

Fragile ecosystems: sustainable mountain development

Introduction

The Rio conference in 1992 recognized the crucial role played by mountain ecosystems by highlighting that the livelihood of about 10% of the world's population depended directly on mountain resources such as water, forests and agricultural products and minerals (United Nations, 2001). In addition, populations living in valleys and plains depend on the mountains for water as many major rivers originate there. This aspect was also stressed in Agenda 21 which stated that about 40% of the world's population lived in adjacent medium and lower watershed areas. The vulnerability of mountain areas to environmental degradation pressures placed by increasing population growth, tourism and economic development, was also highlighted. Notably, Agenda 21 drew attention to ecological degradation in the Himalayan region resulting from the cultivation of marginal lands due to population growth.

This chapter begins with a description of the main mountain ecosystems in India. The key issues for sustainable mountain development that were identified in Agenda 21 are then presented. This is followed by a section highlighting the policies, programmes and legislation that have been implemented specifically for the development of mountain regions in India. An analysis of these policies, their achievements and concerns with respect to Agenda 21 issues follow. The last section presents some strategies that address environmental and social concerns of mountain ecosystems in the country.

Mountain ranges in India

The major mountain ranges in India are the Himalayas and the Western Ghats. The Himalayas are among the youngest and highest mountain systems in the world. They traverse an arc of about 2500 km between the Indus and the Brahmaputra rivers, with an average width ranging from 100 to 400 km. The Himalayas pass through eight countries: Afghanistan, Pakistan, India, China, Nepal, Bhutan, Bangladesh and Myanmar. In India, this mountain ecosystem is spread over 11 states: Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal. They are inhabited by 51 million people, covering

18% of the geographical area and 6% of India's population. The Himalayas have probably one of the highest hydropower potentials in the world, which includes the Indus, Ganga and Brahmaputra rivers. This mountain system represents one of the richest natural heritage sites in the world. One-tenth of the world's known species of higher altitude plants and animals occur in the Himalayas (IPCC, 2001).

This rich environmental heritage of the Himalayan region is under pressure from natural and human-induced stresses such as earthquakes, landslides, construction activities (roads and dams) and poaching. The impacts of these pressures is illustrated by declining forest cover in the states of Assam, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim, the loss of wildlife habitat and the loss of life and property caused due to natural disasters. Deforestation has resulted in many species of flora and fauna of the region becoming endangered.

The Western Ghats run to a length of about 1600 kms, more or less parallel to the west coast, starting from the state of Maharashtra and continuing until Kanyakumari, the southern-most tip of the country. The region covers an area of 1.6 lakh sq kms supporting a population of 442 lakh people (Census of India, 1991). The Western Ghats are the source for many major peninsular rivers such as the Godavari, Krishna, Kaveri and Periyar. About 30% of the area of the Western Ghats is forested. The region faces increasing stress from population, submergence of forests areas by river valley projects, encroachment and clearance of forest lands for raising plantations and shifting cultivation (Ninth Five-Year Plan, 1997-2002). The steep topography combined with high precipitation makes this region susceptible to soil erosion. In Kerala for instance, a total of 50 lakh tonnes of nutrient-rich soil is washed away ever year (Planning Commission, 2001a).

Sustainable mountain development and Agenda 21

Two programme areas were identified in Agenda 21 for sustainable mountain development.

- Promoting integrated watershed development and alternative livelihood opportunities
- Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems

Specific areas for action that were identified under these broad programme areas are discussed as follows.

Promoting integrated watershed development and alternative livelihood opportunities

Agenda 21 drew attention to the problems of ecological deterioration in watershed areas adjacent to mountain ecosystems. It called for the adoption of an integrated approach to the development of natural resources of land, water, flora and fauna in these watershed areas. Concern was also expressed regarding poverty and unemployment in these regions and alternative livelihood opportunities were to be promoted in order to improve the standard of living of rural people in mountain areas. The need to improve infrastructure and social services in these areas to protect the livelihoods of local communities was highlighted.

Specific activities that were to be undertaken to address the above concerns were:

- Undertaking programmes for prevention of soil erosion
- Establishing task forces or watershed development committees to support local initiatives in animal husbandry, forestry, horticulture and rural development
- Enhancing popular participation in management of local resources
- Promoting national policies that would provide incentives to local people for the use of environment-friendly technologies, farming and conservation practices
- Establishing natural reserves and national parks for the protection of biological diversity
- Undertaking income-generating activities in cottage and agro-processing industries
- Diversifying mountain economies by creating/strengthening tourism.

Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems

This programme area was based on the concern that knowledge on mountain ecosystems was lacking. It called for action by national governments, in coordination with relevant international and regional organizations, on the following fronts.

- Strengthening existing institutions or establishing new institutions at local, national and regional levels to generate a knowledge base on mountain ecosystems.
- Creating mechanisms for cooperation and information exchange among national, regional and international institutions for building and maintaining databases and information systems on ecological resources, evaluation of environmental risks and natural disasters in mountain areas. Identification of areas vulnerable to natural hazards and exchange of information was particularly stressed for countries sharing mountain ranges and watersheds.
- Establishing and maintaining meteorological, hydrological and climate-monitoring analysis and capabilities.
- Building an inventory of soils, forests, water use, crops, plant and animal genetic resources.

Review and analysis of policy and other initiatives for sustainable mountain development

Highlights of legislation, policies, programmes and other initiatives

There is an entire range of environmental, economic and social policy and legislative initiatives that impact mountain ecosystems in the country. The focus of this chapter is on those policy initiatives that have been specifically developed and targeted for hill regions in India and those that address particular Agenda 21 issues for sustainable mountain development. Highlights of these policies, programmes and institutional activities are presented in Table 12.1 below. It must be emphasized that these policies should be considered in addition to national policies^a and programmes developed for protection of forests, biodiversity, water and other natural resources. These national policies apply equally to mountain regions and are separately addressed in other chapters.

^a The policies and programmes for protection of forests and biodiversity have been outlined in separate chapters in the Assessment report.

Table 12.1 Highlights of policy initiatives for hill regions in the country

Year	Policy/ Legislation/ Programme/ Institutional activities	Highlights
1974	Hill Area Development Programme (HADP)	The main objectives of the programme are eco-preservation and eco-restoration with emphasis on preservation of biodiversity and rejuvenation of hill ecology.
1974	Western Ghats Development Programme (WGDP)	The programme adopts an integrated watershed development approach in the Western Ghats area, prioritising eco-development, eco-restoration and meeting the basic needs of food, fuel and fodder.
1992	National Policy for the Integrated Development of the Himalayas	<ul style="list-style-type: none"> ▪ An expert group was set up by the Planning Commission to formulate a policy for the development of the Himalayas ▪ Based on the recommendations of this group, six sector-specific sub-committees have been set up under the Chief Secretaries of the states of the Himalayan region to formulate and implement schemes in the following areas. <ul style="list-style-type: none"> ▪ Environment and Forests ▪ Agriculture and allied activities ▪ Industry and industrial infrastructure ▪ Social sectors including health and family welfare ▪ Transport, communications and tourism ▪ Energy including non-conventional energy and science and technology
1992	Ministry of Environment and Forests Notification on restriction of certain activities in specified areas of the Aravalli range	<ul style="list-style-type: none"> ▪ Issued under the Environment (Protection) Act, 1986, the notification restricts certain activities causing environmental degradation in the Aravallis ▪ The activities that were prohibited in these specified

Year	Policy/ Legislation/ Programme/ Institutional activities	Highlights
2001	Notification on protection and improvement of quality of environment in the Himalayas	<p>areas included location of any new industry, new mining operations and mining in sanctuaries and national parks and deforestation.</p> <ul style="list-style-type: none"> ▪ Environmental Impact Assessments and Environmental Management Plans are required for carrying out any of the restricted activities in this region. ▪ Issued by the Ministry of Environment and Forests under the Environment (Protection) Act 1986, specifically for environmental protection in the Himalayan states. ▪ The activities relate to location planning in urban areas, rainwater harvesting and guidelines for construction of hill roads.
	Activities undertaken by the Botanical Survey of India (BSI)	<p>The primary activities undertaken by the BSI include:</p> <ul style="list-style-type: none"> ▪ Survey of plant resources of the country ▪ Undertaking taxonomic studies of all flora of the country ▪ Enlisting endangered species ▪ Preparation of a national database of herbs
	Activities undertaken by the Zoological Survey of India (ZSI)	<p>The primary objectives of the ZSI are:</p> <ul style="list-style-type: none"> ▪ Exploration and survey of faunal resources ▪ Taxonomic studies ▪ Status survey of endangered species ▪ Publication of assessment of fauna of India
	Activities undertaken by the Forest Survey	<p>Maintenance and development of national zoological collections</p> <p>The FSI undertakes assessment of the forest resources of the country</p>

Year	Policy/ Legislation/ Programme/ Institutional activities	Highlights
	of India (FSI)	through parameters such as forest cover, growing stock, annual increment, species composition, bio-diversity, non-timber forest products etc.
	Activities undertaken by the Indian Meteorological Department (IMD)	The mandate of the IMD includes: <ul style="list-style-type: none"> ▪ Taking meteorological observations and providing meteorological statistics ▪ Warning against adverse weather phenomena such as cyclones and heavy rains ▪ Detection and location of earthquakes and evaluation of seismicity

Sources. Ninth Five-Year Plan, 1997-2002; Planning Commission (2001b); Ministry of Environment and Forests (2001)

The following section analyzes the policies highlighted in Table 12.1 above from the perspective of Agenda 21's objectives of promoting integrated watershed development, promotion of alternative livelihood opportunities, improvement of infrastructure and social services and the development of a knowledge base on mountain ecosystems.

Achievements

Promoting integrated watershed development and alternative livelihood opportunities

In India, some of the economically-weaker states are treated as Special Category States. These include Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Manipur, Meghalaya, Nagaland, Tripura, Arunachal Pradesh and Mizoram (Ninth Five-Year Plan, 1997-2002). Special Central Assistance is given, 90% in the form of a grant and 10% as a loan, compared with the proportion of 30% and 70% respectively, for other states (Planning Commission, 1999).

In addition to this special status accorded to hill states, specific programmes are being implemented for hill areas in other states. Since 1974, two programmes: the Hill Areas Development Programme (HADP) and the Western Ghats Development Programme (WGDP), have specially focussed on mountain

areas. The primary objectives of both these programmes are eco-regeneration and eco-preservation with emphasis on preservation of biodiversity and rejuvenation of hill ecology (Planning Commission, 2001b). Until now HADP was being implemented in designated hill areas in Uttar Pradesh, Assam, Tamil Nadu and West Bengal. With the formation of Uttaranchal as a separate state, the programme will no longer be in operation in the hill districts of erstwhile Uttar Pradesh during the Tenth Five-Year Plan. The areas covered by the WGDP include parts of Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. Under these programmes Special Central Assistance is given to supplement efforts of the state governments in the development of these ecologically fragile regions (Planning Commission, 2001a). The assistance is apportioned between the designated hill districts and the Western Ghats areas in the ratio 84:16. The allocation of funds for these programmes is co-ordinated by the Planning Commission. Between 1974 and 2002, there has been a ten-fold increase in allocation of special central assistance under the HADP and the WGDP (Table 12.2).

Table 12.2 Allocation (Rs crore) of Special Central Assistance under the HADP and the WGDP

Programme/ State	Fifth Plan 1974- 79	Sixth Plan 1980-85	Seventh Plan 1985-90	Eighth Plan 1992-97	Ninth Plan 1997- 2002
Hill Areas Development					
Programme					
Assam	24	72	118	194	249
Tamil Nadu	7	22	34	55	107
Uttar Pradesh	104	350	554	910	936
West Bengal	15	30	45	97	111
Survey and studies	0	12	4	3	0
Total HADP	150	485	754	1259	1405
Western Ghats Development					
Programme					
Kerala	5	18	24	39	61
Maharashtra	6	23	38	63	97
Tamil Nadu	4	13	20	33	51
Karnataka	4	14	28	46	72
Goa	1	4	6	10	15
Survey and studies	0	3	1	1	1
Western Ghats Secretariat	0	0	0	0	1
Total WGDP	20	75	117	191	297
Total HADP and WGDP	170	560	870	1450	1702

Source. Planning Commission (2001a)

The Western Ghats Development Programme adopts an integrated approach to development of identified watersheds in the areas under its purview. This is done through the formulation, implementation and monitoring of soil conservation, agriculture, afforestation, fuel and fodder development, minor irrigation, animal husbandry and sericulture schemes in these watersheds. Some of the main activities that have been undertaken in watersheds in the Western Ghats under this scheme are discussed below.

Programmes for soil conservation on watershed basis receive maximum attention as they serve the special needs of the Western Ghats (Planning Commission, 2001a). Specific programmes that have been undertaken include land development activities such as levelling, terracing and contour bunding. Water harvesting and erosion control structures such as check dams have been built. The other area which has received attention in the WGDP is the development of horticulture. The Western Ghats region has tremendous potential for cultivation of horticultural crops, with about 3.6 lakh hectares of culturable wasteland (Planning Commission, 2001a). Under the WGDP, the cultivation of horticultural crops on wasteland will serve the twin purposes of ecological regeneration and provide complementary avenues for income for small and marginal farmers. Various horticulture programmes are being implemented depending on the needs and demands in the local areas.

Deforestation is a serious concern in the Western Ghats region and to address this, programmes for afforestation, regeneration of degraded forestlands, fuelwood and fodder development, pasture land development and social forestry schemes have been implemented under the WGDP.

The approach and strategy for the Hill Area Development Programme has evolved over the various Plans but has been confined largely to eco-preservation, eco-development and eco-restoration. Towards reducing soil erosion, the programme encourages diversifying the cropping pattern as also improving the crop productivity. Under this, subsidies have been provided to small and marginal farmers for agricultural implements, power sprayers, sprinklers, high-yielding annual vegetable crops, and perennial crops. Alternative livelihoods such as animal husbandry, dairy development, sericulture, and tourism have been encouraged through specific allocation of funds.

Generating and strengthening knowledge about the ecology and sustainable development of mountain ecosystems

As highlighted in Table 12.1, there are established scientific and research institutions such as the Botanical Survey of India (BSI), the Zoological Survey of India (ZSI) and the Forest Survey of India (FSI) that undertake comprehensive assessments of the flora, fauna and forest resources in the country.

So far, 65% of the total area of the country has been surveyed. The BSI has collected three million herbarium specimens. During 1987-97, 106 new species were discovered by the BSI. The institute has also undertaken special surveys in Alpine Himalayas. The ZSI discovered 759 new species during 1987-97 (Ninth Five-Year Plan, 1997-2002). The FSI prepares a comprehensive State Forest Report including a National Forest Vegetation Map once every two years. A National basic Forest Inventory System (NBFIS) is maintained by the FSI which contains data related to forestry for national and state level planning.

Meteorological analysis, climate monitoring and assessment of vulnerability to natural disasters in the country is done by the Indian Meteorological Department (IMD). The IMD's network includes 559 surface observatories, more than 800 rainfall monitoring stations, 100 satellite data collection platforms in remote areas, 203 observation ships, 10 cyclone detection radars, and 17 storm detection radars. The IMD has also been undertaking ozone measurements since 1928. There is thus a rich repository of information on natural resources and processes in the country.

Apart from creating an inventory of natural resources, the need for educating people on implications of environmental degradation is well recognized by the government. Steps are being taken to ensure effective use of traditional technology and development of appropriate technology required for hill areas. Environmental aspects are being included in the curriculum of primary and high school education.

Concerns

Promoting integrated watershed development and alternative livelihood opportunities

While the WGDP is implemented on a watershed basis, this is not the case with the HADP. In case of the latter, Special Central Assistance forms a sub-component of the state plan. As a result, other sectors or areas receive priority and environmental concerns do not receive adequate attention (Planning Commission, 2001a). Of particular concern is the utilization of Special Central Assistance meant for the ecological preservation of hill areas for meeting non-plan or salary requirements. Maintenance of assets created under the

programmes is a challenge which also needs to be addressed. A start has been made recently in this direction which should be made permanent.

Preservation of forests and the rich biodiversity of the mountains is a continuous challenge. The issues related to these areas have been discussed in the chapters on forests and biodiversity. The special schemes for the mountain areas have focussed more on ecology and general services like health and education. Pressure on the environment comes primarily from economic causes. It is therefore necessary to provide a greater role to interventions that will promote sustainable livelihoods for the people living in these areas.

Strategies for sustainable mountain development

Thrust areas that have been identified for promoting ecological development in hill regions under the HADP and the WGDP, in the future are as follows:

- Continuing the watershed-based approach adopted in the Western Ghats region and adopting it in the hill areas of Assam and West Bengal
- Adopting a participatory approach in the formulation and implementation of schemes under these two programmes, by encouraging the involvement of Panchayati Raj Institutions and non-governmental organizations
- Development of technologies suited to local conditions such as farm implements for small landholdings, micro-hydel projects, rain-water harvesting and water conservation schemes
- Providing incentives to farmers for conserving the traditional gene pool through promotion of traditional farming practices
- Greater role for development of income generation schemes for local communities
- Provision of funds for maintenance of assets on a continual basis in both programmes.

Out of these, the most important is the adoption of a participatory approach by involving local people, NGOs and the Panchayati Raj Institutions (PRIs) in the development process. The PRIs can facilitate the involvement of people and NGOs to ensure informed decision-making. While NGOs can play an important role in mobilizing people at the grassroots level the local community can respond to changes by breaking social, cultural and psychological barriers. Local communities possess traditional knowledge and skills which can be applied to development challenges faced by these hill areas. NGOs on the other hand can serve as the medium for knowledge exchange and facilitate the

flow of information from the government. Coupled with use of funds under these schemes for local capacity building, this strategy can help in realizing the objectives of the plan in the identified areas.

The relevance of renewable energy technologies as decentralized sources of energy for meeting needs in hill areas should be fully recognized. Such technologies are emerging as an attractive option to provide light and power to non-electrified remote areas where grid extension may be unviable. In the Approach Paper to the Tenth Five-Year Plan (Planning Commission, 2001), the government recognizes the role of non conventional energy sources in meeting the energy demands of remote and inaccessible areas^a, using local resources and cutting out the expensive delivery mechanisms associated with conventional energy sources. WGDP already has a component for promotion of renewable energy sources and initiatives have been taken in some states and the Western Ghats, encouraging the use of wind, solar and other such forms of energy. However, these efforts need to be carried forward and technologies suited to hill areas such as micro-hydel projects should be accorded priority.

^a In the budget of 2002-03, the government has announced electrification of 500 villages (through hydropower village electrification programme) and installation of 82,000 solar cookers in remote and far flung areas.

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