therefore, is to stimulate collective initiatives and action in institutional contexts so that communities are organized, motivated, and facilitated for planned action. In this endeavour, village *panchayat(s)*, *van panchayat(s)*, women's groups, youth groups, and similar collectives have a role to play. NGOs can play

facilitating, communication-bridging, and model-building roles.

Irrigation

Irrigation in the three subregions of the NWHRI is limited. In Jammu and Kashmir, the net area sown was 732,800 ha in 1996-97, while the net irrigated area was 313,260 ha (42.7%). Sources of irrigation were canals (84,250 ha), tanks (2,570 ha), wells (1,420 ha), and other sources (25,020 ha). The gross irrigated area was 447,000 ha — which means that the area irrigated more than once was 134,000 ha (Jammu and Kashmir Directorate of Economics and Statistics 1996-97). Groundwater potential in 1984 was estimated by the Central Water Commission at 3.7 km³/yr while the draft was only 0.050 km³/yr (1.35%). In Himachal Pradesh, net sown area was 572,000 ha in 1994-95 while net irrigated area was about 100,000 ha (17.5%). The sources of irrigation were canals (6,473 ha), wells/tube-wells (11,100 ha), and other sources (81,937 ha). The gross irrigated area was 171,000 ha, indicating that the area irrigated more than once was about 71,000 ha. According to the Central Water Commission (1985) the irrigation potential was 385,000 ha but less than half had been used by 1994-95. Groundwater potential was estimated at 0.29 km³/yr but only one-fourth had been utilised up to 1991-92. In the Uttar Pradesh hills, net sown area was 666,665 ha in 1993-94 while net irrigated area was 231,673 ha (34.8%). Figures for source-wise irrigated area are not available; the irrigation system was comprised of 5,822 km of canals, 387 state tube-wells, and 6,298 private tube-wells. Gross irrigated area was 389,613 ha, indicating that an area of 157,940 ha was irrigated more than once.

Drinking Water

In Jammu and Kashmir, 99.69 per cent of the total number of 6,477 villages had a

pipied-water supply by 1996-97. In Himachal Pradesh, 87 per cent of the total number of 16,807 villages were covered by a drinking water programme by 1994. In the Uttar Pradesh hills, 99.5 per cent of the total number of 15,806 were covered by drinking water programmes by early 1996. The drinking water figures in terms of the percentages of villages covered may look bright but, on the ground, the situation is different. Many drinking water schemes are non-functional; in many others, water yields have fallen sharply while some water sources have dried up altogether.

National Watershed Development Programme for Rainfed Areas

The National Watershed Development Programme for Rainfed Areas (NWDPR) was launched in 1990-91. It covered 10,000 villages with an area of 3.7 million ha (15 million people) and also included mountain uplands. It was based on a farming systems' approach. Detailed guidelines covered surveys, project preparation, laying of nurseries, demonstration management of common property land resources, livestock development, people's participation, and involvement of NGOs. In-built provisions existed for research, monitoring, and review. Emp hasis was placed on making use of every resource available and on building on local knowledge. The main planks were affordability, replicability, and sustainability. A World Bank project was launched in the Uttar Pradesh hills in the 1980s, but it had limited success. It did not mesh with ongoing development programmes in the area. A second World Bank project for hill areas was initiated in 1990-91. Three projects were started with assistance from the European Commission in the degraded ecosystems of the Uttar Pradesh hills. Implementation was better on account of the adoption of participatory rural appraisal techniques. Most programmes are donor driven and patterns of implementation vary

in nuances and emphasis. The NWDPRRA relies largely upon water conservation technologies where greater use of biological means is attempted to control erosion, use of organic manure is promoted to improve *in situ* moisture, and efforts are made to integrate diversified production systems, e.g., mixed farming, agroforestry, water-harvesting, dryland horticulture, and livestock development. Self-help groups are established. Of net income, 10 per cent is transferred to the village development fund and 15 per cent to a revolving fund used for common property land resource development. The remaining 75 per cent is shared by the beneficiary group. The results of the NWDPRRA are mixed, but it is a beginning that needs to be pursued and built upon with purpose and determination.

Case Study of Nahar Village, Dehradun District

Nahar is one of the 13 villages of Sectla Rao subwatershed in Sa haspur block of Dehradun District. The total area of the village is 72 ha of which 20 ha are reserve forests, 39 ha are agricultural lands, and the rest either uncultivable fallow or other miscellaneous types of land. About 56 per cent of the agricultural land is irrigated. The village is comprised of 45 households with a total population of 249. Nearly two-thirds of the population is literate. Most of the land holdings are small and scattered. The animal population was about 235 before the village was brought under the watershed management project supported by the European Commission. At the beginning of the project in 1995-96, villagers met about four-fifths of their fuel requirements from adjoining reserve forests while the rest came from agricultural lands and other alternative sources. There was an annual fodder shortage of about 240 tonnes.

The strategy of the project was additional plantations, introduction of high-yielding varieties of agricultural crops, improvement of biomass production, and promotion of

alternative sources of energy such as biogas. It also included reducing the number of animals with low productivity and replacing them with high-yielding, stall-fed buffaloes. Training was an important component and village planning was attempted essentially through participatory rural appraisal. Villagers voluntarily agreed to reduce the number of goats.

Once the consensus of villagers had evolved through participatory rural appraisal, the project selected entry-point strategies in the form of financing biogas plants, providing mini-kits and better implements for agriculture, and repairing terraces. Also, the irrigation system was improved. Eight water-harvesting tanks were built. For the animal husbandry programme, a high-quality breeding facility was provided, fodder mini-kits were distributed, and chaff cutters and feed troughs were introduced. In the adjoining reserve forest, plantations were undertaken with the involvement of villagers. On more than 10 ha of land, silvi-pastoral development was carried out. On about two ha of land, private orchards were established. Vegetable mini-kits were distributed.

While inputs were provided by the project as a gap-filling strategy, important achievements were in the area of community organization and institution building. Firstly, a Gramin Resource Management Association (GAREMA) was established with membership of all 45 households. Eleven executive members were elected and a revolving fund begun which, at the time of the case study visit, contained about Rs 90,000. From the revolving fund, the GAREMA made a number of productive consumer loans and loan recovery was 100 per cent. Loanees were willing to pay interest at the rate of two per cent per month. Loanees preferred to pay this higher rate of interest because disbursement was hassle-free and they found it convenient to repay the loan installments locally. A women's self-help group was also established. This group con-

sisted of 27 women who contributed Rs 10 a month. It provided loans to 17 women for knitting sweaters and growing mushrooms.

At the time of the case study visit, the project had practically withdrawn its active phase from the village; project people were trying to encourage sustainability of institutional arrangements. The main results of community mobilisation were in the following areas.

- Village people had set up their own institutional arrangements for resource management and generated resources in the form of a substantial revolving fund. This had reduced their dependence on other sources of credit such as banks, etc. In the maintenance of accounts, a certain degree of transparency prevailed. The revolving fund is understood to be used with the consensus of all the members of the GAREMA and the experience of recovery was highly encouraging.
- The number of animals was brought down and low quality cows were replaced by buffaloes that were stall-fed.
- Out of 45 families as many as 30 families have installed biogas plants to meet domestic energy needs and obtain better quality manure for their fields.
- The area under improved varieties of agricultural crops went up, increasing productivity as well as production.

Case Study of Misraspatti Village, Dehradun District

Misraspatti is situated at 1,000 m in the Swarria watershed of Dehradun District. It covers over 300 ha and is comprised of five hamlets. The number of households is 101; the total population is 622 of which nearly 45 per cent are scheduled castes. Nearly one-third of the people are literate. The total number of animals in 1994-95 was 894;

the number of goats being 396. In this village, most fuelwood was obtained from adjoining reserve forest. Nearly all of the gross sown area of about 180 ha was planted with local crop varieties.

A watershed management project supported by the European Commission was started in 1995-96. The project included, as one of its chosen strategies, a shift to improved crop varieties in more than half of the agricultural area. For this purpose, mini-kits, chaff cutters, and other implements were distributed. The total number of cattle was brought down and goats were practically eliminated.

As a result of large-scale afforestation of fuelwood species and other silvi-pastoral activities, the fodder situation was converted from deficit into surplus and farm incomes improved. Village water channels were repaired and improved. This was the result of decisions taken during the first participatory rural appraisal exercise. About 40 small stone checkdams, 17 crate-wired dams, and 21.5m of side walls were built to check soil erosion and improve the water regime.

A Gramin Resource Management Committee (GAREMA) was set up. In the Executive Committee of the GAREMA all five hamlets are represented. The GAREMA had Rs 55,000 at the time of the case study visit. As a result of decisions taken by the GAREMA, the number of cows was reduced by about 30 while the number of buffaloes went up and stall-feeding was adopted. Seven *gobar* gas plants have been established. A women's self-help group has been established but is not successful. Just 13 women joined and they could collect only Rs 2,600. A single loan of Rs 1,800 was given to a beneficiary for purchasing ginger seeds. From the GAREMA fund, 18 people have been given loans amounting to Rs 17,000. All these loans are for ginger seeds: ginger is an economic crop for the village. Village women cut grasses in the

forest for which a fee of Rs 50 per family is charged; this has resulted in Rs 2,300 for the village fund.

In Misraspatti, the plantation programme has succeeded while capacity-building of local institutions has been only partially successful. Villagers recognise that soil erosion has been reduced, but increase in plantation cover has increased the threat of wild animals. They complained that animal health-care facilities were missing, and access to reserve forests for wood needed for making ploughs has been restricted. Also, following the withdrawal of the project, difficulties have been experienced in sustaining both the GAREMA and the self-help group. A positive aspect has been that the village has shifted from open grazing to stall-feeding and has achieved greater biomass and crop production. A problem the village has solved was that of the traditional passage of transhumant animal herds. People made collective representation and were successful in stopping itinerant animal herds from passing through their village while moving from the foothills to higher regions each year.

Water Storage in Mountain Areas

The precipitation pattern in the NWHRI is informed by acute seasonality. This seasonality becomes less acute to the west. Even so, it is a dominant feature of the incidence of annual rainfall. Floods in recent

decades have become more acute and incessant in India. Most of these are caused by the Himalayan rivers. Unfortunately the major thrust of control programmes has been on the channel phase of floods, namely, river training, construction of spurs, embankments, bunds, barrages, and channels. The land phase of floods has not received the attention required; namely, soil conservation, afforestation, soil-binding grass cover, land treatment, and water storage. This last is admittedly controversial but demands consideration. Building dams (especially large ones) has many negativities but, against the background of the monsoon precipitation cycle, the need for improving supplies of water in non-rainy periods, and the need for tempering floods, this option has to be considered. Another issue is production of hydel energy that could be used to meet the existing acute need for electricity. Dam construction in mountain regions must be made safe and environmentally secure. This can be done by selecting locations, sizes, and designs carefully; by giving priority to catchment area treatment; and by adopting humane and generous rehabilitation policies in favour of those who are displaced.

Chapter 8

Tourism

After the British consolidated their hold on India they looked for areas climatically akin to their homeland for rest and recreation. They established mountain resorts such as Nainital, Mussoorie, Dalhousie, Shimla, and Darjeeling. After the British departed, hill tourism began to build a base for mass pilgrimage, recreation, and adventure. With new roads, many areas opened up to tourism. Population increased; so did the number of tourists. However, for local people, the value-added component of tourism did not match the increase in the annual tourist inflow. The average duration of stay of visitors, particularly pilgrims, came down. Resort tourism was replaced by social tourism in which turnover is high, trips are short, and the pace frantic. Thresholds were ignored; capacity levels crossed; and interest and respect for nature and local cultures were substituted by consumerism and disdain for local cultures, values, and lifestyles. Resort towns and pilgrim centres that had been developed for small populations had to bear the 'flocking in' of tourists and pilgrims causing severe strain on local people and limited civic facilities. Few attempts, if any at all, were made to

deconcentrate and disperse tourist destinations.

Growth of Tourism in the NWHRI

Jammu and Kashmir

As a bundle of tourist destinations, Jammu and Kashmir is legendary; the Valley of Kashmir is particularly beautiful. Tourism has become an economic activity of great value and importance. It contributes substantially to the income of the state and its people. It has created employment and given rise to activities in the secondary and tertiary sectors. Tourist traffic to the Kashmir Valley was 184,790 in 1975 rising to a peak of 722,035 in 1988. Since 1990, militancy has caused traffic to fall to only 8,520 in 1995. The picture is quite different for pilgrim traffic. It was 120,000 for the Amarnath shrine in 1996 and over four million for the Vaishno Devi Temple in Jammu Division. Ladakh has been attracting tourist traffic in increasing numbers (about 25,000 in 1997). While employment and incomes have gone up and infrastructure gains have been made, adverse impacts

have also become apparent. Heavy traffic to the Kashmir Valley caused severe pressures on Dal Lake and its environs. Both the Dal and Anchar lakes became turbid and shallow with high concentrations of pollutants; their areas shrank. Land was lost to construction of hotels. Public open spaces were encroached upon to build lodges, restaurants, and tea stalls. In Jammu Division, the trees at the Patni Top area have suffered damage on account of the poor drainage that hotels and lodges provided for effluents. In Ladakh, impacts have been cultural and social. Foreign tourists have plenty of money. This has affected lifestyles, value systems, and people's roots in their own culture and environment. Precious art objects have been lost. Dress habits have changed and pursuit of wants rather than needs has become the objective for many.

Himachal Pradesh

Himachal Pradesh is a region of lofty mountains interspersed by narrow valleys, fringed by low Siwalik hills, and drained by many rivers. It is scenically beautiful and has a rich cultural heritage. There are about 6,000 temples depicting a wide variety of architecture, some more than a thousand years' old. Life without religion, festivals, fairs, dances, magic, and folk singing is unthinkable. Tribal life is rich and varied. The people wear colourful dresses, produce beautiful craftware, and paint artistically. The British built up summer resorts such as Shimla and Dalhousie; some roads were also constructed to interior areas. Kullu Valley became accessible in the 1930s with the opening of the Mandi-Larji gorge road.

Tourism traffic has grown rapidly, and more so since 1990 on account of militancy in the Kashmir Valley. In the early 1980s, visiting tourists numbered about half a million a year and nearly 30,000 were foreigners. This number rose sharply to over 1.8 million in 1994. With more than 50,000 foreign tourists; nearly 60 per cent went to

Shimla and Kullu districts. The contribution of tourism to the state's economy is estimated at Rs 2–2.5 billion (Sharma 1997). Annual growth between 1989-90 and 1992-93 was 17 per cent. While there are some pilgrim destinations, recreation, sightseeing, and adventure are the main attractions.

Many impacts can be witnessed. Transport and the hospitality industry have benefitted from increasing inflows. The income multiplier factor is estimated at 2.5–3. However, pressure on hill towns, such as Shimla, is acute, with mounting congestion and construction of multistoreyed buildings. Manali and Kyelong have experienced a tourist boom. There is increasing non-biodegradable garbage and inappropriate waste disposal. The demand for fuelwood has increased causing stress on forests; the tree line is reportedly receding.

Uttar Pradesh Hills

Uttarakhand (12 hill districts of Uttar Pradesh) is a rich tourism resource area. In the past, it was mainly pilgrim and trade-related tourism. With the opening up of the area, it has also become a destination for recreation, leisure, adventure, and sports' tourism. It is scenically well endowed. Two of the most sacred rivers of India, the Ganga and Yamuna, drain it. Some of the highest Himalayan peaks (Nanda Devi, Kamet, Chaukhamba, and Trishul) are located here. There are glaciers, lakes, alpine meadows, forest stands, sculpted terraces, and wide as well as narrow valleys. Numerous religious shrines of national importance dot the land (Badrinath, Kedarnath, Gangotri, Yamotri, and Rishikesh). The mosaic of cultures is rich and colourful — including tribal communities such as Bhotia, Tharu, Busa, Jaunsarie, and Raji. The people of Garhwal and Kumaon are well known for their arts and crafts, rituals, folk dances, and festivals. In its earlier form, pilgrim traffic, which used trekking or riding for movement, ensured eco-friendly benefits to local peo-

ple. There are many summer resorts such as Nainital, Mussoorie, Ranikhet, Almora, and Landsdowne.

Tourism is an economically important activity that contributes substantially to the region's income. Tourist traffic is heavy and growing. In 1984, the number was 9.5 million — including 25,000 foreigners. The inflow rose to 14 million in 1995 with foreign tourists numbering 41,000. Rishikesh received over four million visitors in 1991, Nainital 1.1 million in 1993, and Mussoorie 1.5 million in 1993. Half a million went to Badrinath and 119,000 to Kedarnath in 1993. Tourist numbers are seasonal; summer and autumn arrivals are high causing acute pressure on areas of concentration.

Economic advantages and additions to infrastructure can be traced to growing tourism. However, social impacts have been harmful to local cultures and traditions. Environmental impacts on land use, water bodies, and fauna and flora have been negative. For example, in Mussoorie, 5,000 ha of land was used for construction in a period of eight years between 1990 and 1997 (LBS National Academy of Administration 1998). Highly sloping land was used for construction and practically no gently sloping land is available for future development. Land degradation has caused landslides along the frequently used Mussoorie–Dehradun road. Land values have shot up making it difficult for local, permanent residents to own housing. A similar situation can be found in Nainital where the Supreme Court had to intervene to put restrictions on improvident and environmentally dangerous land use for construction purposes. The lake of Nainital has deteriorated and, even now, part of the town's sewerage finds its way to this water body.

Another example of development leading to degradation can be found at Gangotri and Gaumukh, the origin of the Ganges. The opening of the bridge at Lanka in-

creased the number of visiting pilgrims. This put pressure on adjoining forests for fuel and construction purposes. Large quantities of garbage litter the paths and trails. The Gangotri Conservation Project was launched in 1994 by the Himalayan Environment Trust to provide environmental rehabilitation. The State Government has set up the Greater Gangotri Special Development Authority to regulate development of the area. The Sikh Gurdwara at Govind Ghat in Chamoli district had been persuaded to shift from using fuelwood for its large free kitchen to alternative fuels, either coal or liquid petroleum gas.

The Uttar Pradesh Government announced a new Tourism Policy in 1991 and declared tourism an industry. The main policy thrust was deconcentration of tourism through development of new tourism towns/villages, giving preference to locations that had potential and where some basic infrastructure was available, and providing encouragement to private investment.

Carrying-capacity Approach

Three components of the carrying-capacity theory are the bio-physical environment, socioeconomic and cultural environment, and infrastructure. Broadly it implies a search for balance; for ascertaining the limit to physical and other resources that may be used without causing lasting damage to land, water, biomass or other life forms, and the assimilative capacity that enables the environment to absorb, without unacceptable consequences or ill effects, the impacts of development. Tourism carrying-capacity analysis criteria should include the following aspects.

- Visual impact: scenic beauty, good air and water, low noise levels
- Land, water, and biomass conservation needs
- Protection of biodiversity (including

wildlife)

- Value-additions, incomes, and turnover
- Local employment and skill development
- Broaden access to tourism by extending facilities to middle and lower income groups
- Tourism volume and quality that can be absorbed without jeopardising local cultures, social mores, and lifestyles
- Tourist education
- Protection of cultural forms and traditions and uniqueness of structures, buildings, monuments, temples, and shrines
- Utilities, water, power, accommodation, catering and wayside facilities
- Transportation and communication
- Other facilities such as health cover, markets, service centres, and skilled manpower

The concept of carrying capacity is complex and fraught with operational difficulties. It is dependent upon a host of parameters, many of which are not easily quantifiable. The cause–effect relations are multi-dimensional, and cost-effective, sustainable trade-offs are often subjective and uncertain. However, certain fundamentals are perhaps unexceptionable. There has to be compatibility between tourism growth and ecological, social, cultural, and economic support systems. The aim should be not only to maintain, but also to enhance ecological balance, land capability, biodiversity, water regimes, and quality of life. Also, importantly, community cultures and identities should not be meddled with, acculturation should be shunned and local peoples' control over their lives ensured.

National Tourism Policy

The last National Tourism Policy was announced by the Central Government in 1982. A new policy has been drafted, and was circulated in June 1998. The document states, 'The emergence of tourism as an important instrument for sustainable human development including poverty alleviation,

employment generation, and environmental regeneration necessitated the enunciation of a new tourism policy. The solemn mission is to promote tourism and to sustain economic development and positive social change through development of tourism while preserving and protecting the environment and heritage.' The government would essentially assume a facilitating/enabling role, encourage the private sector, and introduce regulatory measures to ensure 'social, cultural and environmental sustainability, involvement of local communities and benefits to them'. The states of the Himalayan region would be regions of special interest where a judicious balance between conservation and development would be sought and eco-tourism promoted. Tourism as a subject would be included in the Concurrent List of the Constitution and a Tourist Development Fund would be set up to 'bridge critical infrastructural gaps'. The new policy is expected to receive approval in the near future.

Steps for Tourism Development

- Match infrastructure to tourist load and vice versa
- Deconcentrate tourism by developing new urban and rural locations
- Shift mountain tourism from its skewed urban orientation to its rural, decentralized aspect
- Adopt a proactive alternative energy (fuel) policy to reduce pressure on forests — ban use of wood as fuel for hotels, restaurants, expeditions, etc and provide a choice of other sources of energy
- Emp hasise tourist education and education of host communities for eco-friendly tourism
- Mobilise social action through people's institutions for conservation-oriented tourism
- Encourage training/skill development for sustainable tourism and ensure that employment and income benefits flow to

local people

- Work towards reducing acute seasonality in tourist traffic through an appropriate set of incentives and disincentives
- Build consensus amongst stakeholders and promote community participation at all levels (Stakeholders would be the Central and State Governments, hill people, visiting tourists, tour operators, hospitality industry, adventure and sports' clubs, financing institutions, and community institutions)
- Preserve biodiversity
- Promote biospheres, national parks, and sanctuaries to protect flora and fauna

Benign tourism is difficult to achieve, much more so in mountain environments. However, it is possible. If appropriate considerations are kept in mind, mountain tourism can be moulded to become an instrument of sustained hill development in which local people thrive and visiting tourists can enjoy beautiful and soul-lifting environments.

Chapter 9

Conclusions

Rather than analysing the findings of this study in order to draw conclusions in a conventional manner, a SWOT analysis of sustainable land use and land management in the NWHRI has been undertaken.

Strengths

- Wide range of topography, terrain, landforms, and climates where a considerable spectrum of production choices is available
- Agroclimatic heterogeneity that can support agri-silvipastoral diversification and preservation of biodiversity
- Niche advantages for production of special crops/fruit/off-season vegetables/nuts/spices and high-value items such as saffron, mushrooms, flower and vegetable seeds, cut flowers, tea, etc which can generate higher incomes
- Sufficient rainfall (except in cold desert and westernmost areas of the region) that can be harvested for productive purposes
- Manpower availability
- Equable climates (except at very high altitudes), scenic endowment, and good possibilities of developing environmentally-friendly tourism
- Immense hydropower resources
- In rainfed agriculture, there is considerable productivity potential for which technology is available.
- With appropriate skill development and encouragement to entrepreneurship, there is much scope for achieving value-addition before produce moves out of the region for marketing.
- A large and growing consumer market is available in adjoining states. There are also export possibilities.
- The region has seven universities (including three agricultural and one forest/horticulture university) and more than a dozen national and state research institutions and facilities in areas such as environment, forestry, agriculture, survey work, soil and water conservation, geology, horticulture, remote sensing, medicinal plant/herbs, seed development, high-altitude crop/vegetable production, wildlife management, etc. These valuable facilities can effectively provide support for better and more sustainable land use.

Weaknesses

- The database in respect of land resources is both weak and inaccurate. Land in the region is not fully surveyed cadastrally. Reliable time-series' data are not available. Water-flow data (except in respect of main rivers) are not available. This makes land and water planning difficult.
- Information in respect of soils is also inadequate. This creates difficulties for farmers in planning appropriate nutrient application and water use regimes.
- From the administrative and developmental point of view, field personnel of the departments/agencies of the state governments are thinly deployed and weakly developed in terms of present-day knowledge, skills, motivation, and managerial needs. Human resource development has remained an area of low priority.
- Accessibility and transportation/communication infrastructure are poor.
- Extension arrangements are weak and, where available, mostly confined to crop husbandry. Community mobilisation is wanting. People generally do not identify with common property resources such as forests and rangelands. This hampers protection and gives rise to non-sustainable use of these resources.
- Lab-land interface is not interactive or people-friendly. This is an area of neglect and deserves attention on a priority basis. Research must be related to problems of farmers/growers and, where technology prescriptions are evolved, they need to be proved in farm conditions. Varietal research and development are of low intensity.
- Value-additions to produce are almost absent. Hence, returns to farmers/growers are low and spoilage losses high. Post-harvest technologies are hardly used.
- Livestock quality is poor. The percentage of cross-breds or animals of better breeds is abysmally low.
- Investments in forestry are inadequate. The rate of afforestation is low and forest cover is only a fraction of what it should be as laid down in the National Forest Policy 1988.
- Credit-deposit ratio is low and declining. Long- and medium-term credit that is meant for bringing about permanent improvements in land has shown little progress. In some areas, it has declined.
- Institutions of democratic decentralization (*panchayats*) and local-level resource management (e.g., *van panchayat(s)* and cooperatives) are weak. They need to be empowered in terms of resources, organizational capacity, and authority. While joint forest management and joint eco-development initiatives are welcome, they have yet to be translated into wide-based, successful and sustainable arrangements.

Opportunities

- Improvements in land use and data reliability are possible.
- Productivity gaps, particularly in high hill areas, are considerable. Based on current knowledge and technologies available, it is not difficult to fill gaps and increase yields.
- Water regimes and their utilisation can be improved by increasing biomass cover; by encouraging infiltration of water and reducing surface runoff; by adopting conservation methods such as leak-proof conveyance, reduction in evaporation, and use of drip irrigation; through *in situ* moisture protection; by adoption of crop regimes that are less water intensive; and by harvesting water through polythene-lined shallow tanks and diggies
- Intensive soil surveys/testing can help

in developing farm/field-based fertility regimes and appropriate combinations of organic/inorganic fertilizers and other micro-nutrients.

- Integrated pest management and integrated plant nutrition management can greatly improve soil health care and sustained fertility capacities.
- Many technologies can be harnessed to increase forest/agriculture/horticulture/rangeland yields and achieve better growth rates, e.g., remote sensing, biotechnology, tissue culture, etc.
- Broad-banding of extension arrangements can stimulate more integrated use of resources at the farm/field level, e.g., cropping/agroforestry/fruit and vegetable growing/poultry/animal husbandry/floriculture; etc.
- Opportunities can be converted into tangible actions and results only if people are fully carried along and involved in the process of development. This implies greater adoption of community and joint management strategies in which people clearly perceive that they can become better off in the process and sustainability can be achieved at the same time.

Threats

- Mountain terrains are difficult, often remote, and soil cover (except in valleys and foothill plains) is thin. Restoration can be difficult, costly, and time-consuming. Maintenance poses similar problems.
- Fragmentation and the unconsolidated nature of land holdings make land management difficult, low-yielding, and labour intensive.
- At many places, especially near urban agglomerations, prime agricultural land is diverted to non-agricultural, non-biomass uses. This accentuates

shortage of cultivable land, an already scarce commodity in the NWHRI. This diversion needs to be curbed.

- Water management leaves much to be desired.
- Demographic increases are creating great pressure on resource bases. Often, this pressure becomes intolerable. For want of productive employment and incomes, outmigration takes place which affects the quality of human resources available for land management. Policy interventions, education, and awareness are necessary for stabilising populations within carrying-capacity levels.
- There are about 17.5 million animals in the NWHRI and most are nondescript, scrub types with extremely low productivity. This number has generated grazing pressure that exceeds yields by a factor of 2.5–3. There are serious fodder shortages in many parts of the region.
- Demand for fuelwood is steadily increasing. Forests cannot meet these demands. Alternative sources of energy need to be provided at affordable prices. At the same time, energy conservation is essential (e.g., pressure cookers, improved stoves, etc)
- Seed replacement rates are low (except in foothill *terai*/flat valleys). Hence, productivity gains are difficult to obtain and retain.
- Unless road-building techniques are made safe, these activities will continue to create problems for hill lands. Technologies/methods of environmentally-friendly road-building are available but, generally, have not been adopted.
- Community-wildlife-park management conflicts offer a threat to biodiversity protection objectives. They need to be resolved by taking people 'on board' in the preservation and management of protected areas.

References

- AISLUS, 1997. *Information Digest of All-India Soil and Land Use Survey*. New Delhi: All-India Soil and Land Use Survey Organization.
- Arora, R.K., 1993. *Himalayan Plant Resources: Diversity and Conservation*. Almora, India: G.B. Pant Institute of Himalayan Environment and Development.
- Bahuguna, S.L., 1986. *Three Weeks in the Himalayas* (Mimeograph).
- Bartarya, S.K., 1988. *Geohydrological and Gemorphological Studies of Gaula River Basin*. Ph. D. Thesis, Kumaun University, Nanital, India.
- Baviskar, A., 1998. 'Nature at Stake'. *Seminar*, 446.
- Bir, S.S., 1993. 'Uniqueness of Peridophytic Flora of the Himalayas'. *Himvikas*, 3.
- CDS, 1996. *Consolidation of Land holdings of Hill Areas in Uttar Pradesh: Beef Experiment*. Nainital, India: Centre for Development Studies, Uttar Pradesh Academy of Administration.
- Dent, F.J., 1996. *Framework for Conservation of Lands in Asia and the Pacific*. Kathmandu: PWMTA Farm Field Document No. 6.
- Development Alternatives, 1989. *CPLR Management Studies in Four States of India*. New Delhi: Development Alternatives.
- FSI, 1993. *State of Forest Reports*. Dehradun, India: Forestry Survey of India, Ministry of Environment and Forests.
- FSI, 1995. *State of Forest Reports*. Dehradun, India: Forestry Survey of India, Ministry of Environment and Forests.
- FSI, 1997. *State of Forest Reports*. Dehradun, India: Forestry Survey of India, Ministry of Environment and Forests.

- Ghildiyal, M. and Banerji, A., 1998. 'Status of PFM in Uttarakhand Himalayas, Uttar Pradesh, India'. (Unpublished paper) Kathmandu: International Centre for Integrated Mountain Development.
- Government of Himachal Pradesh, n.d. *Statistical Diaries of Himachal Pradesh*. Himachal Pradesh: Government of Himachal Pradesh.
- Government of Jammu and Kashmir, n.d. *Statistical Diaries of Jammu and Kashmir*. Jammu and Kashmir: Government of Jammu and Kashmir.
- Government of Uttar Pradesh, n.d. *Statistical Diaries of Uttar Pradesh*. Uttar Pradesh: Government of Uttar Pradesh.
- Government of Uttar Pradesh, 1996. *Statistical Diary of Uttar Pradesh Hills*. Uttar Pradesh: Government of Uttar Pradesh.
- Gulati, A.K., 1998. 'Status of PFM in Himachal Pradesh, India'. (Unpublished Paper). Kathmandu: International Centre for Integrated Mountain Development.
- Jammu and Kashmir Directorate of Economics and Statistics, 1996-97. *Digest of Statistics*. Jammu, India: Directorate of Economics and Statistics, Government of Jammu and Kashmir.
- Jammu and Kashmir State Land-Use Board, 1995. *Basic Land-Use Data*. Jammu, India: Jammu and Kashmir State Land-Use Board.
- Khoshoo, T.N., 1992. *Biodiversity in the Himalaya: Conservation and Utilization*. Almora, India: G.B. Pant Institute of Himalayan Environment and Development.
- Khosla, P.K., Swatantra, S.D., Mehta, T., and Kumar M., 1992. *Study on Jammu and Kashmir*. Solan, India: Solan University of Horticulture and Forestry.
- Kumar, K., Dhyani, P.P., and Palni, L.M.S., (eds) (1996). *Land Utilization in the Central Himalayas*. New Delhi: Indus Publishing Co.
- LBS National Academy of Administration, 1998. *Carrying Capacity of Mussoorie*. Mussoorie, India: Supreme Court of India Monitoring Committee.
- Mackinnon, J. and Mackinnon, K., 1986. *Review of the Protected Area System in the Indo-Malayan Realm*. Gland, Switzerland: International Union for Conservation of Nature and Natural Resources (IUCN).
- Mehta, J.S., 1996. 'Forest Fires and Land Degradation in Uttarakhand'. In *Regional Workshop on Sustainable Land Utilization* held by G.B. Pant Institute of Himalayan Environment and Development. Almora, India: GBPIHED.
- Messerli, B. and Ives, J.D., 1989. *The Himalayan Dilemma: Reconciling Development and Conservation*. London: Routledge.
- Ministry of Agriculture, n.d. *Directory of Economics and Statistics*. Government of India: Directorate of Economics and Statistics, Ministry of Agriculture.
- Misri, B., 1995. 'Forage Production in Temperate Himalaya'. In Hazra, C.R. and Misri, B. (eds) *New Vistas in Forage Production*. Jhansi, India: Indian Grassland and Fodder Research Institute.
- NRRC, 1997. *State of Environment and Development in NWKH*. Mussoorie, India: National Resources and Re-

- search Centre, LBS National Academy of Administration.
- Rawat, A.S., 1998. *Biodiversity Conservation in Viewpoint*. Nainital, India: Centre for Academy of Administration.
- Rizvi, S.S., 1994. Managing the Forest: Herdman's Way. *Wasteland News*, May-July 1994.
- Rodda, A. 1991. 'Women and Environment'. India: *Economic and Political Weekly*. Vol. and Issue not given.
- Rodgers, W.A. and Panwar, R.S., 1988. *Planning of Wildlife Protected Areas Network in India*. Dehradun, India: National Wildlife Institution.
- Sarin, M. (ed), 1998. *Who is Gaining? Who is Losing?* New Delhi: Society for Promotion of Watershed Development.
- Sen, K.K., Roa, K.S., and Saxena, K.G., 1997. 'Soil Erosion Due to Settled Upland Farming: Case Study of Pranmati Watershed. *International Journal of Sustainable Development and World Ecology*, 4.
- Sharma, A.K., 1996. *Major Threats to Sustainability of Land Resources Management*. Almora, India: G.B. Pant Institute of Himalayan Environment and Development.
- Sharma, P., 1997. *Mountain Tourism*. Kathmandu: International Centre for Integrated Mountain Development.
- SHERPA, 1992. *Himalayan States of India: Development Profiles*. Lucknow: Society of Himalayan Environmental Rehabilitation and People's Action.
- SHERPA, 1993. *CPRL Management in Uttar Pradesh*. Lucknow: National Wasteland Development Board.
- Singh, J.S., 1992. 'Man and Forest Interaction in the Central Himalaya'. In *Himalayan Environment and Development: Problems and Perspectives*. Almora, India: G.B. Pant Institute of Himalayan Environment and Development.
- Sood, B.R., Singh, C.M., and Premi, O.P., 1995. Forage Production Systems in Humid Western Himalayan Region. In *Forage Production*. Jhansi, India: Indian Grassland and Fodder Research Institute.
- Spate, O.H.K. and Learmouth, A.T.A., 1984. *India and Pakistan - A General and Regional Geography*. London: Methuen Press
- Tejwani, K.G., 1987. Biophysical and Socio-economic Causes of Land Degradation. In *SHERPA Seminar on Himalayan Rainfed Agriculture*, G.B. Pant University, Pantnagar, 10-11 January 1987. Almora, India: GBPIHED.
- Trivedi, P.R. and Sudarshan, K.N. (eds), 1994. *Environment and Natural Resources Conservation*. New Delhi: Commonwealth Publishers.

Annex 1

Responses to Questionnaires

General

Extent of Problem

About 31 per cent of the land in the areas comprising the north-western Himalayas has been estimated to be degraded but certain pockets report much higher proportions. Such areas fall largely in non-agricultural tracts (reserve forests, protected forests, *panchayat* forests, wastelands, and pastures). Substantial parts of agricultural lands are also affected. The problem has assumed serious proportions, particularly in the mid-elevation zone (1,000–2,000 m) where population and livestock densities are relatively high.

The main factors causing degradation have been recognised as heavy rainfall, landslides and soil erosion, floods and drought, open grazing, lack of replantation activities after deforestation, fires, extension of agriculture to steep slopes, unscientific mining, lack of water-harvesting measures, and road and building construction activities in a manner unfriendly to the environment, all of which

threaten slope stability. Degradation is often proportional to the degree of slope, reduction and depletion of vegetal cover, biotic pressures, intensity of fires, etc.

According to the response of Dr B.M. Singh, Director of Research, Himachal Pradesh Agricultural University, there is a serious problem of land degradation in Himachal Pradesh. He reports, 'In one study in Kangra district, carried out on idle lands using parameters such as day moisture equivalent ratio, erosion ratio, and clay ratio, it was demonstrated that almost all the sample wastelands in 200 villages were highly erodible as per the various indices of erodibility and, consequently, needed appropriate management technology.' Another case relates to the catchment areas of major river systems of Himachal Pradesh, which has brought into focus the quantitative aspects of soil erosion. For example, in the higher Himalayan basins of Sutlej River (12,000 sq.km.), the sedimentation rates of Kinnaur and Spiti (tributaries) basins were found to be 157,000 m³/100 sq.km. and 95,000 m³/100 sq.km.. These are quite high

sedimentation loads. Further, of the annual sediments of B hakra reservoir an additional 52 per cent comes from high Himalayan basins. Likewise, the sedimentation rate of Giri catchment was found to be of the order of 66,400MT/100 sq.km. According to information received from the Chief Project Director, Watershed Management Project, Dehradun, in the project area, 16.8 per cent of the land suffered from severe erosion (E3) and 0.8 per cent area had been destroyed (E4). The proportion of severely eroded/destroyed categories varied from 4.6 per cent on agricultural lands to 16 per cent in forest lands and 66.9 per cent on blanks.

Impact of Policy Measures and Steps Taken to Bring about Improvements

Measures taken by government agencies include soil and water conservation, afforestation, bunding, development of horticulture, agricultural improvements, and use of alternative fuel supply sources. According to respondents the programmes have not been successful so far and/or the benefits accruing from these measures are too meagre as yet. One NGO has estimated the impact of government efforts at about five per cent in terms of area treated. The reasons for poor achievements, as reported, are as follow.

- Lack of funds for actual field work — the funds available are mostly consumed in payment of salaries to workers.
- Complex procedures are encountered for raising bank finances.
- Lack of coordination among government departments (Agriculture, Forest, Irrigation, Rural Development, etc)
- Focus not on people's priorities — people's priorities are mostly for the supply of water and inputs.
- Lack of people's participation — it is reported by government functionaries that people respond and cooperate only so long as employment opportunities, inputs, or subsidies are made available to

them on their doorsteps. After the project period is over, there are no institutional arrangements for maintenance nor are the people motivated or enabled to maintain the assets created.

- Uncontrolled and open grazing
- While controlled fires, as part of silvicultural practices, are beneficial, uncontrolled fires that recur repeatedly in the hills are extremely harmful to land stability.
- Lack of education
- Non-availability of skilled manpower
- Lack of an integrated watershed management approach — however, one view is that the importance of a watershed approach is now being increasingly realised, although it is still not widely practised.
- Socioeconomic constraints
- Misuse of funds meant for development

It was suggested that (i) sloped fields should be levelled to check erosion, (ii) spring sanctuaries should be established to prevent their drying, (iii) road construction technologies should be improved, and (iv) penal provisions should be provided in contracts for defective road construction. It was also suggested that there should be sustained afforestation programmes on vulnerable slopes and farm-forestry programmes should be fully supported for augmenting fodder and fuel supplies. Formation of land management committees and equitable distribution of benefits were also suggested.

Problems in the Implementation of Agrarian Reforms

Land reforms were introduced in the NWHRI to provide land for tillers and the landless. These reforms have succeeded but not wholly. According to one view, in the Uttar Pradesh hills, the implementation of land reforms resulted in fragmentation of holdings as no minimum or floor size of land holdings was prescribed. At the same time, the land ceiling laws have not been enforced

strictly as local revenue officials function under the influence of vested interests. At present, landlords are not interested in giving uncultivated lands to sharecroppers. Tracts of slopy uncultivable wastelands (often common lands) have also been allotted to landless farmers. This has further aggravated the problems of land degradation. These lands should have been developed as forests, pastures, and grasslands. All this has resulted in many tracts becoming cultivable wastelands. It is alleged that there appears to be lack of political will to implement land reforms honestly. The staff, too, does not put in whole-hearted efforts in the face of the pressure of vested interests. Implementation of land reforms in Himachal Pradesh and Jammu and Kashmir has, however, been reported to be comparatively more successful although some problems exist.

Support of Communities, NGOs, and Other Institutions

The support of local communities, NGOs, and institutions has either been low (except in small pockets) or it is confined to the matter of resolving conflicts relating to agricultural lands. Normally, policies are framed at the state level and programmes are handed over to local administrative units for implementation without involving them or the beneficiaries in policy formulation. The approach is top-down. In the Doon Valley Watershed Management Project, however, there is strong emphasis on community participation. Participatory rural appraisal, entry-point activities, development of local-level institutions, creation of revolving funds, training in income-generation activities, formation of women's self-help groups, etc are suggested strategic approaches. The support of the community, it is suggested, should be institutionalised. Joint forest management is also being attempted in some areas. People are required to manage their forests within the framework of *panchayat* rules. This programme/

policy began in recent years and has still to be institutionalised with success and impact. The principal causes of failure of the *panchayat* forest system can be traced to duality of control, lack of technical management capacities, and problems of red-tapism that cause delays in giving usufruct to local communities. Moreover, blanket bans on the felling of green trees above 1,000 m in the Uttar Pradesh hills has left little incentive for resident villagers to support forestry. As joint forest management is a comparatively new concept, particularly in the Uttar Pradesh hills, the implementing agencies report that it is too early to evaluate the system. Some NGOs and agencies, such as Uttarakhand *Sewa Nidhi* (UKSN), Vivekanand Laboratories, Pantnagar University (Ranichoura Campus), and others are, however, making laudable efforts in small pockets. It is suggested that efforts should be made to intensify and operationalise people's participation and to infuse refinements in the development processes with respect to joint forest management. People, it is said, must perceive joint forest management to be beneficial to them. Only then can it succeed.

Training of Beneficiaries and Workers, and Strengthening of Infrastructure

Presently there are some ongoing training and extension programmes, but these are inadequate and are confined to a few project areas. Their inadequacy is that they are mostly suited to, and are largely confined to, male workers. In the hills, women play an important role and, therefore, it has been suggested that training programmes should be more women-centred and should mainly be field-oriented. It is further felt that many trainers are not conversant with local problems and cannot generally speak the local language. There is paucity of publicised literature for land, water, and forest management in the languages understood by farmers. In order to make training more

meaningful, the contents and methods should be made appropriate for village conditions. However, there are some exceptions. For example, in the Doon Valley Project, training has been given high importance, and adequate in-house and other arrangements have been made for the purpose.

Acceptance of Government Measures by Principal Stakeholders

Acceptance of government programmes by various stakeholders depends on perceptions about the fulfillment of their needs. Each group seems to be self-focussed in approach and accepts the measures so long as these suit them. Cultivators welcome land development measures for which they do not have to pay in the short run. Cattle owners and grazing communities welcome fodder and pasture development programmes but hate grazing restrictions and are even willing to flout them. With some exceptions, generally, there is apparent lack of structured interaction between government agencies and target groups. The rules of rotational grazing are transgressed and recommendations for stall-feeding of animals ignored. Land reforms are welcomed by cultivators but opposed by landowners. Restrictions imposed with the intent of protecting national parks, sanctuaries, and biosphere reserves are resented by the pastoral Gujjar (a cattle-rearing tribe), owners of animal herds, and other cattle-rearers, especially by people who had access to the usufruct of forests before the areas were notified as national parks or wildlife sanctuaries. This is a real problem in all hill states in the NWHRI. Vested interest groups oppose development efforts for their own selfish ends. Programmes that offer subsidies are welcomed and people cooperate as long as subsidies are available, but their attitudes change if and when subsidies are withdrawn or reduced. Subsidies thus have a negative impact on many situations in the long term. The prevalent motivation is cash/kind subsidy instead of programmes. Plan-

tations are welcomed but restrictions on the use of forest products are not accepted. Village leaders are reported to favour measures that bring more money to them and enhance their clout. The blanket ban on felling of green trees above 1,000 m is unpopular. It is considered by the NGO as well as foresters to be unscientific and in disregard of silvicultural requirements. A different, but perhaps more balanced, view is that there is initial resistance wherever wrong practices such as open and uncontrolled grazing, lopping of trees, and felling of trees for fuelwood are checked. Once the benefits of better management through sustained efforts become visible people accept the change. However, great persuasive efforts are required to convince the people.

Impact of Growth of Tourism and Economic Activities on Ecosystems and Lands

There is near unanimity amongst those who have responded that unplanned and uncontrolled growth of tourism, as has generally been the case, damages hill lands and environment. Examples of pollution, caused in Nainital, Bhimtal, Ranikhet, Valley of Flowers, Dal Lake surroundings, and Kullu-Manali areas through the growth of mass tourism have been cited. It has also been emphasised that properly developed, decentralized, and regulated tourism will not be harmful. Instead, it would create employment opportunities and would be beneficial to hill people. A cautious growth path has been suggested with the following measures.

- Non-degradable litter, such as plastic packaging, polythene, glass, and tin containers, etc, should not be thrown around helter skelter. Use of polythene bags should be banned.
- Only vehicles tested for pollution should be permitted. Trekking and travel on foot should be encouraged.
- Sale of land to non-residents should be banned or discouraged.

- The hotel industry should be taxed by levying cess to build up an ecological fund.
- A proper infrastructure should be developed considering the carrying capacity of specific tourist locations and areas.
- There should be eco-guidelines for builders and road engineers, and they should be rigorously enforced.
- There should be environmentally friendly systems for disposal of garbage — including recycling or composting.
- There should be stringent laws to check pollution of land, rivers, and air.

The general view of NGOs working in the field is that tourism should be organized on the principles of eco-tourism.

Examples of Successful Control of Soil Erosion and Land Degradation

- Sukhomajri area in the Siwaliks, Haryana
- A project near Jhansi under Dr Hazra
- Successful demonstrations by the G.B. Pant Institute of Himalayan Environment and Development, Almora
- The Khulgad Catchment Area Project undertaken by CHEA, a local NGO
- Efforts by the Uttarakhand *Sewa Nidhi* (UKSN), Mirtola Ashram, Ahuora and Sarla *Bahen Ashram* (Pithoragarh) in imparting environmental education have been cited as commendable.

Suggestions for Protecting Biosphere Reserves, National Parks, Sanctuaries, Wildlife and Biodiversity

- Generally speaking, the respondents feel that hill people are eco-friendly and do not consciously destroy the biosphere. The use of forest products should be regulated and restricted, but with a human face and taking local people into confidence and motivating them. Alternative fuel sources should be made available where traditional rights and concessions are withheld or reduced.
- Degraded community forests should be

handed back to people's institutions and joint forest management should be expanded as a policy.

- Forest lands (other than those degraded) should be developed as forests, wildlife, and gene bank parks and strictly administered without biotic interference.
- Uncultivable lands and agricultural wastelands should be developed as grazing areas so that pressure on forests is reduced.
- Educational programmes should be organized to improve awareness about the issues relevant to biosphere management and human interaction. These can lead to a check on the number of animals in an area and on open grazing. Focus areas may be closed by rotation.
- Training programmes should be arranged for workers to develop their skills and understanding of biosphere issues. Such programmes are equally important for users, communities, and their leadership.
- There should be strong interaction and collaborative arrangements should be evolved among governments, NGOs, and the people living around biosphere reserves.
- Users' rights should be maintained to the extent possible in forest areas. Village institutions should be given the responsibility of managing and conserving the resources under joint management arrangements.

Forests

Problems Experienced in the Management of Forests

The origin of these problems lies in human and livestock population increases, poverty, lack of employment opportunities, and want of education and awareness. People have enjoyed traditional rights in the use of forest products; but it is a feeling in certain quarters that rights and concessions given in the days of low population pressure way

back in the past cannot be continued if biodiversity is to be preserved. While demands of the local population are increasing, the process of degradation of forests continues. Socioeconomic complexities leading to unchecked human interference create problems in management. While people are not permitted to use trees growing on their land, a question that is commonly asked is why should the tree be planted at all if it cannot be harvested? In the prevailing social milieu, restrictions imposed by forest laws are often not respected by people. Adequate funds and staff are not available. The staff are not adequately trained. There are hardly any community institutions made responsible for equitably sharing forest produce. *Panchayat(s)*, which manage community forests, are not adequately trained, funded, or equipped and lack expertise. Forest fires cause extensive damage. Election to forest *panchayat(s)* are not regularly held. Many *panchayat(s)* are non-functional. The vital help of local communities is not available for protecting forests against fires. It is alleged that forest mafias are damaging forests through unauthorised felling under political protection.

Traditional Rights and Concessions

Local populations have had traditional rights and concessions in the use of forest products—fuel, timber, fodder, herbs, etc. These exist even in reserved forests and have been codified in forest laws, rules, and orders. People can gather dead or diseased wood or silviculturally available trees. Governments have powers to withdraw concessions under certain conditions. Since concessions have continued to exist, they are equated with rights and any attempts at withdrawal or reduction are resisted. Although these rights were envisaged for a fixed population (and not a growing one) and they are not transferable, pressures mount owing to expanding demands in the wake of growing population. People have greater freedom to use forest produce in

community forests but use of certain products is prohibited. It is generally felt that the actual demands made by people are excessive and cannot be met without damaging forests. The problem arises from the fact that ‘rights and concessions’ relate to the point in time of settlements. Relevant laws do not take into account subsequent increases in demand.

Suggestions for Improving Management of Forests

- Forest laws should be strictly enforced in reserved and other forests.
- People’s fora/institutions should be organized in and around reserved and other forests, national parks, and sanctuaries to ensure equitable distribution of forest produce. People should be involved in forest management.
- People should be made aware of the dangers of degradation of land and forest fires.
- Extra fire guards should be provided during the fire seasons. Fire regulations should be enforced.
- Forest *panchayat(s)*, village development committees, and village forest development committees should be organized where they do not exist to manage community forests. These bodies should have the freedom to manage the revenues accruing from community forests. They should be strengthened and empowered to manage grazing lands.
- Use of alternative sources of energy, fuel, and fodder should be encouraged.

Holdings

Agricultural Holdings

Fragmentation of land holdings is a severe problem. Land productivity is low. A large livestock population is being maintained. Generally a pair of bullocks is a must for hill farmers. In these areas, mechanisation

does not have much scope. A large livestock population causes overgrazing, threatening soils on hill slopes. The solution lies in shifting to horticulture as has been done in Himachal Pradesh. Mechanisation, even on a limited scale, wherever possible, can help to reduce livestock population. Development and use of garden tractors can be helpful in this respect. Consolidation of holdings has been advocated. It is suggested that consolidation should be taken up separately for the lands in valleys (irrigated land) and hillside fields and terraces (mostly rainfed). A voluntary agency, CHEA, has reported failure in its attempt to consolidate in an experimental area owing to lack of interest on the part of the district administration. It is recognised that consolidation of holdings in hill areas is much more difficult than in the plains, but some voluntary consolidation attempts have been encouraging in Kumaon. A further suggestion is to undertake farm forestry and horticulture between agricultural fields and, thus, to make winter grass available. Such experiments, it is reported, have been successful in Khulgad Catchment Area (Almora).

Absentee Landlords

Many areas in the hills remain uncultivated since landowners migrate to other places in search of employment or better earning prospects and only females, children, and old people are left behind to cultivate land. Transfer of land to outsiders, other than kith and kin, can cause serious problems owing to tenancy laws. It has been suggested that laws should be amended to ease the leasing of land to sharecroppers while maintaining the rights of landowners. Ways should be found to enable actual cultivators to raise loans against the 'tenanted' land and landlords should be deemed to be the sureties automatically. Irrigated land owned by absentee landlords can be usefully brought under cultivation (on a rental basis) while the unirrigated land should be brought under horticulture. Marginal lands

can be brought under plantation of environment- and cultivator-friendly species such as oak, willow, etc or fuelwood species.

Common Lands

Most villages have some common lands for use of the community (e.g., as determined according to the settlement of the year 1880 in the Uttar Pradesh hills). *Panchayat* forests and civil and *soyam* forests are parts of common lands. Afforestation of these lands can provide fuel, grasses, and fodder to local populations. Portions of village common lands have been encroached upon either by influential people or by landless cultivators; such lands are no longer available for common purposes. One view is that there should be strict eviction proceedings in such cases and community forests should be grown there collectively under participatory management of the community. The other view is that the productive use of encroached land has been beneficial as it has, at least, checked degradation of the land, although the community has lost a part of its common property. The management of available common lands can be improved by handing over their planning, use, and maintenance to village *panchayat(s)* or other people's institutions, which should be strengthened and empowered. Such lands must be brought under productive uses such as afforestation, development of pastures, horticulture, etc. Weeds growing on common lands should be removed and useful species planted there. The choice of species should be left to people living around common lands. Equitable allocation of produce should be the responsibility of the village *panchayat(s)* that would be distributing produce from forests as well.

Water

Scarcity of water is a serious problem in the hills. Semi-urban areas, such as

Bhowali and Bhimtal in the Uttar Pradesh hills, have to be served drinking water through tankers during the summer. Although rainfall is plentiful in most areas (except in the westernmost reaches of the region and high cold desert areas) and there are numerous rivers and rivulets, springs are drying up and discharge in many rivers and rivulets has been going down. For improvement in water management, components of the hydrological cycle need be studied in terms of seasonal availability of water. In a study in Kumaon, it was found that water balance was negative for eight months in a year and that water was available as surface runoff for only four months a year. Irrigation is extremely important for hill areas, although possibilities are limited. Better use of existing irrigation potential can help transform the economy of the hills. If better water management is used, floriculture, horticulture, and cultivation of vegetables and other cash crops can be undertaken. It is reported that many storage tanks built under the schemes of five-year plans are lying unserved for want of repairs. If springs are harnessed, rainwater is harvested and stored, and existing gullies and canals are commissioned, some additional irrigation of crops can be undertaken. A local NGO, CHEA, is doing some pioneering work in

this respect in the Shitlakhet area of Almora district. Hill rivers can also be harnessed for generation of electricity by erecting hydro-electric dams and used for supply of drinking water besides providing some additional irrigation and scenic resources. Water conservation can be improved by better management of forest resources. It has been suggested that there should be afforestation around water sources and a chamber should be constructed along with filters and disinfection to make it safe for drinking purposes. Rainwater from rooftops can also be stored for domestic purposes by constructing storage tanks at intermediate levels. Catchment treatment plans should be developed to improve the recharge of water by adopting suitable bio-engineering measures. Community participation for management of springs and other water sources can further improve matters as demonstrated by *pani panchayat(s)* in some areas.

Annex 2

Selective Statistical Indicators of India

Area (sq.km.)	3,287,000
Population (millions) (1991)	846.3
Density of population (number/km ²) (1991)	274
Sex ratio (1991)	927
Life expectancy at birth (years) (1993)	60.7
Infant mortality (per thousand) (1990)	80
Population growth rate/year (%) (decennial 1981-91)	2.14
Literacy rate (%) (1993)	51
Occupational pattern (worker distribution) (%) (1991-92)	
Cultivators	38
Agricultural labour	26.09
Household industry	2.38
Other workers	32.81
Domestic production (sectorwise distribution) (%) (1990-91)	
Primary sector	33.1
Secondary sector	25.8
Tertiary sector	41.1
Gross national product (billion Rs) (1996-97)	11354
Per capita income in Rs (1995-96)	9321
Area under forests (million ha) (1997)	
reported	76.52
actual	63.39

Net sown area (million ha) (1990-91)	142.2
Net irrigated area(million ha) (1990-91)	47.43
Food grain production (million t) (1997-98)	194.1
Cropping intensity (1990-91)	130.4
Irrigation intensity (1990-91)	133.3
Per capita net cultivated area (ha) (1990-91)	0.17
Fertilizer consumption (kg/ha) (1991-92)	68.6
Average yield (kg/ha)	
Wheat (1991-92)	2394
Rice (1991-92)	1751
Per capita electricity generated (kMW) (1991-92)	270
Industrial production index (1997-98)	317.3
Agricultural production index (base year1981-82) (1997-98)	169.2
Electricity generated (billion kVA)	420.2

Source: Government of India documents

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