
UNIT 14 PARTICIPATORY MANAGEMENT OF MOUNTAIN ECOSYSTEMS

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14.1 INTRODUCTION

Mountain ecosystems are an important source of biological diversity, along with water and mineral resources while forestry, agriculture and recreation are important economic activities in several mountain areas. Further more, mountain conditions, being different from those on the plains, need special consideration. However, these conditions have been disregarded by both conventional development strategies and by mountain people themselves (within the changing demographic, institutional, and technological settings), leading to the breakdown of production systems that are resource-regenerative and there is diversified, indiscriminate resource use intensification, and degradation of environmental resources.

As 10% of the earth's population live in mountain areas this has resulted in various forms of resource degradation reflected by decreasing resource availability and productivity, and general deterioration in the economic conditions of most people depending directly upon mountain resources, especially land-based activities. Thus, proper management of mountain resources and socio-economic development deserves high priority.

In this unit we will stress upon the ecological role of mountains, agriculture, biodiversity and various socio-economic constraints of mountain ecosystem. These days' tourism and urbanization are becoming one of the important factors responsible for degradation of mountain ecosystems. But sustainable ecotourism can also play an important role in conservation of mountain areas. The Hindu Kush-Himalayas travels

along the eight countries and play important role in deciding the economic as well as ecological conditions of these countries. Various issues and long-term goals for sustainable development of Hindu Kush-Himalayan region are dealt with great emphasis on people's participation in this area.

Objectives

After studying this unit you will be able to:

- appreciate the ecological role of mountains,
- describe the environmental importance and fragility of mountain ecosystems,
- list the various issues of socio economic considerations,
- appreciate the participatory management in mountain ecosystems,
- explain the importance of sustainable mountain development,
- list the high priority issues in Hindu Kush- Himalayas, and
- describe long-term goals for sustainable development of the Hindu Kush-Himalayan region.

14.2 MOUNTAIN ECOSYSTEM

The highest mountains of world are in the Himalayas with Mount Everest being the highest.

Mountains are ecosystems with a distinct identity just like the flood plains, deltas, mangroves, wetlands, and deserts, When we attempt an overview of the mountain ecosystem of South Asia, we find a fascinating variety from the high mountains of the Karakoram, Himalayan, and Hindu kush ranges starting from Iran and Afghanistan and ending in Nepal, India and Bhutan to the low flung hills elsewhere in Pakistan, India, Bangladesh and Sri Lanka. Thus, we have the Zagross in Iran and Sulaiman and Central Makram ranges in Pakistan; the Aravalis; Sivaliks, Vindhyachal ranges, the Khasi, Naga and Mizo hills and the Western and Eastern Ghats in India; the Chittagong hill tracts of Bangladesh which are like a spur from the Himalayas and the central mountains of Sri Lanka.

14.2.1 Fragility of Mountain Ecosystems

Most of the mountain ecosystems are very fragile in the geological sense, prone to seismic movements. Lands slides thus are highly erodible. The Himalayan ecology is always characterized as fragile 'brittle' and vulnerable. The interconnections between different types of vegetation and water are so close and so precariously balanced, that even a slight change or imbalance in one can affect all others. The rocks are often loosely held together and there is evidence from the fossil findings in the Himalayas and even in the rock formations in the Deccan that many of these mountains were raised from the ocean floor millions of years ago. Such movement implied the existence of sand, shale, limestone, marl, phyllites, schists and other marine substances. Hard rocks like granite predominate. Even now there is some evidence of activity, particularly in the Himalayas where the plate movements below seem to suggest that the mountains are rather young.

14.2.2 Ecological Role of Mountains

The mountains of South Asia as in other areas have a definite role to play in the climate of the rest of sub region. For example like Himalayas, (Fig. 14.1) they act as windbreaks or stop the march of the desert. The mountains do have a bearing on the climatic conditions on the plains. Their role as water conservers and moderators of water flows is however better understood and appreciated. Thus, melting snow from the Himalayas keeps rivers like the Indus, Ganga and Brahmaputra all over the year and help in irrigation of the plains below. The other major mountains ranges, the Satpuras, the Vindhya, the Aravalis and the Khasi and Garo hills in the east, fulfil similar roles to a greater or lesser degree.



Fig. 14.1: The majestic Himalayas

The Himalayas (Sanskrit for “abode of snow”), is a mountain system in Asia, comprising a series of parallel and converging ranges and forming the highest mountain region in the world. More than 30 peaks of the Himalayas rise to heights of 7620 m (25,000 ft) or more, and one of these, Mount Everest (8848 m/ 29,028 ft), is the world’s highest mountain.

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.

The Himalayan terrain encompasses a large variety of structurally weak rocks and planes that are prone to mass movement. The rocks are weak, sheared, shattered and cleaved due to existence of several faults and thrusts and many of them are still active and show considerable movement. The Himalayan region is still seismically active and prone to earthquakes, which also accelerates soil erosion. In India, this mountain ecosystem is spread over 11 states: Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal. They are inhabited by 51 million people (6% of India’s population.) covering 18% of the geographical area. 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 impact of these pressures is reflected by declining forest cover in the states of Assam, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim and the loss of wildlife habitat, life and property caused due to natural disasters. Many species of flora and fauna of the region are becoming endangered due to deforestation.

In India, 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 is 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).

Participatory Resource Management

Dr. M. S. Swaminathan, the well-known agricultural scientist in his first G. B. Pant memorial Lecture. Said, "the destiny of nearly 40% of our population inhabiting the Gangetic plains depends on the management of the Himalayan hydrological estate. One of the urgent tasks facing us is the conservation and wise use of this extensive hydrological estate, spread over an area of about 6,0,000 sq. km".

The Western Ghats also plays an important role in controlling and directing monsoon. As the rain bearing winds from the ocean hits the Ghats, they drop their moisture on the western side and have little left for the vast space across the hills. Thus Bombay has 100 inches (254 cm) of rain while Puna (160 km away) on other sides of Ghats gets mere thirty inches (76 cm). The Western of seaward slopes of Ghats is lush and rich in vegetation.

Innumerable springs, streams and waterfalls in most mountains help in storing water for drawls in emergencies like long period of drought. There are many lakes among the mountains, which help stabilize the water regime helping the fauna as well as the flocks of the nomads. The waters of the mountains feed some of the most beautiful wetlands (Fig. 14.2) of the world like the Dal Lake.



Fig. 14.2: Renuka Wetland in Himanchal Pradesh
(Source: ENVIS-NODE Himachal Pradesh)

14.2.3 Soil, Vegetation and Agriculture

The mountain ecosystems store a great deal of soil and also add, constantly by the processes of erosion of the rocks, to the silts of the river and deltas enriching food production potential downstream. Excessive run off of soil occurs when the diverse forests on steep gradients are removed. There are cold deserts too in parts of the mountains like Himalayas, which have different types of impacts on climate of the rest of the region. There are grasslands or rangelands too in the mountains like the Alpine meadows, which support large populations of domestic and wild animals. In the Niligiri mountains of South India the grassland forest ratio is a matter of considerable debate. Recent efforts to convert grasslands into forest plantations have encountered resistance from the indigenous population of Toda tribal living there as they have a pastoral tradition.

The South Asian mountains have the special feature of having high human and animal population densities. This dictates a great deal of diversion of land for agricultural settlements and allied activities. When the agrarian practices are not oriented to soil and water conservation, a vicious cycle sets in, denuding a lot of mountain slopes of its soil cover. As the process continues, people go for extensive cultivation to support themselves, in the process destroying the forests and compounding the problems. The mountain regions of South Asia are subject to the greatest amount of shifting cultivation, which involves opening up biodiverse areas having long duration forestry crops for monoculture and short duration crops like cereals. Absentee landlordism is noticed in several areas resulting in fallows and neglect of crop rotations. Intensive cultivation couple with population pressure has resulted in very small land holdings. Thus the average size of holding in Himalayas is smaller than elsewhere and that of the country as a whole.

The 'Shola' forest in South Indian hills, the dense vegetation alternate with treeless grass lands on exposed hill sides.

14.2.4 Biodiversity

The mountain systems in South Asia largely lie in the latitudes nearer the Equator and thus have very rich tropical biodiversity. Himalayas, the entire mountain chain running from northwestern to northeastern India, comprising of a diverse range of biotic provinces and biomes, and 7.2% of the country biomass. Trans-Himalayas an extrusion of the Tibetan plateau, harboring high altitude cold desert in Laddakh (J&K) and Lahaul Spiti (H.P.) comprising 5.7% of the country landmass. The Himalayas have a mixture of diversities, both tropical and temperate. They also have, in pockets like northeast India some of the richest biodiversity, entitling them to the sobriquet of a “hot spot” of biodiversity which you have already studied in Unit 6 of Block 2 of MED-006.

Western Ghats region is considered as one of the most important and one of the richest centres of endemism. The region has 490 arborescent taxa of which as many as 308 are endemics,(43%), of which 235 species of endemic flowering plants are considered endangered. Due to the past geological events, there is vegetation of Indo Malayan origin in these areas. There is tremendous species richness and endemism. These mountains are considered another hot spot. But the advent of roads, industrial projects, townships and mining are destroying the biodiversity; a matter for considerable worry and with deforestation of the Western Ghats the surface horizons of the soil are rapidly carried away by the torrential monsoon rains, the steep slopes hastening the process. There are no chances of reinstating such dense forests on the poor soil that is left behind. Agro forestry practices could partially help redress the balance but they are also rarely used in the South Asian mountain ecosystems.

14.2.5 Management of Biodiversity

Scientific research to document biodiversity and to increase productivity of traditional crops or trees as also of acceptable exotics should be put on a firm footing. Scientists should ensure this is done without destroying the base of biodiversity. There should be no compromise on protection of biodiversity in the mountains and for this purpose full use should be made of the provisions of the Convention on Biodiversity. You have also read about various approaches of biodiversity management in Block 3, MED-006.

Research and extension methods with the co-operation of scientists, technologists, government, farmers and industry should find ways of providing additional incomes and employment in mountain villages by ensuring value addition in the collection and processing of medicinal plants. Successes on this can be replicated with foods like honey, fruits and flowers but care has to be taken that this is instep with human resource development and conservation of natural resources. Any wild swings in standards of living that will promote excessive consumerism and creation of wastes should be guarded against.

National Biodiversity Strategy and Action Plan in India

National bio-diversity Strategy and Action Plan has been initiated by the Ministry of Environment and Forests (MOEF) which aims to formulate local, regional, state and national strategies and action plans for conserving biodiversity for sustainable use of biological resources and achieving equity and fair benefit sharing in such use. The Council has been identified as a nodal agency for co-coordinating the formulation of State Biodiversity Strategy and Action Plan by the state of UP.

SAQ 1

- i) Why mountain ecosystem are considered fragile in nature?
- ii) Describe the importance of mountains in determining the climatic conditions of the sub- regions.
- iii) How Western Ghats help in controlling monsoon rain of that area?
- iv) Lists the activities in mountain areas, which accelerates soil erosion.

- v) List various methods to conserve and manage biodiversity in mountain areas.

14.3 SOCIO ECONOMIC CONSIDERATIONS

The mountains in South Asia harbour nearly 10% of the population of the region except in few countries. Of course more than 50% of the rest of the population depend on the bounties of the mountains like river waters, river sediments, timber and non-timber forest produce, and agricultural and horticultural produce. Landless unemployed are growing in numbers, leading to “money order” economics. This also has increased the burden of work on women who have shouldered the brunt of the household chores for centuries due to social structures and the phenomenon of out migration of able-bodied males. The basic reason is that in the context of rising population, the natural resources are being depleted at a much faster rate than they are regenerated. Consequently many able-bodied males migrate to the plain in search of work.

Knowledgeable observers are of the view that the extent of out migration from Kumaun and Garhwal hill areas is higher than that from any other part of the country. The migration from Chamoli has a specific characteristic i.e. the able bodied educated and skilled manpower goes out of the rural areas leaving their families behind. The migration, itself is a result of disequilibria between resources and needs.

14.3.1 Gender Issues

Gender issues are coming to the fore as literacy spreads, albeit slowly. Also women find the environment increasingly hostile as forests on which they depended vanish and they have to walk longer distances to collect fuel and fodder (Fig. 14.3). The medicinal plants on which, they depended for dispensing ‘grandmothers medicines’ are also disappearing, when they are exploited commercially, rather recklessly. According to Dr. M. S. Swaminathan; “the neglect of traditional food crops like Amaranthus, Chenopodium and buck wheat has not only weakened the household nutrition security system of the hill people, but also prevented the Himalayas from becoming the home of the health foods of the future”.



Fig 14.3: Women are left alone the mountains to do various work

14.3.2 Urbanization

The advent of forces of development, which are bringing roads, transport, telephones, television, are also bringing new diseases too to remote villages. The economic development of the mountain systems has also resulted in distortions. Projects like Dams generating hydel power often evacuate the power to the plains. In India we have 435 Dams built. Roads connecting villages and farms in the hills take away more produce and goods than they bring in. All this is breeding restlessness in the air and the

'Uttarakhand' agitation in the U.P. Hills of India is an example. There, the people want full-fledged autonomy and a complete say in managing their own affairs. In the Eastern Ghats of South India the tribal in the hills are agitated about non-tribal people from the plains taking away their lands and assets both by fair or foul means. The fact that many of these complaints are sometimes rooted only in perceptions does not take away the problem.

Urbanization and industrialization are features which are developing to the point of bringing in air and water pollution as well as waste accumulation in the hill economies, which always enjoyed clean air and good quality water, and where all wastes: predominantly organic used to be recycled. Cities like Kathmandu in Nepal, Shimla and Udhagamandalam (Ooty) in India, Thimpu in Bhutan are growing, ringing alarm bells of loss of natural beauty and onset of pollution.

14.3.3 Socio-economic Priorities

The socio-economic and related conditions of the mountain people ranks very high. The degradation of the natural resources is partly a function of natural factors and mostly those caused by human interventions. People use its resources, unsustainably. It is their demand for food, fodder, fuel, fats, and fibre, from the mountain sides and the changes in their lifestyles that make the immediate demands on the flora, fauna, water and land of the mountains. They have to avoid degradation and engage in sustainable utilization of natural resources. For betterment of the lot of their women and improvement in their knowledge of the environment should be revamped. They should be made to play an effective role in managing their own resources. To achieve this, the population has to be literate, healthy and reasonably well off economically. Programmes for eradication of illiteracy especially among women, and promotion of child welfare, health and sanitation should go hand in hand with poverty alleviation programmes tailored to the situation in the mountains.

In relation to gender issues, Regional Conference on Sustainable Development of Fragile Mountain Areas (SUDEMAA) at the meeting convened by ICIMOD in December 1994, advocated joint ownership of resources; and document case studies on the relatively higher status of women in mountain areas and incorporate them into the mountain agenda.

The cultural attributes of mountain people, which are conducive to sustainable development, should be protected. Ethno knowledge is one of the key attributes requiring careful attention with a view to documenting it and recording it too. One of the powerful ways to doing this is to empower communities especially women in the political, social and economic spheres. All programmes should be devised after full dialogue with the local people and this should be village based (also see Unit 13, MED-006).

14.4 ENVIRONMENTAL AWARENESS

The fragility of mountain ecosystem itself creates lots of environmental problems. In most countries of the region institutional strengths are not available to study the ecosystem as a whole and its carrying capacity to chart a path to sustainable development. The few institutions that do exist which traverse long distances to make their work percolate to the people at the end of the chain. Their studies too, with the aid of tools like satellite imagery have to reach the stage where they can influence policy makers to act in time to manage the mountain ecosystems better. The awareness has to increase in the people living in mountain ecosystems, and equally in the people living in outside non-ecosystems using the produce of the mountains as well. Unless others too appreciate the problems of the mountains and the mountain people, there will be no congruence of objectives of policy, legislation etc. Areas of mutual concern should be highlighted especially the need for water conservation, protecting medicinal plants, and preserving the sanctity of, religious worship places, to name a few.

14.5 LEGAL AND INSTITUTIONAL MECHANISMS

There are no specific regulations to cover mountain development. Regulations from the plain areas are applied mechanically to the mountains. This results in mining leases being granted in areas where they ought not to be and opening of mines without precautions. The floor space area index for buildings in the plains is adopted in the hills, adding to the congestion and loss of the mountain skyline. There is hardly

any protective legislation focusing on the fragility of the mountain ecosystems. Even where they do exist as in the Aravali hills in north India the follow up and implementation is weak.

Very often courts of law have been forced to intervene. In Dehara Dun Limestone mining lawsuit, the Supreme Court of India had to step in to stop the mining in mountain areas and appoint a committee to oversee rehabilitation of closed mine areas. The same august court has intervened in the Delhi Ridge, which is part of the Aravalli mountain system that was being overrun by encroachments injurious to the ecosystem. The poor awareness and weak institutional base have not helped in creating proper policy and legal regime under which sustainable development can be encouraged.

14.6 SUSTAINABLE AGRICULTURE

Promotion of sustainable agricultural practices is the second major plank of both policy and people's response to the problems of management of mountain ecosystems. Appropriate technologies for soil and moisture conservation are a must for sustainable agriculture. Sloping Agriculture Land Technology (SALT) and Sloping Watershed Environmental Engineering Technology (SWEET) are two technologies which are used as models for soil and moisture conservation. They were started in the Philippines and are now practiced in China and other countries and ICIMOD is playing a key role in this. They are also being tried out by G. B. Pant Himalayan Institute of Environment and Development as a package for regeneration of degraded lands in Indian Himalayas.

Measures like organic farming and agro forestry (Fig. 14.4) have to supplement the mechanical measures for reversal of soil degradation. Areas of degradation or areas suitable for agriculture or pastures should also be mapped using GIS (Box 14.1) and other techniques in order to determine the most appropriate package for a particular area. This area specific approach must have a people specific approach determining what part of sustainable or traditional practices already being used by people to some advantage (and which they understand better than techniques involving mere extension) and then can be conveniently grafted into programmes or new techniques. Absentee landlordism which results in unnecessary fallows and neglect of conservation of slopes thus impacting on other cultivated holdings must be tackled both by the application of the law and persuasion by communities.



Fig. 14.4: Community nursery.

(Source: <http://www.mountain.org/tmi.cfm>)

Box 14.1: Geographical information system and its application.

GIS is an advanced type of information management system that has presently become indispensable in studies related to environment. GIS is a computerized information system that has capabilities for entering, storing, sorting, manipulating, analyzing, displaying and retrieving geographic data. A well organized and upto date GIS enables the manager to foresee the effects of alternative management plans on the environment, thus helping in decision-making. The input data in a GIS may be obtained from various sources such as satellite imagery, aerial photographs,

toposheets, soil and agricultural survey maps and land use maps. Socio-economic data may be obtained from reports and records.

Typical GIS Application

- Environment impact assessment
- Forestry and wildlife tracking
- Wasteland development
- Ground water resource management
- Land use and thematic mapping
- Urban and town planning
- Health care
- Tourism
- Biodiversity etc.

14.7 INFRASTRUCTURE INDUSTRY AND ENERGY

On the infrastructure and industrial fronts, the fields of energy deserves to be looked at closely with a view to developing alternate energy sources like solar, mini hydro and wind in a big way in India because we are blessed with these natural energy resources. The projects of renewable energy resources should be entrusted to communities and smaller organizations in a decentralized manner and can also act as real alternatives to the creation of large power projects on mountain sides.

The slow rate of growth in economic activities in mountains area is due to the prevailing development barriers of inaccessibility, marginality and fragility. But a more positive strategy would be to capture the opportunities generated by the mountain specific characteristics rather than harping on the constraints. It can therefore be concluded that energisation of mountain communities can be made feasible out of appropriate technological interventions, in terms of energy sources, technologies and institutional mechanisms that are conceived and translated into reality. Energy technology interventions with increased economic activities will lead to environmental degradation. However, if energy transformation is implemented appropriately, even the poor can contribute to it in a significant way, which would affect their lives as well as the overall economy and be important factor for conservation of mountain environment.

All industries that are to be developed must have energy and water conservation as the main part of their agenda. It is desirable that industries creating wastes, especially hazardous wastes are totally avoided in the mountains. For this purpose, a very detailed environmental impact assessment must precede the setting up of every industrial or infrastructure project in the mountains and a public hearing must be mandated in such assessments. The main agenda of highland development revolves round reconciling land-use conflicts, reducing demographic pressure and developing alternate sources of energy. To protect natural vegetation, programming of activities will be more realistic through a better understanding of traditional resource management systems and with full involvement of local institutions and beneficiary participation. In regard to area specific infrastructure development it is necessary to look at ways of avoiding man made landslides in roads or building constructions by proper risk engineering. Proper housing and road laying in seismic areas of mountains also deserves detailing.

14.8 TOURISM AND URBANIZATION

All along the Himalayan foothills, from Srinagar in the west to Darjeeling in the east, are strung towns, situated in the most beautiful locations. Seasonal visitors are an important factor in the economic well being of the local population. So while tourists enjoy their visit, local people get the money. But every area has carrying capacity and has its own dangers, which should be taken into account while promoting tourism in mountains.

Tourism should be determined by using GIS and other techniques to avoid locating them in very fragile areas, but also whatever tourism does get promoted should have a wholesome ecological balance between nature and man. The impact and implications of mountain tourism tend to differ according to the nature, magnitude and seasonality. Lack of concern for 'carrying capacity' and non existence of impact monitoring framework and the overall neglect in relating tourism to community development, local institutional development and gender concerns can harm the mountain ecosystem (ICIMOID - International Centre for Integrated Mountain Development project report)

Strategic intervention by the government through local community groups was seen as an essential aspect in making mountain tourism a vehicle of local economic, environmental and community development. There were several specific issues to each country and region.

It must also be realized that due to tourism and associated economic development the dangers of indiscriminate urbanization and build up of solid waste has already reached the mountain ecosystems. It seems that no part of even the most inaccessible mountains, even the Himalayas, is now left alone. If the terrain cannot sustain any other human activity, it is pressed into use as a tourist area. A hotel brings tourists right up to the base of Everest itself. Unfortunately this seemingly innocent activity, which gives pleasure to so many people, and earns so much foreign exchange for our country, is another source of danger to the health of the mountains. The current popular (and wholesome) interest in trekking and mountaineering has thrown up several alarming problems. A major one is the disposing of garbage, which includes biological waste. It is feared that parts of the Himalayan slopes may soon begin to look like the garbage dumps in our cities. Recent studies have shown that problems of solid waste have invaded the high Himalayas in places like the Valley of Flowers. Mountaineering expeditions to the high peaks are leaving piles of junk behind. If that were so, the growing towns in the mountains will also soon be among the most polluted. The municipalities here should be strengthened to act soon on such issues.

14.9 NETWORKING

In this section we will study about the importance of networking. NGO's working in the mountains does struggle against odds. Rather low priority is given to this even in area planning or national developmental planning. A change in this approach is essential for better management of the mountain ecosystems. A strong networking of all the institutions working together, both in the mountains and plains, can achieve more than fragmented or individualistic thrusts. Networking should be coupled with full dissemination of scientific findings on the dangers ahead on account of natural and man made disasters etc., as well as potential for sustainable growth. Networking should be done by all, whether government, communities, institutions, experts, industry or NGO's. A greater thrust should be given to NGO activities in this direction and in ensuring proper spread of success stories so that successful activities can be applied in other areas.

14.10 SUSTAINABLE MOUNTAIN DEVELOPMENT

Mountains are important sources of water, energy, minerals, forest and agricultural products and provide an area of recreation. They are storehouses of biological diversity, home to endangered species and an essential part of the global ecosystem as they also affect the climatic conditions of the area. The fate of mountain ecosystems affects half the world's people. About 10 percent of the Earth's population lives in mountain areas, while about 40 percent occupies watershed areas below. From the Andes to the Himalayas, and from Southeast Asia to East and Central Africa, there is serious ecological deterioration in these watersheds because of deforestation, excessive livestock grazing and cultivation of marginal soils.

Mountain ecosystems are susceptible to soil erosion, landslides and the rapid loss of habitat and genetic diversity. Among mountain dwellers, there is widespread unemployment, poverty, poor health and bad sanitation. Most of the mountain areas are experiencing environmental degradation.

Proper management of mountain resources and the socio-economic development of people need immediate action. There is need to develop land use planning and management for mountain fed watersheds. Plantation should be done to maintain the ecological balance in mountains. There is also a need to provide services, such as education, health care and energy resources, for local communities and indigenous people. The people also need more opportunities to earn livelihoods from such activities as sustainable tourism, fisheries, environmentally sound mining and cottage industries, such as the processing of medicinal and aromatic plants and renewable produce from forests.

Government should give opportunities and also:

- Promote erosion control measures that are low in cost, simple and can be easily used;
- Offer people incentives to conserve resources and use environment friendly technologies, help them to understand what is sustainable development in mountains and involve them in resource management;
- Provide information on alternative livelihoods involving, for example, crops, livestock, poultry, beekeeping, fisheries, village industries, markets and transport;
- Create protected areas to save Biodiversity (wild genetic resources);
- Identify hazardous areas that are most vulnerable to erosion, floods, landslides, earthquakes, snow avalanches and other natural hazards and develop early-warning systems and disaster response teams;
- Identify mountain areas threatened by air pollution from neighboring industrial and urban areas; and
- Create centers of information on mountain ecosystems, including expertise on sustainable agriculture and conservation practices where people can turn up for help in learning about sustainable mountain development.

The fate of mountain ecosystems affects half the world's people (Micheal Keating, 1993)

SAQ 2

- List the socio-economic factors influencing the developing of mountain ecosystem.
 - How environmental awareness can be increased in mountain areas?
 - What is sustainable agriculture and how people can help to achieve it?
 - How tourism is destroying the fragile mountain ecosystem?
 - Discuss the ill effects of tourism in mountain areas of India.
 - Why sustainable mountain development is important for the people residing there?
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14.11 SUSTAINABLE DEVELOPMENT OF THE HINDU KUSH-HIMALAYAS

14.11.1 Overall Trends

Development of the Hindu Kush-Himalayan mountain region (because it covers eight countries, i.e., Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan) poses a serious dilemma with its deterioration and will also affect all the eight countries.

At present, it seems that there is a real danger that the ecological balance of this mountain may be irreversibly disrupted due to several factors which we have discussed in earlier sections. In the past, policy makers did not pay adequate attention to mountain areas because it was generally believed that mountain areas had limited

potentials for development. Consequently, the resources of mountain areas, such as cheap labour, abundant water, and forest resources, were used to support urban-oriented development strategy. The Government Policy generally overlooked the needs of mountain people and the major environmental role of mountain areas.

There was general lack of understanding of the biogeochemical cycle and human resources, characteristics of the mountains due to neglect of mountain areas and, consequently, the natural and human processes affecting these mountains development (Fig. 14.5). Improper understanding of ecological processes can lead to unsustainable development. Thus the development dilemma this region is facing is that, whereas natural resources have to be used to their optimum potential, information and knowledge on such natural resources and the processes affecting them is insufficient. These considerations are reflected in Table 14.1. We have tried to discuss these entire factors in this section.

Table 14.1: Interactions and implications of unchanged biophysical and rapidly changed socioeconomic circumstances in mountain areas.

Socio-economic changes Interacting with biophysical factors, i.e., human interventions in mountain area	Biophysical factors (mountain specificities) and their imperatives			
	Inaccessibility (Semi-closedness, limited dependability of external support, local resource focus of activities)	Fragility and marginality (Incompatibility with high intensivity uses, focus on diversified, low cost, low risk activities)	Diversity (High potential for diversified, interlinked activities)	'Niche' (Products, activities with comparative advantages including human adaptation measures)
Population growth; Changed expectation levels/attitudes; per capita increased activities guided by greed or forced by poverty	Excess pressure on local resources with limited outlets; resource use intensification, over extraction, degradation	Indiscriminate resource use intensification; disregard of resource extensive, diversified practices; reduced resource regeneration; discard of usage regulation, group action	Pressure of food needs; reduced diversification and narrow specialization; resource regeneration	Pressure of food needs, disregard or misuse of natural potential
Market forces, trade links, pressure of external demand; changes in people's attitudes and expectations	Integration with mainstream market situation despite low physical accessibility, additional pressure on resources; market driven corridors of change	Distant demand induced over use of resources, backlash of selective commercialization, decline of environment sensitive local concerns and practices, poverty of ethnic minorities and women	Market driven narrow specialization, reduced diversification; marginalisation section of traditional knowledge practices	External demand induced over exploitation; marginalization of petty 'niche', local concerns, traditional small scale activities
Public interventions a) Generalized development strategies, including investment priorities,	Reduced isolation, increased integration and level of activities; unmanageable increase in pressure or	Direct and side effects on fragile/marginal resources, increased use intensity; degradation	Resource use intensification; reduced diversification and access determined narrow specialization; backlash on	Over exploitation of area with high potential products; disregard of side effects and local

technology choices, macro economic policies price, tax, trade, resource extraction, etc	resources		food supplies	concerns; emergence of a dual sector economy
b) Infrastructure for accessibility; integration; market driven harnessing of 'niche', etc	Application for improved mobility, integration; priority to areas with high potential; regional inequities	Priority to production over conservation; indifference to resource limitations; and long-term consequences; excessive subsidization	High cost external input use; narrow specialization and focus on limited product attributes; disregard of traditional know how and institutional arrangements for diversification	Market drive over extraction; disregard of side effects on environment, people's survival strategies, traditional know how
c) Technological and institutional support: narrow focus, directed to short term needs, sectoral orientation, external origin/ orientation	Inaccessibility-induced invisibility of problems/opportunities, development measures as inappropriate impositions	Focus on current production; high-use intensity; disregard of resource limitations and long-term consequences, sustained through subsidies; neglect of local concerns and consequences	Narrow specialization, through incentives and support systems; technologies disregarding organic linkages and performance of total system; marginalization of traditional systems; increased dependency, subsidization	Focus on revenue generation meeting external demand; extraction levels disregarding the side effects; locally useful, area specific potential given low priority

a. Based on the synthesis of evidence and inferences reported of (Jodha *et al.* 1992; Banskota and Jodha 1992a, 1992b; ICIMOD 1993; Sharma and Partap 1993; Sharma 1993; Sanwal 1989; Singh 1993; Banskota 1989; Blaikie *et al.* 1983; Dev 1992; Bjonness 1983; Lall and Moddie 1981; and Ives and Messerli 1989)

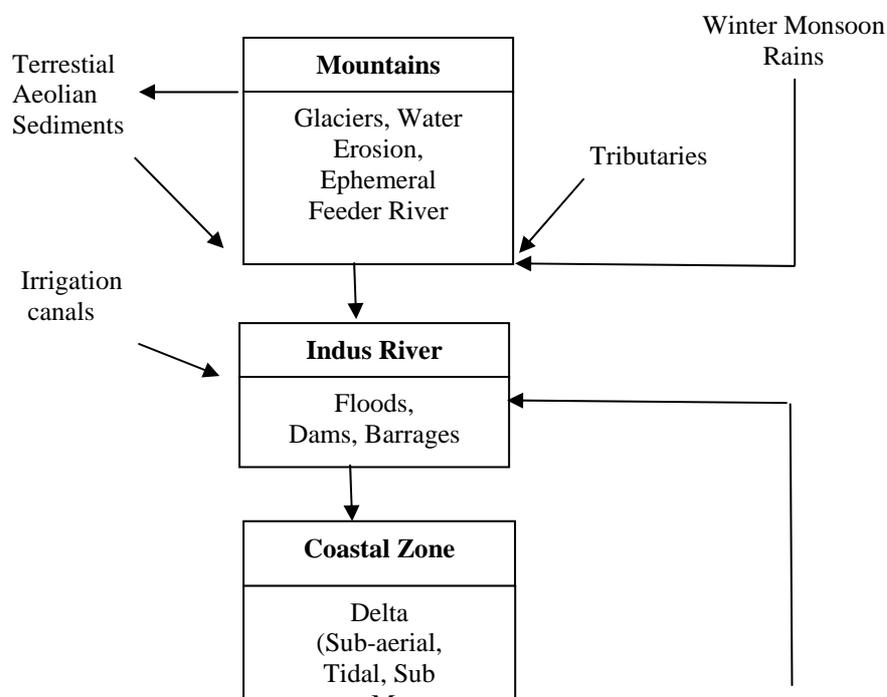


Fig. 14.5: Mountains, The Indus River and the Coastal Zone as interacting system.
(An Asian Example (Integrated Environmental Management) Development, Information and Education in the Pacific Region Edited by Yasumara Itakura *etal* 1999.)

There is a great variation in mountain conditions across the region over short distances. Thus a careful assessment of constraints and opportunities are required in all cases. Mountain people in the Hindu Kush Himalayas have to live within the carrying capacity of the mountain conditions. The resources of the mountain must be used without destroying the fragile environment upon which the survival of people inevitably depends. Modern science and technology must now operate within the limits set by the needs of conservation. The history of development in mountain areas of the HKH countries is very recent and, thus, the changes needed to integrate conservation and development may be less drastic than for many other areas. However, mountain areas are also more fragile and, given the recent pace of rapid change, enduring commitments are needed at all levels (Government and Local People) to move mountain communities towards a sustainable style of livelihood that is harmonious with the mountain ecosystem.

14.11.2 Mountain Areas in Different Countries of the HKH Region

Afghanistan

Afghanistan has been the meeting place of four ecological and cultural areas – the Middle East, Central Asia, the Indian Subcontinent, and even the Far East, for the Pamir Mountain intrude into Chinese Sinkiang. Dominated by the Hindu Kush, the westernmost extension of the Karakorum Mountains, and the Himalayas, the ranges stretch across 960 kilometers literally. Many passes cut through the Central Hindu Kush Mountains and, in the past, provided the main routes to and from the north and south. Out of the eleventh geographical zones in the country, the first six zones (the Wakhan Corridor – Pamir Knot, the Badakhshan, the Central Mountains, the Eastern Mountains, the Northern Mountains and Foothills, and the Southern Mountains and Foothills) belong to the Hindu Kush Mountain system. The remaining five zones embrace the deserts and plains that surround the mountains from the north, west, and south-west (Dupree 1980). Afghanistan is a landlocked country with a wide diversity of habitats and ecosystems, ranging from steppe, semi desert, desert, riverine forest, to mountain areas. The natural vegetation of a significant proportion of the country was originally woodland and forests, but centuries of destruction have resulted in an almost complete disappearance of the forests from the plains and valleys.

Over 80 per cent of the country's energy comes from forest and range resources (ICIMOD 1994). Sustainable development of mountain areas requires rehabilitation of degraded land based resources, their sustainable use, and improvement in the living standards of the people.

Bangladesh

Bangladesh's hilly region is known as the Chittagong Hill Tracts (CHT) and covers about 10 percent of the land area with about one percent of the population. The CHT

are at present inhabited by 13 tribes, each speaking its own distinct dialect. In 1991, the population was 967,420 (Rahman, 1993). The Chittagong Hill Tracts (CHT) have a predominantly agricultural economy. Owing to the subsistence economy, the tribal people, apart from cultivation, are involved in other productive activities to meet their basic needs. The CHT at present constitute a food deficit area. With relatively higher population growth rates in the tribal areas and poor sustainability of the land, more productive farming practice, diversification of agriculture, and generation of environmentally friendly off-farm activities, need to be explored.

The Kingdom of Bhutan

The Kingdom of Bhutan is a small, landlocked country situated on the southern slopes of the Eastern Himalayas, bordering Tibet in the north and the Indian States of Sikkim Assam, and Arunachal Pradesh in the west, south, and east respectively. It has an area of 46,500 sq. km. and a population of 600,000 (in 1992) (NES/PC 1992). The country covers the southern slopes of the southern boundary, which is situated approximately where the Himalayan range rises suddenly from the North Indian plains. Bhutan is a country, which almost totally depends on its own natural resource base. No change in this dependence is likely in the coming decade, although population growth and diversification in employment trade, and consumer patterns will place a heavy strain on this interdependency (NES/PC 1992).

With its small population, largely consisting of farmers living on their own land depending on a complicated traditional system whereby farm, forests, and alpine meadows all contribute to farming productivity, Bhutan is a country which almost totally depends on its own natural resource base.

The major environmental concerns in almost all developing countries reflect the close interaction between population growth, poverty, and environmental degradation. Although these three major factors are all relevant concerns for Bhutan they do not at present form the kind of interlinked vicious circle, which, in so many other countries, impedes forward planning towards sustainability. It is the policy of the Royal government of Bhutan to ensure that the development of the country is sustainable and will remain so in the future to avoid this vicious circle (NES/PC 1992).

India

The Indian Himalayan region, which is more than 2,800 km in length and 220 to 300 km wide, is spread over the states of Jammu & Kashmir, Himachal Pradesh, Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and part of Assam, along with eight districts of Uttar Pradesh and one district of West Bengal. It has a total geographical area of approximately 591,000 sq. km. (18% of India inhabited by 51 million people (6% of India) (GPIHED 1992). The region, in general, is characterized by a sparse population; undulating terrain; far flung small villages which are difficult to approach; tiny and scattered landholdings, more so on slopes with shallow and gravelly soil; an agro pastoral economy; scanty irrigation; little use of modern technology and inputs; and low productivity. These, coupled with almost no industrial development and, thereby, low employment potential, encourage the local young males to seek employment away from their homes. The problem of youth moving away becomes aggravated in areas where an inhospitable climate outweighs the sentimental attachment of people to their native land. Agriculture is the primary occupation of the people all through the region, but the agricultural land use patterns vary from region to region. While in the north-eastern region, shifting cultivation continues on the slopes, settled agriculture on terraced slopes dominates in the central and north western region. All through the region valleys are characterized by settled agriculture and intensive cropping.

A close association of man, forest, and environment, observed all across the Himalayas, implies a strong perception of ecological principles in the traditional management systems. These systems, however, are becoming weak and are being lost in critical areas. Historically, forests had been treated as a common property resource and thereby freely accessible to those inhabiting the region. Development programmes in the past have not been successful in adequately improving the food fodder energy problems of the area.

Nepal

Nepal, situated in the Central Himalayas, is a landlocked country having both physiographic and climatic contrasts compared to its small area of 147,181 sq. km. The country's economy depends largely on the use of its natural resource base. About two thirds of the country is occupied by hills and mountains with steep to very steep slopes. Nepal's lowland *terai* and the mountains are mostly erodible. Erosion have worsened in areas where agriculture is practiced, especially on the steeper slopes.

Thirty-seven per cent of the country's area is under forest cover, while about 20 percent is under agriculture. Seventy-five per cent of the country's energy requirements are met by fuel wood. Over 5,400 species of vascular plants, including over 245 species of endemic plants, 700 species of medicinal plants, 175 species of mammals, 850 species of birds, 170 species of fishes, 600 species of butterflies, 50 species of moths, and 180 species of dragonflies, have so far been identified in this country. These species are being protected and conserved through national parks, wildlife reserves, and conservation areas covering 12 percent of the country's areas (HMG/N 1992).

Soil erosion, decline in soil fertility, sedimentation, and floods have degraded and continue to degrade scarce land resources.

Rising population pressure on the land and deterioration of the environment have been recognized as major challenges for sustainable development in Nepal. The major environmental problems in Nepal are caused by land degradation, deforestation, and pollution. Poverty is the root cause of environmental degradation. Land and forest resources are overexploited because of heavy dependence on the natural resource base, whereas water and mineral resources are under-utilized owing to lack of financial resources and infrastructure.

Myanmar

Myanmar's highlands are along the border areas and are inhabited by national races, which include the *Shan, Kachin, Loila, Wa, Kokang, Akkha, Palaung, Pa-O,* and *Rakhine* groups who live in the north, north-east, east, and western areas of Myanmar (NCEA 1992). A total of 135 ethnic groups are located in these areas. On account of various factors, these border areas and national races have been deprived of development programmes in the past. More recently, the government has been making a major effort to improve the living conditions of the people in these border areas through different development activities.

Shifting cultivation is practiced by about 2.6 million people, mostly living in the Kachin, Kayah, Kayin, Chin, and Shan states. Most of the shifting cultivators are unaware of any damage to the environment caused by their traditional farming system.

Pakistan

Pakistan has two mountain areas – the Northern Mountains, and the Western Dry Mountains, the Murree-Kahuta tehsil(s) of Rawalpindi District covering 96,340 sq. Km. and which has a population of 7.82 million in 1993.

Land in the region is used either for arable farming, pasture, or forestry, depending upon the altitude, climate, physiography, soil moisture, and socio-economic conditions. Over 90 percent of the areas are comprised of steep to very steep mountain slopes having only a thin and patchy soil mantle. These slopes, being unstable, are generally unsuitable for arable crop production and support natural vegetation that varies from place to place. Large tracts of mountain slopes from between 900 to 3,300 m, they are grazed during summer only. In winter, animals are fed on hay made from the grasses cut from the areas. The majority of the population is subsistence farmers who manage to meet only the barest needs of food, fodder, and fibre for the household.

The Western Dry Mountain region makes the core of the arid land and covers by far the major part of upland Baluchistan, excepting for a narrow coastal belt along the

Arabian Sea. The potential population-supporting capacity of the region is low. However, the total sum of population growth and consumption patterns to produce food, manufactured goods, leaves the region with a highly impoverished environment.

A rangeland-based livestock industry is the major economic activity in the region. About one-third of the region is used as rangeland by dominantly transhumant, nomadic, and sedentary agro-pastoralists. It has very little groundwater resource. The region exports coal, gas, mutton, hides, temperate fruits, and vegetables to other regions and imports staple food and manufactured goods from the irrigated plains. Soil erosion is a major component of the desertification in the region. The main cause of soil erosion is the reduction of plant cover.

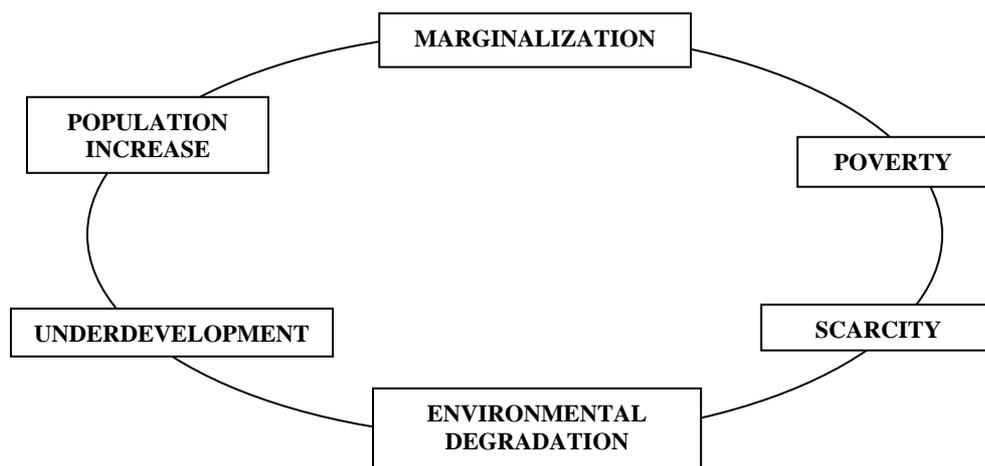


Fig. 14.6: Hindu Kush-Himalayan region with various socio economic causes

14.11.3 Different Development Approaches in Mountain Area

Mountain development problems and options can be differentiated within mountain areas. So specific information on ecology, natural resources, potential and socio-economic activities of mountain ecosystem are essential (Fig. 14.6). Such an approach is useful for focusing on the critical problems in specific mountain areas. The following section is only an indicative scenario and underscores the future work needed in this area.

Developing and Poverty ridden Mountain Areas

Although large parts of mountain areas show the signs of acute poverty in local population, environmental deterioration, low levels of development but there are a number of pockets within the Hindu Kush - Himalayas that also show dynamic signs of economic prosperity. Such pockets are found in all the countries of this region and their indicative conditions include good access, commercialization of agriculture, dynamic market centers, development of human resources, economic diversification, and growing external linkages.

The problems of these areas are more similar to other developing non-mountain areas and are related to sustaining development that is pro-people, pro-women, and pro-environment with adequate measures to cope with rapid urbanization, deforestation, overgrazing, pollution from industries and vehicles, chemicalization of agriculture (fertilizer and pesticide use), management of solid wastes, and educated unemployment. The poverty ridden areas, demonstrate problems of poverty, degradation of resources, poor quality of human resources and infrastructure, and a limited capacity to generate internal resources.

Environmental problems are related to agriculture and the use of natural resources. The major challenge in these remote areas is to help identify measures to improve the quality of life of these people and to promote development options that are sustainable for long term.

Causes of Ecological Variations

Ecological zonation of mountain areas provides a territorial basis for determining overall development potentials and identifying ecological sensitivity. Greater efforts are needed to undertake the zonation of mountain areas to provide an ecological basis for development decisions for each zone. Different ecological factors, such as slope, altitude, temperature, top soil conditions and water etc influence land-use suitability in mountain areas and the extent to which limits posed by these factors are understood and thus could determine the effectiveness of development interventions. With increasing slope and altitude, land-use suitability moves from seasonal crops to perennials and, finally, to protection of natural vegetation. In spite of high moisture in high altitude areas, the limitations of temperature and low soil depth hinder crop growth and development. Ecological zonation, based on the factors indicated above, for specific mountain areas are immensely helpful for identifying appropriate development activities, and for identifying the nature of environmental problems that may be encountered.

The top few centimeters of soil is called top soil and it is only in this soil that seeds can germinate, and young saplings draw nourishment and sustenance.

Analysis of all types of variations and problem that integrates different aspects of the mountain environment and economy will be critical for identifying the overall constraints and opportunities for development.

Locational variations

The Hindu Kush-Himalayan Region covers a wide area consisting of different ecosystems such as forests, wetland, ponds and river etc. Specific regions have their own specific problems and opportunities. Some broad environmental and socio-economic problems are listed below in Table 14.2.

Some problem such as poverty, soil erosion, soil fertility, deforestation, and overgrazing are common, while desertification and shifting cultivation are specific problems. There is a need to develop approaches that take into account both common as well as unique problems of mountain areas. An elaborate work is needed towards sustainable development in future.

Table 14.2: Locational variations in HKH regions.

Regions	Problems of the Area
Hindu Kush-Region	<ul style="list-style-type: none"> ▪ Poverty, inaccessibility ▪ High priority to controlling desertification and protecting pastures and grazing land ▪ Water and fuel wood scarcity ▪ Population density relatively low ▪ Vegetable/horticultural development and biodiversity conservation.
Karakoram Region	<ul style="list-style-type: none"> ▪ Poverty and access problems ▪ Conditions change significantly with slope and altitude ▪ Soil erosion control and soil fertility management ▪ Population density slightly greater than in the Hindu Kush ▪ Deforestation ▪ Good for tourism and high-value crops with irrigation ▪ Water scarcity
Eastern Himalayas	<ul style="list-style-type: none"> ▪ Shifting cultivation; soil erosion and soil fertility management ▪ Monsoon flooding ▪ Good reserve of forests, but deforestation very rapid ▪ Population density low but growing very fast ▪ Priority area for biodiversity conservation
Northern Himalayas (Tibetan Plateau and its adjoining areas)	<ul style="list-style-type: none"> ▪ Poverty and access problems ▪ Protection of pastures ▪ Cold arid where agricultural opportunities are limited ▪ Population density low ▪ Good for tourism
Western and Central	<ul style="list-style-type: none"> ▪ Poverty, access, and communication problems

Himalayas	<ul style="list-style-type: none"> ▪ Monsoon flooding ▪ Soil erosion control and soil fertility management ▪ Population density very high ▪ Seasonal water scarcity problems ▪ Deforestation and overgrazing ▪ Good for tourism ▪ Considerable scope for horticultural development and other high-value crops ▪ Conditions change significantly with slope and altitude
Hengduan Mountains of China Joining the Himalayas	<ul style="list-style-type: none"> ▪ Poverty access, and communication problems ▪ Flooding, debris flows ▪ Soil erosion and soil fertility management ▪ Population density low ▪ Deforestation and overgrazing ▪ Good for tourism and has potential for cash crops

14.12 HINDU KUSH REGION AND HIGH PRIORITY ISSUES

14.12.1 Poverty

In most of the countries of the Hindu Kush-Himalayas the acute poverty of the mountain people has been recognized as a major crisis. Poverty has been exacerbated by many different factors, amongst which the important ones are rapid growth in population, limited development of human resources, stagnant agriculture, infrastructure, and degradation of resources. Migration for search of alternative employment and income opportunities has been a continuing strategy of mountain people throughout the HKH Region, but in recent years this has accelerated in response to the monetary needs of families living in even the most remote areas.

In Hindu Kush-Himalayas several critical areas for intervention have been identified. These are as follows.

i) Development of Human Resources through Improved Physical Infrastructure

There have been improvements in provision of basic education, health, and drinking water. This has enhanced household capacities for socio-economic improvements on a gradual basis.

Improving access is almost a primary precondition for harnessing comparative advantages of mountain areas. Where access conditions have improved, it has been accompanied by improved condition of human resources and availability of improved technology, credit, and extension. Economic opportunities have greatly multiplied through harnessing of mountain comparative advantages. Various NGO's and Government are also working for it.

ii) Promotion of Participatory Development

The most important aspect is the promotion of participatory development and decision-making that is sensitive to the needs of the disadvantaged groups. This has also been an important component of successful anti-poverty activities. In the mountain areas where conditions are more difficult, participatory and decentralized approaches have an even greater role to play in mountain economy.

In many mountain areas the focus should continue to be on improving the condition of human resources and economic services as that will play an important role in improving the quality of life. Participatory management of mountain areas will be helpful in making the livelihood of people more comfortable (Fig. 14.7).



Fig. 14.7: Development through participation in mountain

14.12.2 Environmental Problem in HKH

In this region most evident environmental problems are in three major areas – deforestation, soil erosion, and problems of water management. These problems are related to changes in mountain agriculture. Deforestation is related to the growing food, fodder, and fuelwood needs of hill households. Soil erosion is mostly attributable to natural causes (steep slopes and intense monsoon rains) and also due to human activities, such as cultivation of marginal lands (slash and burn steep slopes), deforestation, and abandonment of old terraces, livestock management systems, and other cultivation practices which have also contributed to increasing soil erosion in the mountains. Loss of forests and vegetation cover, has reduced biodiversity, increased runoff, reduced soil moisture, and increased water management problems in mountain. The main resources affected are given below.

- *Cultivated Land:* declining fertility, fragmentation of land holdings, loss of land area increasing soil erosion, partial desertification, and severe soil degradation and water management problems.
- *Pasture:* large-scale overgrazing and degradation of pastures, landslides, soil erosion, and livestock management patterns that focus on numbers rather than on quality.
- *Forests:* Clearing of forest area has reduced forest areas, decreasing crown cover, continuing encroachment, over-harvested, and very poor afforestation and weakened local systems for protection and management and loss of wild life.
- *Water:* increasing shortages and flash folds, as well as water quality problems.
- *Flora and fauna:* increasing loss of biodiversity and genetic biodiversity (flora and fauna) as human needs and reckless exploitation destroy habitats.

A strenuous gigantic effort is needed to reduce the pressure on these resources through appropriate policies, technologies, and management systems because continued loss of these resources will mean the growing inability of the ecosystem to support any type of human survival. It also need the participation of local people.

14.12.3 Sustainable Mountain Development in the Hindu Kush-Himalayas

The skill and the aptitude to integrate environment and development are generally limited; it is even more so for mountain areas where the history of development is fairly new. There are great difficulties of formulating suitable programmes and their effective implementation are greater in mountain areas where overall conditions are not very favorable.

A determined effort is needed in this field if the other problems of mountain development are to be adequately tackled, not just at the national but also at the sub-national level. Any attempt to strengthen the institutional capacity for sustainable mountain development should acknowledge the enormous scope of indigenous knowledge systems and long-established structures for resource management.

14.12.4 Long-Term Goals for Sustainable Development of the HKH Region

To respond to the equitable aspirations of the people of the HKH and the need for sustainability in natural resources management the following broad goals have been identified for national governments, local authorities, NGOs, and the international donor community during the next ten years by ICMOD which are given below:

Goal 1:

To promote the well being of mountain people by overcoming poverty, inequity, and marginality through:

- development of sustainable mountain farming systems;
- promotion of new income and employment opportunities;
- improving the status of women and promoting gender-balanced decision-making;
- improving access to basic physical infrastructure;
- improving access to basic education and health services; and
- participatory systems of decision-making and development of strong, autonomous local organizations.

Goal 2:

To improve the circumstances of mountain natural resources and environments through:

- sustainable use and management of arable lands, forests, pastures, ranges and grasslands, and water resources;
- promotion of local organizations in natural resources management;
- protection of biodiversity in wild;
- enhancing women's participation and capabilities to improve their management of natural resources;
- better understanding of mountain hazards and identification of mitigation measures; and
- better understanding of mountain climatic changes.

Goals 3:

To improve the capabilities of institutions and organization to promote sustainable mountain development through:

- promotion of participatory development focusing on the poor, women, environment, and local organizations;
- development of policies that address mountain-specific problem and opportunities;
- development of guidelines and monitoring mechanisms for involvement of local group and benefit distribution women and other marginalized groups;
- development of appropriate planning methodologies for sustainable mountain development, at both the macro- and micro-level;
- promotion of national capacities for research in mountain-specific development opportunities;
- support to training in mountain-specific subjects;
- promotion of linkages and collaborative arrangements between institutions and organizations concerned with mountain development; and
- improving awareness and networking in and among mountain development agencies, locally, nationally, regionally, and globally.

14.13 THE ROLES OF DIFFERENT AGENCIES AND INSTITUTIONS

The goals that have been discussed above represent critical areas for sustainable mountain development. The agencies that are concerned with the mountains should give their full support and commitment by promoting the areas of their competence and supporting others to do their part.

- National and sub-national agencies are the most important ones in developing and implementing policies and programmes that can fulfill the local aspirations

and potentials for sustainable mountain development. They should be in the forefront of identifying; and promoting the opportunities for development within national and local institutional, cultural, and ecological contexts. Key agencies are:

- National planning commissions,
 - National level agencies,
 - District-level agencies in mountain areas, research organizations,
 - Non-government organization, community based organizations in mountain areas in particular, and
 - Educational institutions.
- Donor organizations should give a special focus to the Hindu Kush-Himalayas and provide support to the national agencies. Through regular consultations with the key staff of National Planning Commissions and key agencies, they are in a unique position to guide donor funding to mountain areas. The neglected mountain areas in the past and the scale of interconnected problems and opportunities, donor assistance should be accelerated and should be long-term in nature.
 - International agricultural research centers, with their specific orientations and expertise from a global perspective should provide scientific information to mountain areas specific for food crops. Linking international centres with a global scientific research mandate to national and regional agencies with an instructional mountain mandate should be given high priority.
 - Centers such as ICIMOD have a very important role to play in developing concepts and strategies for sustainable mountain development as well as methodologies for assessing specific problems and opportunities of mountains.

ICIMOD mandatory functions are

- a) Information exchange,
- b) Research and Training
- c) Advisory service.

It should concentrate on those areas in which the limited resources in mountain areas can be put to best use and wherever ICIMOD countries share common concerns. Its comparative advantages lie in working in those areas not generally focused on by national agencies those dealing with concepts, methodologies, strategies, innovations, and lessons of experience. Most of all it should provide a regional perspective on national and local sustainable mountain development with people participation.

To sum up we can name the following issues which are important in mountain ecosystem and are of prime environmental concern:

- i) Inaccessibility
- ii) Fragility
- iii) Marginality
- iv) Diversity
- v) Hostile climate
- vi) Scattered population and small agricultural holdings

In the light of the above given issues, the following areas have been identified, which are of environmental significance and need attention on a priority basis:

- i) Construction of highways, massive buildings and big dams.
- ii) Extension of orchards into environmentally sensitive agricultural and forest lands.
- iii) Destruction of forest cover.
- iv) Deep Channel cutting for minerals and open cast mining for building materials.
- v) Pollution and garbage.
- vi) Participatory management of mountain ecosystem.

14.14 SUMMARY

- Mountain ecosystems are important source of biological, water and mineral resources.
- The mountain ecosystems are fragile and are diminishing due to a variety of natural and man made factors. In many mountain areas growing degradation is causing widespread poverty among local inhabitants. Thus proper management of mountain resources and socio-economic development deserves high priority.
- Hindu Kush-Himalayas passes through all the eight countries. Though each country has its own socio-economic problems but enduring commitments are needed at all levels for sustainable development of these mountain areas.
- Long term goals of HKM region are (i) promotion of well-being of mountain people by reducing poverty and inequality, (ii) sustainable use of mountain resources, (iii) development of mountains through regional, national and international level with co-ordination and cooperation of people residing in mountains.
- Mountain development without a substantial commitment to augmenting the levels of investment in critical areas becomes quite pointless. When considering options for investment, care must be taken to ensure that such investments reduce poverty, restore the environment, and diversify the mountain economy in the long run.
- International efforts to deal with mountain development problems have been very limited both in coverage and support. UNCED's Agenda 21 (Chapter 13) represents the first global recognition of the plight of mountain areas and their critical environmental role in different parts of the global. The initiative of Chapter 13 must now be sustained through wider efforts by NGOs, National governments, and international agencies, if mountain areas are to receive the attention and support they deserve. Centres, such as ICIMOD, can play a important role in Hindu Kush- Himalaya for sustainable development.
- Other agencies, Government and Non-Government must develop mountain-specific initiatives within their own mandates if the attention of the global community on mountain areas is to be further strengthened in the future.

14.15 TERMINAL QUESTIONS

1. What ecological role Himalayas play in our country?
2. Describe how Himalayas provides the most important natural resources for our country.
3. Make a project that describes the important of Himalayas with reference to water, hydropower, biodiversity and horticulture for our country.
4. Study the biodiversity of mountain area you visit/or live in. Try to study the population density of major flora of that area.
5. If you are living in near Western Ghats try to study its flora, also name the endemic flowering plant with the help of a botanist.
6. Discuss the causes of migration from mountain area towards plain area.
7. What are the difficulties that the women of mountain areas have to face due to migration of men folks from mountain area?
8. How urbanization is destroying the fragile ecosystems of mountain?
9. List various methods to conserve and manage biodiversity in mountain area.
10. Describe how energy sector of mountain ecosystem can be revamped.
11. Discuss how tourism in mountain ecosystem can become boon or bane simultaneously?
12. How networking can help in sustainable growth in mountain areas.
13. Describe the importance of mountains as store house of natural resources.
14. Discuss various parameters to achieve sustainable mountain developments.
15. "Sustainable development of Hindu Kush region will support the people of all the eight countries of the mountain area". Discuss.

BIBLIOGRAPHY

Banskota, M. and Sharma, P. (eds), 1994. *Development of Poor Mountain areas: Proceedings of an International Forum*. Kathmandu: ICIMOD.

- Dupree, L., 1980. *Afghanistan*. Princeton: University Press.
- GPIHED, 1992, Action Plan for the Himalaya, pp 11-16. Almora: Shyam Printing Press.
- HMG/N, 1992. UNCED 92, National Report, Nepal. Kathmandu: New Era.
- ICIMOD, 1994. *International Symposium on Mountain Environment and Development: Constraints and Opportunities*. ICIMOD: Kathmandu.
- Micheal Keating, The Earth Summit's "AGENDA FOR CHANGE", Geneva, Centre for Our Common Future, 1993, p.23.
- Mohammad, N. (editor).1994. *Combating Desertification in Pakistan*. Islamabad: PARC.
- National Report on Environment and Development of the Union of Myanmar. Yangon: National Commission on Environment Affairs.
- NES/PC (National Environmental Secretarial/Planning Commission), 1992. *Bhutan Towards Sustainable Development in a Unique Environment*. Thimphu: National Environment Secretariat.
- Rahman, A.H M., 1993. *Social Organization of Tribes of Chittagong Hill Tracts and its Role in Managing the Shifting Cultivation System in Particular and Other Natural Resources in General*. SAD/BIDS/ICIMOD.
- Ruizhen, Y. and Yuan, W., 1992. *Poverty and Development: A study of China's poor areas*. Beijing: New Press.
- Rajamani, R., Wijayadasa K.H.J. (ed). 1997. *Harmonizing Environment and Development in South Asia*. Publication of South Asia Co-operative Environment Programme in collaboration with UNEP and NORAD.