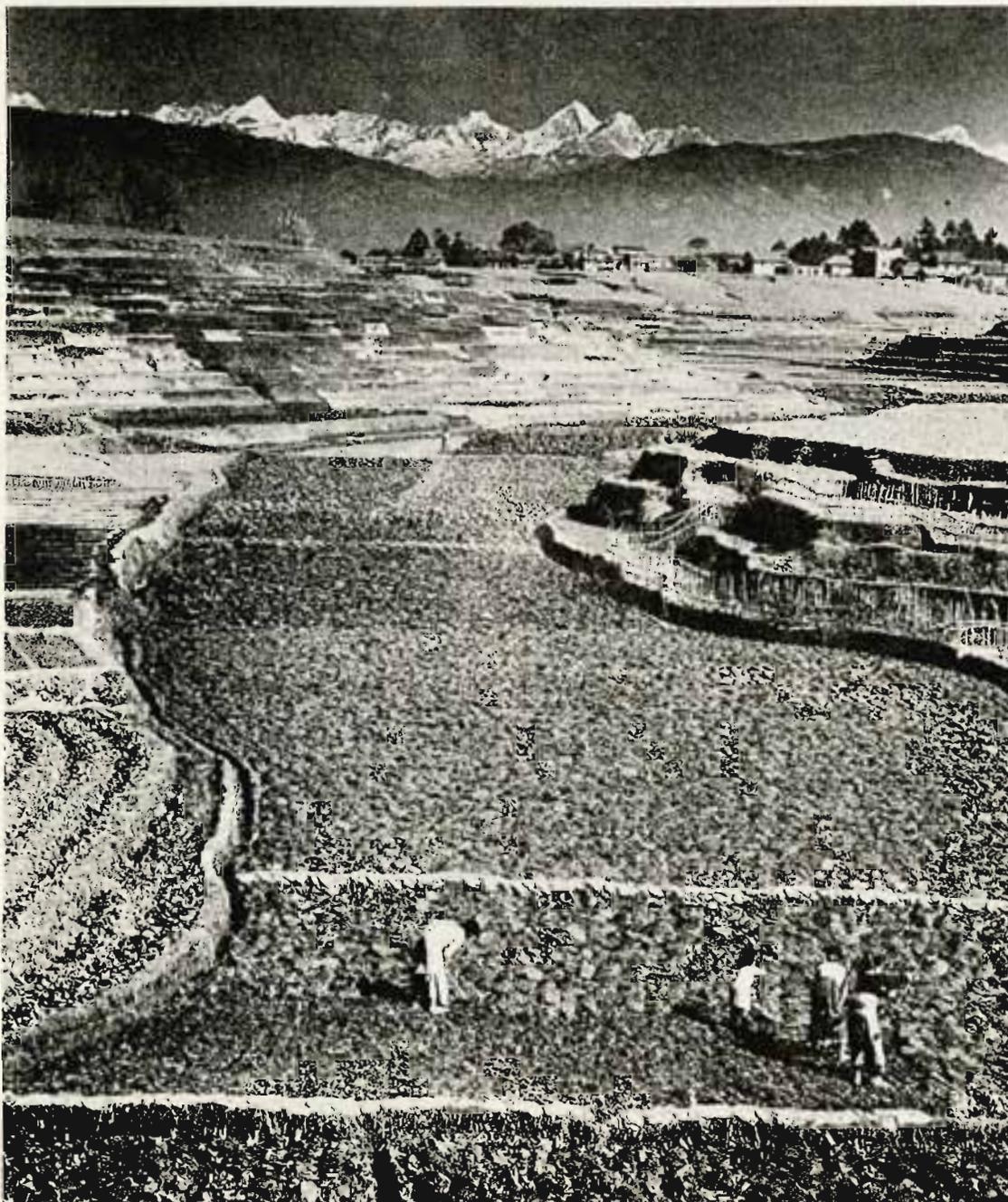


Introduction to Country Statement Section of Symposium

The following section contains views on conditions in the Hindu Kush-Himalaya and the state of development, as seen from the individual perspectives of the countries in the region. These statements have been excerpted and summarized from the addresses and papers presented at the Symposium or material published subsequently.

This section focuses on the challenges, problems, and progress of mountain development as experienced by the member countries in dealing with their particular portions of the mountain environment. The comments also direct ICIMOD's attention to special needs of each country and list some expectations of ICIMOD.



Country Statement—Afghanistan*

The Hindu Kush dominates the topography of Afghanistan, reaching southwestward out of the Pamirs into the centre of the country. In the east and southeast, mountains and hills extend to the international boundary. In the north, they extend to the Northern Plains and the flood-prone flatlands of the Amu Darya (Oxus River) on the USSR border. Approximately 60 per cent of the country's population lives in the mountains. The Hindu Kush also controls the economy of Afghanistan, supplying timber, minerals, pasture lands, and water for hydroelectricity production and irrigation. Fuel provided by trees and shrubs meets over 50 per cent of Afghanistan's domestic energy needs, the demand for which is leading to deforestation and increases in fugitive dust in the atmosphere.

Afghanistan covers about 65.22 million hectares, of which approximately eight million hectares are arable—and only about half of this is cultivated annually. Agricultural land is scarce but water is scarcer still, which limits cultivation. Water is the key to life in Afghanistan and the snows of the Hindu Kush are the source of most of it.

Stability of the Hindu Kush is vitally important to Afghanistan for soil conservation, afforestation, and prevention of sedimentation in water storage facilities, among many other needs. Stability is important for maintaining hydroelectric generation, irrigation water supply, and a healthy environment for timber and fruit trees. Pistachio, for example, which grows wild in the

mountains, is a large earner of foreign exchange for Afghanistan.

The concept of integrated mountain development is extremely important to Afghanistan, of which about 80 per cent is in mountains and hills. Ecologically and economically sound management of mountain environments is necessary to improve the lives of the people who live there and for improved production from resources, such as forests. Combined efforts of the countries of the region, with assistance and co-ordination of ICIMOD, can be very helpful. Care should be taken, however, to insure that ICIMOD does not become only an academic centre. ICIMOD should become a centre to which the countries of the region can look for technical assistance and guidance.

Documentation is an excellent idea, the primary purpose of which should be the sharing of information. Member countries should be kept aware of important development practices in the region so that they may benefit from relevant experience gained elsewhere.

Seminars, workshops, training, and the provision of expertise will assist greatly in evolving and implementing integrated mountain development plans. Experienced consultants could visit the countries of the Hindu Kush, assess the resources, and suggest lines of action. Training or workshops could then be organized to deal with the particular needs of each country.

Country Statement—Bhutan*

Bhutan covers approximately 46,000 square kilometres, of which about 31,399 is forested. Bordered by China on the north and India on the south, Bhutan lies between 26° 40' and 28° 15' north latitude and between 88° 45' and 92° 10' east longitude. The country is largely mountainous with lowlands in the south. Elevation varies from 158 metres to 7,554 metres at the highest point in the northern mountains. Administratively, the country is divided into four regions, comprising 18 districts (Dzongkhag) which are sub-divided into 202 blocks. Roads serving the mountainous areas total 1,900 kilometres.

The total estimated population is 1.2 million. Thimphu, the capital, has 20,000, and Phuntsholing, on the Indian border, has 13,000. The remaining population is widely dispersed, with an average density of about 24 persons per square kilometre.

Bhutan's Gross Domestic Product (GDP) in 1980-81 was Nu. 985.6 million (U.S. \$98.56 million), annual per capita income was Nu. 839 (U.S. \$83.90). The economy is largely subsistence with barter a common medium of exchange. Agriculture, including forestry and livestock, accounts for 54 per cent of the GDP and 95 per cent of the employment.

Forests constitute one of the major resources of Bhutan and are vital for the environmental balance and economic development of the country. Conservation and sound uses of forest resources are extremely important. Bhutan has adopted a National Forest Policy focussing on the following programme areas: Forest Conservation, Afforestation, Resource Survey, Utilization, Wildlife and Recreation, Forest Administration and Training, Investment, Revenue, Research and Publicity, and Forest Law.

A national inventory of land use and vegetation has been carried out. Non-forested lands permanent snow and glacier areas, barren lands, water covered areas, and valley, terrace, and traditional shifting cultivation—account for 15,200.9 sq. km., or 32.61 per cent of the total land area. Forested land includes: areas classified as forest land but without trees—alpine meadows and scrub land (5665.75 sq. km.); and tree covered forest land—conifer, upland and lowland/tropical hardwood, and plantation (25,733.65 sq. km.). Total forest area covers 31,399.4 sq. km., or 67.39 per cent of the country.

Animal husbandry is an important part of the agricultural sector. Cattle provide draft power and milk. In higher regions, yaks provide transportation, milk, and meat. Sheep, pigs, and poultry are also important.

Although livestock are well adapted to local conditions, productivity is low. Bhutan's Fifth Five Year Plan emphasizes increased productivity through improved breeding and management of livestock, and better nutrition through the Pasture, Fodder, and Feeds Development Programme.

Of the 31,399.4 sq. km. of forested area, 9,020 sq. km. has been set aside as sanctuaries, national parks, and wildlife reserves. The Department of Forests has proposed an additional six reserve forests for southern Bhutan amounting to 485 sq. km.

Existing and proposed reserves and parks will account for 20 per cent of the total land area of Bhutan.

To protect the mountainous environment of Bhutan, the Forest Department has made the following land-use proposals:

- all level land and slopes below 20° should be reserved for cultivation and settlement;
- areas close to settlements with slopes between 20° and 45° should be used for orchards;
- areas included in the above categories but, for some reason not suitable for cultivation or orchards, and slopes above 45° should be maintained in permanent forest cover;
- areas above 4,000 metres should be maintained as alpine pasture with rotational grazing allowed under the Pasture Development Programme;
- fuel, fodder, and fruit trees should be planted on boundaries of cultivated areas and in buffer belts between forests and settlements.

Social forestry will also be promoted in order to create an awareness among rural households of the need for better forest management and to increase the supply of fuel, fodder, and timber. Each household will be encouraged to plant ten trees on its own land with trees supplied by the Government. During the Fifth Plan, the Government will expand and improve forest nurseries and distribute 400,000 trees.

Under the afforestation programme, a World Bank financed plantation effort is underway in the denuded forest areas of southern Bhutan, comprising 40 sq. km. The objective is to improve the degraded area and increase the supply of wood for industry and fuel for domestic use.

The mountainous topography of Bhutan requires special efforts to preserve the forest cover. Some of the problems faced by Bhutan in preserving forests are:

- shortage of trained technical and professional forestry personnel;
- lack of experience;
- lack of public awareness of the need for forest conservation due to the low literacy rate;
- lack of communication;
- forest fires—the majority of which are deliberately man caused;
- shifting cultivation—a traditional practice in the south and eastern regions—depletes forests and damages soils through repeated slash-and-burn activity;
- un-regulated and migratory grazing.

The Government of Bhutan has undertaken a programme to reduce the damage caused by shifting cultivation. A systematic survey is being made of the affected areas and the percentage of land that can be converted to permanent fields and terraces is being determined. Incentives to discontinue the practice are being offered to shift cultivators and, in some instances, they will be re-located to suitably developed areas. Land, housing, schools, and health facilities will be provided.

*Prepared by C. Dorji

The annual per capita consumption of fuelwood in Bhutan is estimated at 2.6 cubic metres, creating heavy pressure on forest resources. The Government is considering developing and introducing fuel efficient wood stoves and bio-gas facilities.

ICIMOD could help Bhutan in its forest and environmental development needs in many ways. Training Forest Department personnel would strengthen the Department's ability to carry out its programme. The Forest Department is also a very young agency and effective transfers of technology in areas of silviculture, afforestation, research, and communications would help greatly.

ICIMOD could help Bhutan reduce the pressure on its forests by providing guidance and assistance in developing fuel-efficient wood stoves, bio-gas, solar energy, and mini-hydro power plants. Assistance in designing and operating local manufacturing facilities for these products would be helpful.

ICIMOD could also provide expert or consultant services for specific needs. Study and observation tours for Bhutanese development personnel to appropriate sites in other countries would help in the exchange of technology and allow them to learn from the experience of others.

Country Statement—Burma*

Geographically, Burma lies between 10° and 29° north latitude and 92° and 101° east longitude. It extends 2,092 kilometres north to south and 933 kilometres east to west, encompassing 676,571 square kilometres. Mountains and hills border the north, east, and west; the land declines toward the sea in the south. The elevation varies from sea level to about 6,096 metres in the mountains bordering China. Several rivers flow from north to south, the most important of which are the Irrawaddy, the Chindwin, the Sittang, and the Salween rivers, all of which are navigable to a large extent. Burma is divided into fourteen States and Divisions, of which seven Divisions in the north, east, and west are mountainous and cover a considerable area.

The Government considers the development of these mountain and hill area very important and has begun both short and long term programmes in agriculture, forestry, education, health, and communications.

Emphasis has been placed on agriculture, forestry, and livestock development, with priorities on increased production for regional and national self-sufficiency and enhanced production for agro-industries and export.

The strategy has been to introduce the township-wide High Yielding Production Programmes. Initially, these programmes focussed on rice cultivation but, with the success of these strategies, other crops, such as maize, wheat, groundnut, and potatoes, have been added for the mountainous states where soil and climate are favourable. These areas have been deficient in rice and the Government intends to raise these regions to self-sufficiency while developing other crops.

In the hills, traditional methods of shifting agriculture have led to deforestation, soil erosion, soil depletion, and changes in climatic patterns. To counter these damaging practices, the Government is building contour bunds and permanent terraces while concurrently teaching improved farming techniques.

Long-term crops are encouraged: apples, pears, oranges, walnuts, coffee, tea, and citrus. Nurseries established in the region provide high yielding varieties at reasonable prices.

Assistance is being provided for silk worm production, a cottage industry especially suited to these areas. Sericulture has had encouraging success in Chin and Kayah states and has generated supplementary incomes.

Increased agricultural development requires increased inputs, such as fertilizer, pesticides, seeds, and implements. Supply and transport is often difficult, but the Government delivers inputs where needed at subsidized rates.

Mechanized agriculture has been introduced where the geography permits. The Government has established tractor stations and assisted village tractor co-operatives in financing, procuring, and operating their own fleets of tractors.

Irrigation is an essential part of these development efforts, leading toward increased production and more permanent cultivation. The Government has built numerous small diversion weirs and canals and is encouraging village self-help schemes to build irrigation works. Villagers provide the labour; Regional Development Funds provide financing and other inputs.

Combining agriculture and livestock in integrated farming is another approach that, if accepted, would generate additional income for people of the hills. Government livestock farms in these regions provide improved breeds. Inhabitants of these areas are being trained in integrated farming. Groups of successful cadres (trainees) who wish to establish their own farms may obtain loans.

Aquaculture has been introduced to appropriate areas in the hills. Fish breeding centres distribute new varieties of fish and provide training and advice in improved techniques.

Poppy cultivation, a persistent traditional practice in the mountainous areas east of the Salween River bordering China, Thailand, and Laos, has been banned and vigorous steps have been taken to eradicate it and replace it with more diversified crops. The Government assists in resettlement, land preparation, cultivation, and provides inputs at low cost.

Burma has abundant forests in the hill regions which contain valuable flora and fauna. These regions are also the watersheds of the country. Disruption of these areas would seriously alter the climatic patterns and adversely affect agriculture. To protect these forest resources, the Government is undertaking the following measures:

- commercial species of flora are extracted on a scientific, sustainable yield basis;
- areas denuded by shifting cultivation will be reforested, providing soil protection and additional incomes to the local people;
- watersheds, in particular those serving dams and hydroelectric stations, are being protected;
- forest areas will be protected by strict laws and additional reserve forests will be established;
- pastures and grazing lands will be planted with tree wind belts to protect and shelter cattle;
- additional Local Supply Forests will be established to meet growing fuel demands;
- fast-growing species will be supplied free for the establishment of private plantations.

In order to reduce the dependency on wood for fuel, the development and use of bio-gas facilities will be encouraged. The Government provides training, financing, and materials to support this effort.

The supply of sufficient and easily accessible domestic water is another important concern. Storage tanks have been built and water pipes laid wherever feasible.

These are some of the efforts undertaken by the Government of the Union of Burma for the development of agriculture, forestry, and livestock in the mountainous regions of the country. Similar efforts are underway in education, health, communications, and culture.

The problems of Burma's mountainous regions are numerous and complex and their solution is very important to the economy, both regionally and nationally. The papers and discussions at the ICIMOD Symposium will contribute greatly toward concepts of integrated mountain development, benefitting the region as a whole.

*Prepared by H.J. Kimlai

Country Statement—China*

It is very important for China to attend to the conservation and development of natural resources in her mountain areas. Two-thirds of her total land area, two-fifths of her cultivated land, and one-third of her population are in mountainous areas. China's mountains contain many unique eco-systems and rare flora and fauna. Her mountains also generate significant effects on the adjacent lowlands.

The Himalayas and neighbouring mountains and highlands form the Qinghai-Xizang plateau, most of which lies within the borders of China. The interest of world scientists has long been drawn to the plateau's massiveness, elevation, and geological youth. The following is a brief summary of the major characteristics of the plateau as noted through research carried out by China in recent years.

The Qinghai-Xizang plateau is the highest plateau in the world, with an average elevation of 4,000 to 5,000 metres and more than 70 peaks over 7,000 metres. Bordered on the north by the Kumlum Mountains, on the south by the Himalayas, on the east by the Hengduan Mountains, and on the west by the Karakorum Range, the plateau covers 2,400,000 sq. km., one-quarter of China's territory. It is the youngest large plateau in the world, uplifted mostly at the end of the Pliocene epoch, although movement continues in the present.

The effects of elevation, geographical extent, and the monsoon on the plateau have created extremely complex horizontal zonation. The northwest is high and gently undulating; the southeast somewhat lower with deeply eroded gorges. Annual precipitation varies from over 2,000 mm in the south to less than 20 mm in the north. Vegetation ranges from tropical forest on the southern slopes of the Himalays, through montane coniferous forest, alpine scrub and meadow, alpine steppe, and, finally, desert in the north.

Vertical zonation is sharply distinct. In the south and southeast, within a few kilometres, elevation can vary by 5,000 metres. Two systems of vertical zonation occur: the oceanic-humid and sub-humid; and the continental-arid and semi-arid. The oceanic system prevails in the south and southeast, characterized by intensive erosion, biochemical weathering, acid soils, and mesophytic vegetation. The continental system occurs in the interior, characterized by wind erosion, physical weathering, alkaline soils, and xerophytic vegetation.

Flora and fauna are highly diverse. In Xizang alone, there are 191 species of mammals, 532 species of birds, 49 species of reptiles, and 32 species of amphibians. Of higher plants, there are 470 species of ferns, 50 species of gymnosperms, and 5,246 species of angiosperms. A large number of species are relict or rare, having survived in the many diversified or isolated natural habitats. Some areas are so inaccessible that they remain in an almost virgin state, providing opportunities for establishing baseline data in eco-system research.

Cultivated land is limited, covering 0.48 per cent of the area. Any future increases are limited by hydrothermal conditions. Pasture land covers almost 62 per cent of the area. Cold alpine pasture predominates, which is grazed by hardy animals, such as yaks, goats, and sheep.

Forest covers only 4.1 per cent of the area, but the total timber volume is estimated at 14 million cubic metres, the second largest reserve of forest resources in China.

Water, mineral, and geothermal energy resources are abundant. Severe natural conditions, inadequate transportation, and other socio-economic conditions hinder the exploitation of these natural resources.

Regional differences in agricultural production are common. Cultivated land is largely in the valleys. Forests are concentrated mostly in the south and southeast at elevations less than 4,000 metres. Natural conditions are unfavourable for growth of crops, but there are exceptional cases: high isolation and a prolonged period of moderate temperatures recently produced a record wheat harvest.

Many eco-systems and habitats of the plateau are extremely fragile, especially at high elevations and on steep slopes. Human activities, such as logging and shift cultivation, have caused severe erosion and, sometimes, irreversible damage. The problems are especially evident in transitional zones between eco-systems. Management systems should be adapted to local conditions and the characteristics of the specific eco-system.

Since 1950, Academia Sinica and other institutes have undertaken a series of research expeditions to the Qinghai-Xizang plateau. In the 1973-79 expedition, about 1,200 scientists and technicians from 50 disciplines participated in the field or in the laboratory. The results were published in the 32 volume series, *Monographs of the Qinghai-Xizang Plateau*. Many other papers and books were published and a pictorial book, *Exploring the Secrets of the Roof of the World*, and several films were produced. In 1980 an international symposium on the Qinghai-Xizang plateau was held in Beijing with the participation of nearly 300 scientists from 18 countries. Proceedings of the symposium were published in a two volume set, which has been presented to ICIMOD.

Emphasis in the Qinghai-Xizang has now shifted to applied research, especially that concerned with the problems created by local population growth. Study groups have been organized in the following areas: mapping and modelling of optimal use of natural resources; integrated use of energy resources in the mountains; felling and regeneration methods of montane forests and the impact on the environment; livestock carrying capacity of various pasture types; development of hot, dry valleys; prevention and control of soil erosion and mud flows; and selection and surveying of nature reserves.

*Prepared by Y. Hanxi

Country Statement—India*

ECO-DEVELOPMENT IN THE HIMALAYAS

The Himalayan region is a complex ecosystem with varied topography, climate, and soil conditions, ranging from tropical valleys to arctic mountains. The region presents unique ecological and geological features which are being threatened by accelerated pace of development and increased pressure on land, forest, permanent pastures, grazing lands, etc. The problems of the hilly region include:

- limited availability of land leading to agriculture on hitherto forested steep slopes;
- landslides and soil erosion;
- lack of irrigation facilities and windling water resources;
- poor transportation facilities, etc.

Recognizing the need for development of degraded hilly regions and with a view to scientifically manage the natural resources in conformity with environmental conservation, the following eco-development programmes covering both—the generation of basic data, as well as field action—have been initiated.

Action Oriented Eco-Development Research in the Himalayan Region:

Taking note of the need for institutional participation, programmes of eco-development have been devised to achieve total involvement of the students and faculty members of the universities in the Himalayan region for:

- a. arresting further damage to hill ecosystem; and
- b. restoring the damaged ecosystem as speedily as possible.

Forty-two projects are now operational in the Himalayan universities for solving the regional socio-economic and ecological problems. The voluntary agencies and national institutions located in the region have also been brought into the network of field operations. First annual workshop on eco-development action-oriented research in the Himalayan region was held during 21st and 22nd October, 1983 to:

- appraise the operational projects;
- resolve difficulties faced by investigators;
- lay stress on the applied nature of the new projects being evolved;
- emphasize need for more student's participation; and
- acquaint investigators with each other's work.

Major thrust of these schemes are on:

Nursery and Seedling Banks Creation

To cope with the demand of sapling suitable for different altitudes in the Himalayas, a chain of nurseries is being created for forage crops, grasses, and other species by the universities and voluntary agencies.

Watershed Management

To demonstrate the viability of environmentally sound management of a watershed and the stream of accruing benefits,

some selected watersheds, like Dachigam in Kashmir, Gamohar and Kotgarh areas of Sutlej catchment in Himachal Pradesh, Cola catchment in Kumaon Himalayas and Rangoon, and Singtum in Sikkim are being covered for integrated development.

Ecosystem Studies

To improve the existing knowledge of natural ecosystems, studies are being carried out on structure and function of simpler and matured ecosystems, recovery of damaged forest ecosystem, productivity of grassland ecosystems, etc.

Landslide Hazard Zonation and Mitigation

Considering the incidence of landslide occurrence in the Himalayas, this project has been initiated to suggest measures for stability of slopes, mitigative measures for prevention of landslides, and evolve early warning system to prevent loss of life and movable property. The project has been initiated in the Kumaon-Garhwal region. Its findings shall be made available for application in other regions, as well.

Student Participation

In order to create environmental awareness among the youth and to ensure their active participation in field programmes of eco-regeneration, universities located in Himalayan region are being supported for activities like tree plantation, soil conservation, survey and study of health problems, etc.

Regeneration of the Himalayan Foothills

A Technical Committee for detailing with the Himalayan Foothills Development Programmes has been constituted to look into aspects of eco-degradation with a view to evolve strategy for restoration as well as field action projects for immediate implementation. The programme is being developed as action oriented pilot project for regeneration of degraded areas along the fragile Himalayan foothills for sustained development. The project envisages development of technical packages with inputs on agriculture, forestry, horticulture, animal husbandry, management of water resources, etc. Application of these packages is to be undertaken on the basis of a spatial plan for suitable location of development activities. The programme implementation is proposed through regional institutions, universities, and developmental agencies already operating in the area. Action plans are being evolved for field projects at selected locations. One such proposal is being developed for a micro-watershed in Parandal region (Jammu and Kashmir) in collaboration with the State Forest Department. Other identified sites are located in the States of Himachal Pradesh, Punjab, Haryana, and West Bengal.

*Taken from: Department of Environment, Government of India, Annual Report, 1983-84; Chapter VI, pp 48-50.

Establishment of the Himalayan Institute of Environment and Development:

An autonomous Institute of Himalayan Environment and Development is being set up to evolve integrated management strategies and demonstrate their efficacy for conservation of natural resources and sustained development of the Himalayan region. The institute will also be the focal point for integrated policy planning in the areas of research and development, training and education, public awareness, and for undertaking field action projects in the fragile ecosystems.

The Institute will adopt a decentralized structure consisting of a chain of Centres of Advanced Studies, along with field stations,

along the entire Himalayan belt. The experts engaged in the Centres of Advanced Studies would have dual responsibilities—teaching, research, and training in the parent organization, and execution of projects in the charter of the Himalayan Institute of Environment and Development. The dual responsibilities would permit initiation of the regeneration programmes without loss of time. At the same time, such an arrangement would not deprive the existing universities/research institutes of the expertise available with them. A High Level Organizing Committee is to advise on functions, research programmes, and structure of this Institute.

Country Statement—Nepal*

The Kingdom of Nepal, situated on the northern rim of south Asia, covers 147,181 sq.km. and contains a complex maze of mountains and ridges, interspersed by deep valleys and lowlands. The country can be divided into three fairly distinct regions: the Terai, between 60 and 300 metres above sea level; the hills, between 300 and 3,000 metres; and the mountains, above 3,000 metres. These physiographic extremes have resulted in narrow bioclimatic zonation with tropical, temperate, and tundra vegetation types and climates falling very close to one another. Three major river systems drain most of Nepal: the Karnali, the Gandaki, and the Koshi.

The complex problems of hill and mountain development have raised several interrelated issues. Firstly, agriculture alone cannot support the growing population. Secondly, the long-term implications of the massive emigration to the Terai must be addressed. And, finally, there is a pressing need for afforestation in the hills.

Increasing interest has been shown in developing hill agriculture. Agriculture accounts for over 90 per cent of the labour force, 65 per cent of the national income, and, until recently, 75 per cent of foreign trade. The role of the hills in the economy is significant: they contain three-fourths of the land area and over half of the population.

Approximately 0.6 million hectares are under cultivation in the hills and mountains. The average farm holding is 0.5 hectares, compared to 1.7 in the Terai. Three-quarters of the cultivable land is in upland terraces, the remainder in valleys. Population density exceeds 1,600 persons per square kilometre of arable land.

Until recently, Nepali agriculture was self-sustaining, but now agriculture productivity is declining as the growing population demands more land, more building materials, and more fuelwood. Fragile marginal land is being cultivated and deforestation is becoming widespread. The net result has been an ecological imbalance, soil erosion, and landslides.

Poor transportation, communication, and an extremely rugged topography are major physical constraints on development. These are further aggravated by socio-economic constraints; e.g., a large proportion of the population lives below the poverty line and over 75 per cent of the population is illiterate.

The livestock industry plays an important part in the hill economy and constitutes an integral part of the total farming system. Nepal's livestock population per unit of land, however, is one of the highest in Asia. Acute feed shortages, parasites, late maturity, low fertility, inadequate livestock extension services, and migration are serious problems. At present, only 54 per cent of the needed feed requirement is available and that is expected to decline to around 43 per cent by the year 2000. Good quality green fodder is available only in the wet season from June to September. In the remaining seven dry months of the year, animals subsist in a semi-starved condition on crop residues.

Migration of people from the mountain areas to the plains presents many economic, ecological, and social difficulties.

Migration may have served a useful function once, but it has drained the hills of leadership and skills needed for development. While the population of the Terai has increased, there has not been an accompanying decrease in the hill population. The growth rate has declined but the absolute numbers of people living in this region continues to rise.

Until recently, it was believed that the Terai could safely absorb the excess population of the hills. It is now apparent that there is a limit to the carrying capacity of the Terai lands. The only solution lies in the economic development of the hills and mountains themselves. Agriculture, animal husbandry, cottage industry, and tourism need to be developed. Resettlement programmes will have to be initiated in the hills, as well.

In order to reduce out-migration, rural development programmes should begin with local labour resources. Training people for new occupations as well as improving education, rural health services, water supply, sanitation, and providing rural electrification, transportation services, and market centres would help improve life in the hills.

Identification and development of technologies appropriate to hill environments will be necessary. Improved farming methods, seeds, soil fertilization, composting, terracing, animal husbandry, fruit trees, irrigation, fodder production, water storage, and alternative energy sources need to be tested for local applicability and then transferred effectively to the farmers themselves.

Forests constitute one of Nepal's major resources. With the rapid increase in population, demand has grown for more cultivable land, fuelwood, fodder, and timber—with negative results on the forests. As people seek more land and clear trees from the steeper slopes the danger of soil erosion increases.

Wood provides nearly the entire domestic energy supply for the rural people and for a large proportion of the urban population. Lack of adequate energy is one of the major constraints on development in Nepal. With no proven deposits of fossil fuels, Nepal spends almost all of its foreign currency earnings on imported oil. Even the transport of firewood to urban areas depends on imported oil.

Much wood is wasted by inefficient construction methods. In the rural areas, hewing timbers and shingles with the simple hand axe produces a great deal of wasted material. The amount needed to build a house could be reduced by two-thirds if the timber was more efficiently and economically cut.

Extracting fodder from the forests causes heavy, long-term damage. Trees can tolerate limited stripping of leaves and twigs over long periods of time, but, if stripped too severely over short periods of time, the trees will die. Unregulated cattle grazing in the forests also causes serious damage.

The amount of forest land has decreased significantly in recent years. Between 1964 and 1979, Nepal's forest area was reduced by 2.1 million hectares. If present trends continue, accessible forests in the hills will vanish within 14 years and those in the Terai in 25 years. Deforestation and subsequent soil erosion may be the most acute problem facing Nepal.

*Prepared by *M. Malla*

The 200,000 million cubic metres of water that are discharged annually by Nepal's rivers and streams have tremendous potential which has barely been tapped. Total human withdrawals amount to less than 0.5 per cent. Of the estimated 1.5 million irrigable hectares, only 0.2 million have been irrigated. Less than 13 per cent of the population has access to safe drinking water. Of the 24,000 megawatts of hydroelectric generation potential, only 122 mw has been installed. Most water development schemes, however, have been built in response to individual needs—irrigation, power, water supply—and little attempt has been made to develop them on an integrated or multi-purpose basis.

Electricity serves only about 4 per cent of the population, mostly in the urban areas. Electricity for the rural areas will be provided eventually, either through extensions of power lines, or by mini-hydel plants. In developing mini-hydel capacity, it is extremely important to carry out detailed site studies in order to avoid erosion, slope destabilization, or even destruction of the plant by floods or landslides.

Development of hill irrigation facilities is a crucial consideration for increasing agricultural production. Despite abundant water in the hills, only a small portion of the cultivated land is irrigated. Most existing irrigation consists of small diversions from rivers and streams. Structures are damaged during the monsoon season through poor maintenance, sedimentation, or by landslides. In the dry seasons, they dry up completely. Lack of construction skills or an integrated development approach has resulted in many irrigation project failures and damage to the local environment, making it difficult, or even impossible, to rebuild in the same area. It is imperative that, while executing any irrigation project in the hills, careful consideration must go into the overall effects on the environment.

The ability of Nepal's mountain environment to support the country's growing population is now in serious question. The problems have been getting worse in recent decades and unless development measures with less negative effects on the environ-

ment are found, the ecological disruption will continue with great social and economic loss to the country.

Nepal is expecting significant help from ICIMOD in bridging the gaps in environmental knowledge and in devising sound management methods for the mountain areas. Without definitive analysis of the various components of development—water, agriculture, livestock, forestry—it will be difficult to make informed decisions about their sustainable development. The complex interactions between hill ecosystems and household activities must be studied properly in order to identify viable strategies for integrated development. Nepal hopes to gain needed information through the research facilities of ICIMOD.

Nepal will seek ICIMOD's assistance in research and development of appropriate technologies for energy and local industry. This will help conserve local resources as well as generate possible alternative forms of employment.

ICIMOD research may help Nepal identify improved institutional methods for carrying out integrated development on the local as well as the national level. It is important to promote community participation in resource management, using local institutions or organizations. National or regional institutions need to understand that technical and socio-economic development strategies must be suited to the needs and practices of the local community.

ICIMOD can help Nepal by assisting the country overcome its shortage of trained personnel and lack of access to the information and experience gained by other countries, both within and outside the region. By serving as a regional information clearinghouse and a source of expertise and training, ICIMOD will help Nepal avoid duplication of efforts being carried out elsewhere and assist in upgrading the professional capability of her development personnel. Nepal will also benefit from frequent contact with international scientists and experts who will participate in the many workshops and seminars ICIMOD plans to organize in the region.

Country Statement—Pakistan*

Like other countries of the region, Pakistan's dominant mountains are the Himalayas. With local variations, the mountain environment, flora, and fauna are similar. For example, in the far north, the yak is a common beast of burden, coniferous forests are found at the higher elevations, and deciduous forests cloak parts of the foothills.

Many of the problems facing Pakistan's hill environments are similar to those facing the other countries. In particular, Pakistan's forest resources are seriously threatened. Deforestation is proceeding at an alarming rate and, unless preventive action is taken, long-term forest sustainability is in doubt. The causes of deforestation are familiar: Conversion of forest land to agricultural land, shifting cultivation, commercial and illegal logging, firewood extraction, and poor land-use practices. Deforestation has upset the balance of other resources and has caused many socio-economic and ecological problems: excessive seasonal flooding, soil erosion, gully formation, loss of life and property, drought in the dry season, degradation of agricultural land, and siltation of rivers. Forest product industries, like the sporting goods industry of Sialkot, rely on the continued health of the forest resources. Similarly, the poor people of the hills still make their living cutting firewood.

Problems in the mountains and hills cause significant problems for the lowlands and plains. Vast areas of irrigated agriculture, as well as hydro-power generation, rely on the rivers that have their source in the Himalayas. Floods due to heavy rain and snow in the Himalayan catchments can have serious effects on the lowlands.

Impairment of human health is also a widespread problem. Lack of basic community sanitation, drinking water, and primary health care, as well as environmental pollution of air, water, and

soil, are chief causes of the problem. Mortality rates due to water and soil borne diseases are significantly high in Pakistan, as in other countries of the region.

Developments relating to environmental protection are very important. Pakistan is actively addressing environmental impact assessment, pollution control, and ecological degradation, particularly with regard to mountains. Environmental awareness has grown, as evidenced by the formation of many non-governmental and inter-governmental environmental organizations. The institutional framework for sound environmental management has been strengthened, with many individual agencies being established.

An important development has been the growth in awareness among the developing nations of the region that they can learn from, the mistakes of the developed countries and take suitable steps to prevent degradation of their own mountain areas. It is in this context that the involvement of non-regional participants is welcome in ICIMOD. They bring with them wide experience of mountain development in other regions.

Management of the mountains is now seen as an integral part of the development process rather than set apart from it. There are many dimensions to the problems facing mountain environments and approaching them from any one discipline is bound to fail. An integrated approach is the most effective way of helping the countries of this region protect their mountain environments, improve the living conditions of the people inhabiting them, and safely develop the natural resources of the mountainous areas. ICIMOD should address these socio-economic and environmental issues precisely through the methodology of integrated mountain development.

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