The State of Himalayan Environment and Emerging Issues
(A Study in Political Geography)

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Certified that this dissertation entitled `The State of Himalayan Environment and Emerging Issues (A Study in Political Geography)' submitted by Mr. Dibakar Sarkar in fulfilment of nine credits out of total requirements of twenty-four credits for the award of the degree of Master of Philosophy (M.Phil) of this University, is his original work and may be placed before the examiners for evaluation. This dissertation has not been submitted for the award of any other degree of this University or any other University to the best of our knowledge.

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CONTENTS

CHAPTER I

INTRODUCTION

High mountains exist on all continents and in different latitudes. The structure and operation of alpine ecosystems are however, not dependent only on altitude. The interaction between altitude and latitude is more important. These low-temperature, low-pressure, and high-radiation environments have their unique climatic, pedologic, floral,faunal, and socio-economic characteristics and diversities. Latitudinal and altitudinal gradients are primarily responsible for creating the macro-gradients of these parameters within mountain ecosystems. The meso-topographic gradients are primarily caused by topographic differences. Besides, minor surficial forms cause what are termed as micro-topographic gradients.[1] A more detailed study of certain aspects of mountain ecosystems has been attempted in Chapter 2.

Natural ecosystems if undisturbed are perfectly functioning self-regulatory mechanisms in a state of

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1. Billings, W.D; 1985: "High Mountain Ecosystems: Evolution, Structure, Operation and Maintenance"; in Singh T V; and, Kaur, J.(eds); Integrated Mountain Development; Himalayan Books; New Delhi; 43-71.

equilibrium. However, in modern times, human activities promoted by socio-economic goals have brought about cataclysmic upheavals thereby shattering this meticulously nurtured equilibrium.

World-wide concern for these rapidly degrading mountain environments started in the 1950s and resulted in various multinational and national programmes. This concern was primarily because, though only 10 percent of the world's population lives in the mountains, another 40 percent in the adjoining lowlands are directly dependent on the mountains for their requirements of water, minerals, forests, agriculture, and even recreation. For instance, though only 50 million people inhabit the Himalayas, as many as 350 million people inhabit the adjacent flood-plains in India and Bangladesh.

Chapter 3 deals with environmental degradation in the Himalayas and some recent findings that repudiate the oft-repeated Theory of Himalaya-Ganga-Brahmaputra Plains Environmental Degradation. According to this theory which has been largely synthesised by Ives(1987) from different sources, an increasing population in the Himalayas has resulted in an increase in the demands for fuelwood, timber,

and fodder. This has led to rapid depletion of the Himalayan forests. Besides, cultivation of steeper and mariginal land has increased soil erosion and disrupted the hydrologic cycle. This has been directly responsible for increased run-off, floods during the wet season, low-flows during dry season, and large-scale siltation. Scarcity of fuelwood has compelled the people to use animal dung as fuel, thereby depriving the soil of its natural fertiliser. This has also resulted in deteriorating soil structure making it vulnerable to landslipping and erosion. Depleting soil fertility again forces the hill farmer to cultivate more marginal land. Hence, what can been seen is the operation of a series of interrelated vicious circles leading to a downward spiral, and a future demise of the Himalayan system, thereby resulting in a progressive shift from potential instability to that of massive actual instability.[2]

Though at a preliminary level all these assumptions look perfectly sound, these linkages are

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2. Ives, J.S. ; 1985: "The Mountain Malaise : Quest for an Integrated Development"; in, Singh, T.V.; and, Kaur, J.(eds); ibid ; 33-42.

actually not supported by rigorous and reliable data. Under close observation many of these assumptions are untenable, and in many instances the reality has been seen to be diametically opposite. Frequent repetition of certain misperceived impacts of forests have come to be widely accepted. However, fortunately rigorously conducted watershed research has been able to dislodge a number of myths.

Effects of socio-economic process on mountain systems should be studied with the help of core-periphery theories, as mountains are basically peripheral to the overall system. Though the core-periphery theories are somewhat abstract, they are greatly helpful to understand the subjugation-domination relationship in mountain-lowland interacting systems. In Chapter 4 I have thus based this discussion according to the theories of Friedmann (1966) and Zelinsky (1971).[3]

The fragility and sensitivity of high-altitude mountain ecosystems and their spiralling deterioration has led to increasing concern for the

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3. Grotzbach, E. ; 1984: "Mobility of Labour in High Mountains and the Socio-Economic Integration of Peripheral Areas"; Mountain Research and Development; 4(3); 229-235.

physical environment. Despite the remoteness of the Himalayas, the population of these mountains are experiencing a major transformation of their social structure. Traditional social adaptations were functional in an encapsulated environment. However, exogenous influences have de-encapsulated the environment and the traditional social system has undergone various demographic, ecological, and economic transformations.

The sustenance of a sophisticated civilization for 1500 years in the Himalayan region is a great achievement in human adaptation. Considering the harshness and sensibility of the environment, and the possibility of irreversible damages to the environment, this achievement is all the more impressive. This traditional ecosystem homeostasis is however in the process of disintegration due to numerous exogenic forces. This has not only caused environmental deterioration but also social dislocation.[4]

A study of changing man-land relationship in the Himalayas primarily concerns a study of the

4. Goldstein, M.C. ; 1981 : "High-altitude Tibetan Populations in the Remote Himalaya : Social Transformation and its Demographic, Economic and Ecological Consequences"; Mountain Research and Development ; 1(1) ; 5-18.

population explosion occurring in the region, and the effects of inter- and intra-regional migration, as population growth and changes in adaptation patterns of local land-use are directly related. The pressure of population on land has been one of the most intractable problems in many developing countries. This is so in many mountain areas including the Himalayas. For a long time the population growth rate in many parts of the Himalayas was around 1 percent per annum. With enough land still uncultivated, more food could easily be produced by converting forests into arable land. However, in the present century improved health care facilities reduced the mortality rate greatly. But fertility remained almost unchanged. Hence, between 1901 and 1981, the population of the entire Himalayan region from Kashmir to Arunachal Pradesh tripled from 11 million to 33 million.[5] Present estimates place it at 50 million. This has critically affected the environment, and the previously sustainable and self-sufficient economy of the Himalayas.

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5. Hrabovszky, J.P; and, Miyan, K.; 1987: "Population growth and Land use in Nepal `The Great Turnabout'" ; Mountain Research and Development ; 7(3) ; 264-270.

Chapter 5 discusses environmental awareness and conflict situations in the Himalayas. Conflict situations arise primarily due to differences in awareness and perceptions. Perception generally refers to images, memories, preferences, and attitudes which affect human behaviour and also help us to explain, predict, and accomodate future behaviour patterns. Modern studies of man - environment relations are based upon a theoretical framework of cognitive psychology and environmental behaviourism, and consider that man reacts to his environment as he perceives and interprets it through his past experience and knowledge.

Though mental images of individuals are neither holistic nor monolithic, man-environment relations reflect cognitive processes which are essential in understanding human adjustment strategies. Cognitive process are involved in the way people conceptualize, understand, and organize their environment. It is just here that culture becomes an important criterion in influencing human behaviour.

Conflicts arise over the nature of resource utilisation, their uses and allocation. Conflicts could arise due to the scarcity of resources, or due

to opposing values and decisions taken in their utilisation. The greatest potential conflict areas are those where different groups have conflicting interests and differing cultural origins but require the same resources. However, ideological differences can result in differing attitudes even within an otherwise homogeneous cultural group. This requires a multi-disciplinary approach to accomodate disparate metrices, thus requiring eclectic approaches to accomodate multi-dimensional phenomena. This will require us to develop analytical techniques capable of effectively synthesising all the varied aspects to arrive at acceptable propositions.

Indigenous civilizations were sensitive to the natural environment and well-defined social norms guided the management and utilisation of natural resources, thereby maintaining a state of stasis. However, contemproary societies are continously increasing man's access to and the rate of consumption of natural resources. This has inevitably resulted in conflicts related to resource use, and the emergence of multitude ecology movements. These ecology movements attempt to redesign the pattern and extent of the usage of natural resources and bring about

social equality and environmental stability and sustainability. These movements have questioned hitherto dominant concepts of economic development. Though these movements are geographically localised, their impacts are broader in import. They are rooted in the cognitive gaps of our development planning. Such movements can no longer be ignored as they externalise the various adverse impacts and short-comings of our myopic exploitative development policies which have ecological destruction and economic deprivation in-built in them.[6]

Having acknowledged the fact that a crisis situation does exist in many parts of the Himalayas, that could as well be developing in other parts what we urgently require is to formulate a new paradigm to arrest this downward spiral, and to explore new avenues to bring about an ecologically balanced development.

We have forcibly made the diverse traditions of the world to converge onto a homogeneous monolithic

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6. Bandyopadhyay, J.; and, Shiva, V.; 1988: "Political Economy of Ecology Movements" ; Economic and Political Weekly ; 23(24); 1223-1232.

order. We have fallaciously equated development with economic growth, economic growth with expansion of market economy, modernity with consumerism, and non-monetised economies with backwardness. What we need to understand is that local people are to a great extent highly aware of their environment. This is not to say that they are the repository of all knowledge, but that they are the repository of some knowledge. Their traditional life-styles always maintained an equilibrium with the natural environment, which had guaranteed sustainability. If they are not being able to do so at present it is primarily because they are helpless and powerless to the substantially more powerful social, economic, and political forces originating from outside these mountain environments. Herein, lies a great possibility of utilising local perception, awareness and methods in regenerating the environment. Local cultures need to be fused symmetrically with modern technology to regenerate a stasis level in the environment. This will necessarily entail a transfer of power to the powerless and the marginalised. It is precisely this alternative mode to conservation that I have tried to explore in Chapter 6.

However, till today processes accelerating environmental instability in mountain ecosystems are not well known. This will require more intensive ecological research and a fuller understanding of natural and human processes of these regions at a local, regional, and super-regional scale. It is to be understood that environmental deterioration is a cumulative result of slow-acting, long-lasting, and slowly-accelerating uncontrolled processes.[7] A holistic approach to this multi-faceted problem will require specialized contributions from different disciplines, which finally need to be co-ordinated and synthesized, as it is often said that the whole is more than the sum of its parts.

It is also very important to remember that models of mountains symbolising human modifications of the environment have generally been based on the single criterion of altitudinality. In modern times such narrow and closed models are no longer applicable and should give way to more flexible and accomodative ones. Altitude per se, except in a few still

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7. Messerli, B.; 1985 : "Stability and instability of Mountain Ecosystems : An Interdisciplinary Approach" ; in Singh, T.V. ; and, Kaur, J.(eds); op.cit. ; 72-97.

remote areas, has become insignificant in modifying the life of the mountain people. What is of greater importance today is accessibility which has profoundly modified land-use patterns, and brought about the integration and acculturation of these mountain people with the more dominant cultures of the adjacent lowlands.[8]

Another problem often encountered while dealing with the Himalayas is data, which is contradictory and inconsistent. For instance, the estimates of annual per capita fuelwood consumption for Nepal differ by a factor (not percentage) of 67. This pattern is compounded by a mass of contradictory definitions, contending perceptions, divergent personal strategies, and polarized policy prescriptions.[9] To avoid such confusion I have deliberately made it a point of using as little secondary data as possible. Whenever figures have been used, I have verified and cross-checked the same from various sources.

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8. Allan, N.J.R. ; 1985 : "Periodic and Daily Markets in Highland - Lowland Interaction Systems : Hindu Kush - Western Himalaya " ; in, Singh, T.V. ; and, Kaur, J.(eds) ; op.cit.; 239-256.

9. Thompson, M.; and, Warburton, M.; 1985: Knowing where to Hit It: A Conceptual Framework for the Sustainable Development of the Himalaya" Mountain Research and Development ; 5(3) ; 203-220.

Besides, to understand problems like environmental degradation and poverty in the Himalayas statistics are not overly helpful as they tend to aggregate data, and lack data on specific areas and specific time series. Also statistics do not explain the causes and dynamics of a problem. For instance, population growth is often said to be responsible for growing poverty, which might actually be a gross over-simplification as it is a social product that is conditioned by the socio-economic structure. Population growth may hence be a symptom of the system as a whole rather than a cause.[10]

The geography of knowledge about the Himalayas is as varied as the Himalayas themselves. Most of the work has been done on the Central Himalayas (Nepal) where the research access has been relatively easy. In all the other regions work has been on taxonomic studies that are a first step towards an explicit understanding of the region. The implicit understanding concerning the local ethnosciences,

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10. Pitt, D.C. ; 1986 : "Crisis, Preudocrisis, or Supercrisis : Poverty, Women, and Young People in the Himalaya. A Survey of Recent Developments" ; Mountain Research and Development ; 6(2) ; 119-131.

ethno-practices, folk taxonomies, and indigenous land-use strategies have received less attention.[11]

Literature on the environment exists at three distinct levels, - the biophysical, the microsocial, and the macrosocial. However, these are epistemological levels and are but artificial discontinuities in the arrangement of knowledge. However, since systems of knowledge allow us to understand reality, we have to draw upon them and their systemic connections for a conceptual framework.

At the biophysical level physical and biological scientists focus on the physical and natural processes that sustain or undermine the environment. They however tend not to appreciate the role of the individual agents, i.e., the local mountain dwellers.

At the microsocial level, the anthropologists, social foresters, and cultural geographers focus on the social context of the individual agents, eg. the patterns of land tenure, patterns of social relationships, etc. Thus they bring to us various important

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11. Hatley, T; and, Thompson, M ; 1985 : Rare Animals, Poor People, and Big Agencies : A Perspective on Biological Conservation and Rural Development in the Himalaya" ; Mountain Research and Development ; 5(4); 365-377.

socially induced strategies in the lives of the indigenes. However, disruptions of social contexts at the macrosocial level can change the life-styles of these people. Such changes at the macrosocial level are for instances, rapidly rising population, industrial and economic development, geopolitical upheavals, and changes in government policy. These are the basic parameters on which people who deal with the macrosocial level such as political scientists, policy analysts, and students of international relations concern themselves with. However, the understanding of the systemic connections between these three levels is abysmal.

> "But it is precisely these connections-between the natural environment, the myriad strategizing agents, and the large-scale social perturbations - that will have to be explored and understood before we can really tell whether anything can be done about the environmental degradation of the Himalaya and, if so, what."[12]

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12. Thompson, M. ; and Warburton, M ; 1985 ; op.cit. ; 208.

CHAPTER 2

SOME ASPECTS ON THE NATURE OF MOUNTAIN ECOSYSTEMS

High mountains exist on all continents, on many islands and in different latitudes. However, alpine ecosystems are not simply dependent on altitude alone for its structural and operational characteristics. What is more important is the interaction between altitude and latitude. Ecologically, high mountain ecosystems in extratropical areas should necessarily show the absence of tree vegetation and the presence of late-lying snow during the summer season. In the tropics, however, such systems might show occasional snowfall and nightly frosts.[1]

Ecosystems of high mountains have often been compared with those of islands, being surrounded by a `sea' of lowland deserts, grasslands or forests, besides the additional buffer provided by the cold. This has made it possible for mountain areas to maintain their own distinct floral and faunal types.

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1. Billings, W.D.; 1985; "High Mountain Ecosystems: Evolution, Structure, Operation and Maintenance"; in, Singh, T.V. and, Kaur, J.(eds); Integrated Mountain Development; Himalayan Books, New Delhi; 43-71.

This has resulted in many of these areas having a highly endemic biota.[2]

Though only 10 percent of the world's population live in mountain areas, another 40 percent are dependent in some way on these mountains, as for instance,

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2. However, biota in most mountain areas have resulted from the migration of taxa from the adjacent lowlands to higher altitudes, or from lower latitudes polewards due to warming of global climates during Pleistocene interglacials, and the subsequent evolution of these migrating organisms. It may be mentioned here that the southern slopes of the Himalayas from the boundary between Palaeotropic and Holoarctic floristic realms. Floristic realms also differ between the wet, humid eastern Himalayas and the dry western Himalayas, with the Nepal Himalayas being a phytogeographical transition zone. However, in the eastern Himalayas, some western Himalayan forest types are found to occur in relict patches preserved on dry local habitats, such as south-facing convex slopes. These species form the climax species in the western Himalayas, as pioneer species in the middle Himalayas, and as relict species in the eastern Himalayas. Examples of such species are Pinus roxburghii, P.wallichiana, and Quercus semicarpifolia.

The occurrence of such phytogeographical elements might be either because of :

1. relict patches in a local relict environment, or
2. fresh invasions into local habitats with special environmental conditions, such as dry ridge-tops or disturbed habitats. The former is designated as relict-type and the latter as regeneration-type species.
(Ohsawa, M. , Shakya, P.R. and Numata, M, 1986: "Distribution and Succession of western Himalayan Forest Types ; Mountain Research and Development, 6(2), 143-157.)

through their needs for water, minerals, forests, agriculture and recreation. Hence, atleast half of the world's population weather living within the mountains or in adjacent areas are dependent on the mountains.[3] Besides, very soon South and East Asia alone will contain more than half of the world's population. The economy of this area is largely dependent on the rivers flowing from the Himalayas, the Karakorum and Tibet. This suggests that increasing percentages of the world's population is getting directly dependent on the mountains.

Concern for mountain environment degradation from the 1950s resulted in many international, multinational, national and local initiatives, including UNESCO'S MAB programme; the conference on development of mountain environment at Munich in 1974; IUCN'S conference on the management of High Mountain Resources at Christchurch in 1976; the Council of Europe's Conference on the Future of the Alps, the establishment of Highland-Lowland Interactive Systems in 1978 under the United Nations University, the establis-

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3. Messerli, B.,1985:"Stability and Instability of Mountain Ecosystems: An Interdisciplinary Approach"; in, Singh, T.V. and Kaur J.(eds). op.cit; 72-97.

hment of International Mountain Society in 1980; Integrated Mountain Development (ICIMOD) in Kathmandu in 1983, etc.[4] Despite such attempts there seems to be an ongoing trend towards instability of mountain ecosystems and the acceleration of these destructive processes. This brings about the need for better research, better resource development, and better implementation of programmes.

A study of mountain environments should try to clear certain age-old misconceptions about mountains. Mountains have often been considered as barriers to movement but actually mountains have often been quite permeable especially where exploitative resources are located. This has led to highland-lowland circulation systems which have integrated the highlands with the lowlands. Highland and lowlands are continuously interacting and are fundamentally interrelated.

Terms like uplands, hills, mountains and highlands are often used synonymously. However a clear

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4. Ives, J.D.; 1985:"The Mountain Malaise : Quest for an Integrated Development; in, Singh, T.V., and Kaur, J.(eds). ; ibid; 33-42.

distinction is required. Uplands and highlands may often be flat or at most undulating without the characterictic steep slopes of a mountain. This makes the topo-climates of mountains much more varied than highlands, due to the existance of multiple " ecological niches" or "patch environments". Due to the existence of such a large number of niches at different altitudes, mountains have been able to support relatively large populations by exploiting different niches during different seasons. This leads us to the oft-mentioned tiered belt or altitudinal zonation model of mountains whereby fields, forests and pastures are altitudinally integrated into a complementary unit.[5] But such a description will ideally require mountains to be completely isolated which is necessary for accounting for all the matter-energy exchanges inside the bounded space of these low temperature, low pressure, high radiation environments. However this is not the case with most mountains

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5. Such simplistic models are not applicable to mountain areas, atleast in the present world. A discussion supporting this statement has been put forward in subsequent pages.

having been partly or completely integrated with the adjacent lowlands.[6]

The biologic component of these alpine ecosystems is dependent on the primary productive capacity of green plants. As the evolution of photosynthetic system to such extreme conditions is a slow and rare process, the number of vascular plants decrease with altitude and with latitude.

However, for a fuller understanding of mountain ecosystems we should at first attempt to understand the climatic conditions and the internal variations of these ecosystems, as climate besides relief profoundlly influences human adapations.[7] A study of mountain climates will bring out some reasons for the great internal variations in human adapations within mountain systems.

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6. Allan, N.J.R. ; 1985: "Periodic and Daily markets in Highland-Lowland Interaction Systems: Hindu-Kush-Western Himalaya ; " in, Singh, T.V., and, Kaur,J.; (eds). op.cit; 239-256.

7. I use the word influnce with emphasis, and it should not be mistaken to be synonymous with words such as `determines' or `controls'.

Air temperatures decrease with altitude. The dry adiabatic lapse rate being 0.976 C/100m. But at altitudes above the level where water vapour reaches saturation point, the decrease in temperature is according to the wet adiabatic lapse rate due to the release of latent heat.This, however, varies from place to place. Besides, air temperatures are influenced by topography, vegetation and local air movement. Temperatures also vary seasonally and from region to region due to inversions, prevailing wind directions, air masses and cloud conditions. For example, the lapse rate on Mt. Kirishima, Japan is 0.86 C/100m. at 650 m a.s.I. and 0.45 C/100m below that point in February. In August both parts of the slope have a uniform lapse rate of about 0.68 C/100m. If there are few clouds, the lapse rate of minimum and maximum air temperatures are smaller on the upper slopes, while it is the reverse on the lower slopes. Also minimum temperature lapse rates are smaller than those for maximum temperatures. Besides, with increase in altitude, diurnal range of air temperatures decrease. Generally for temperate zones of the northern hemisphere, the lapse rate is greater for northerly than southerly winds, the lapse rate on lower slopes of low mountains is smaller due to high fre-

quency of low level inversions; and, these tendencies are generally stronger in winter than in summer.

Humidity is determined by temperature and water vapour content. The latter decreases with altitude due to decrease in air temperatures, with half of the atmospheric water vapour being below 1.5 km. a.s.l. Relative humidity is related inversely to air temperature, and is low at day time and high at night except in alpine areas. However, it varies seasonally due to air mass influences. Distance from the coast and prevailing summer winds, (as, sea water temperatures and hence evaporation are maximum in summer), also influence humidity conditions. Generally, water vapour pressure and relative humidity above 2000 m. a.s.l. are maximum in afternoon. But, below 1000 m. a.s.l., water vapour pressure is maximum in daytime, and relative humidity in the early morning.

Fogs are also an important weather determinant. Fogs occur due to adiabatic cooling of air masses. The height of condensation level differs from region to region. Air mass movements also influence fogs. Fogs in mountain areas affect every other

climatological phenomena, including, insolation, air and ground temperatures, humidity, etc.

Insolation is affected by altitude and the inclination of slopes. Insolation on mountains is stronger due to the decrease in the amount of water vapour and dust particles in the air. However, the inclination of slopes is more important in determining the amount of insolation. The adret slope or Sonnenseite is the one that faces the equator, (south facing slopes in the Northern hemisphere, and North facing slopes in the southern hemisphere), and therefore receives more insolation than the ubac slopes or the schattenseite which face away from the equator. Adret slopes tend to be warmer and better drained with greater use as pastures and agricultural land. However, fog and clouds also greatly affect insolation. Besides, snow at high altitudes greatly increases albedo.

The maximum precipitation on a mountain generally occurs on the middle slopes. This is called the "precipitation or rainfall zone". This is because ascending air cools adiabatically and at a certain attitude precipitates. However, the altitude varies regionally accordingly to temperature and

water vapour content. Generally, above 2000 m. a.s.l. the decrease in water vapour content in air decreases precipitation. However, in summer as air temperatures are higher the precipitation is likewise higher. In the humid tropics the maximum precipitation zone is generally between 900-1400 m, and at higher attitudes decreases at the rate of 100 mm /100m. An extended high plateau in a mountain region shows a secondary precipitation maximum on the marginal ranges of the plateau. However, local influences at the microtopographical level in mountain areas can be clearly seen from the deviations of the actual snow-line from the climatic or regional snow-line at the macro-or meso-climatological scale.[8]

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8. The snow-line is the line on which ablation of snow and ice is balanced by fresh additions from snow falls. The orographic snow-line is the line connecting the lower limits of the actual snow-line at which snow, sheltered from wind and sun, may survive at lower altitudes than exposed snow. The regional or climatic snow-line excludes local irregularities caused by influences of topography. The actual snow-line varies annually and the average line is called the firn line.(After, Yoshino, M.M.; 1985: "Mountain Development and Local Climate: An Over view;" in, Singh, T.V., and, Kaur, J.(eds); op.cit; 257-274.)

Wind velocity generally increases with altitude, but there are great local variations due to microtopographical features. Also, generally the maximum wind velocities occur at night and the minimum in the day-time at high altitudes. In the case of the adjacent lowlands it is the reverse. Besides, there are great local differences in wind velocity in mountain areas. It has been observed that in some instances the highest velocity on the windward slopes of a mountain was 2/3 to 3/5 of that in the free atmosphere and only 1/4 to 1/5 of it on the leeward side.

Local climates vary remarkably in mountain areas, and agricultural land use which depends largely on local climatic conditions varies similarly. Hence, small topographical differences often result in large-scale differences in agricultural land-use, the most important factors being air temperature, precipitation, sunshine hours, wind, frost free period, snow period, etc. Though crops change according to cultivation techniques, introduction of new crops, financial position of peasants, market demands, and transport facilities, the severe climatic restrictions in mountain areas largely re-

duces the freedom of choice.[9]

Mountain ranges serve as the primary source of water for domestic, agricultural and industrial use for many arid and semi-arid regions of the world. This association of humid mountain ranges with the arid or semi-arid lowlands, has permitted human settlement in otherwise inhospitable areas. As has been mentioned earlier, though only 10% of the world's population live in mountain areas, another 40% living in the adjacent lowlands are directly dependent on the mountains for water.

Pakistan, Afganisthan, Nepal, Sikkim, Bhutan, Northern India, China and Soviet Central Asia are largely dependent upon the rivers (Amu Darya, Indus, Ganga, Brahmaputra, Huang Ho and Yangtze Kiang) that originate in the Himalays and the adjacent highlands. Similarly, large parts of Ecuador, Peru, Bolivia, Chile and Argentina depend on the watersheds located in the Andes. The Nile originating in the mountains drains the arid areas of Ethiopia, Sudan and Egypt.

9. This discussion on climatological phenomena of mountains is largely derived from, Yoshino, M.M.; 1955; op.cit; in, Singh, T.V., and, Kaur, J, (eds); op.cit 257-274.

The Columbia, Missouri and Colorado Rivers originating in the Rocky mountains drain the arid western United States of America. The Alps also contribute greatly to the flow of the Rhine, Rhone and the Danube.

This highland-lowland hydrologic interaction is a complex process. Overuse of mountain ecosystems due to increasing population pressure or economic opportunities can adversely affect the hydrologic regime, thereby altering the timing, volume and quality of surface run-off. Such deleterious changes may result in accelerated erosion, slope instability, increased flood crests, increased sedimentation, and extended dry periods.

Generally, high altitude areas receive more precipitation than the adjacent lowlands, due to orographic lifting of air masses. With increasing altitude, air temperature decreases and precipitation efficiency[10] increases. Losses due to evapotranspiration also probably decrease. Besides, with increasing altitude, the porosity and permeabitity of geologic structures decrease, thereby resulting in a

10. Precipitation efficiency is defined as the ratio of precipitable water vapour in an airmass to that actually precipitated.

decrease in groundwater storage and a corresponding increase in the runoff efficiency.[11] Besides, a large part of the precipitation is in the form of snow, the accumulation of which helps to maintain the water regime in the dry season.

The hydrometeorological environment of mountains varies with latitude, longitude and the altitudinal interval occupied.[12] Thus the timberline and the snowline[13] generally rise in altitude equatorwards. Hence each mountain area has its distinct water exchange relationship according to its three dimensions of latitude, longitude and altitude.

However, the study of mountain-lowland interactions have been constrained by a lack of suitable three dimensional models which can provide a realistic picture. The two dimensional models developed for lowland areas (minus the altitudinal dimension) are not tenable for the mountains. Besides, data from

11. Runoff efficiency if defined as the ratio of precipitation which becomes surface runoff.

12. The timberline is the zone demarcating the timbered montane from the treeless alpine belts.

13. The snow line is the zone demarcating belts of seasonal from belts of perpetual snow.

mountain watersheds are relatively scarce and if present are highly site or scale -specific and are not applicable to entire mountain ranges. This is due to tremendous internal variations as the result of the interaction between local meteorological and terrain variables. Even at present we have made little progress in accounting for this variability. Mountain hydrologic systems and their role in determining water availability in the adjacent lowlands have not yet been properly studied.[14]

Though mountains vary from each other due to numerous factors, the latitudinal and altitudinal gradients called "macrogradients" have a profound control on the distribution of biota due to their influence on such factors as the amount of insolation received, length of day and growing season, temperature and precipitation conditions, etc. Within these gradients exist the "mesotopographic" gradients caused primarily by topography, as topography affects solar radiation soil moisture, soil and air temperatures, wind conditions, and snow drifts. Mesotopog-

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14. This discussion of mountain hydrologic systems is largely based on, Alford, D.; 1985:"Mountain Hydrologic Systems"; Mountain Research and Development; 5(4); 349-363.

raphic gradients largely modify the energy conditions produced by latitudinal and altitudinal gradients. Within mesotopographic gradients, small rock outcrops or depressions produce "microtopographic" gradients due to the protection they provide. All such gradients contribute to the great habitat and biological diversities.[15]

Though high mountain ecosystems are primarily controlled by physical factors which determine, for instance, radiation rates, soil and air temperatures, snow distribution, wind speeds, growing season and slope and soil characteristics; it could be mentioned that the biological portion of the ecosystem is also of great significance.

The biological component of these alpine ecosystems is dependent upon the primary productive capacity of green plants. As the evolution of photosynthetic systems to such extreme conditons is a slow and rare process, the number of vascular plants decrease with increase in altitude and latitude. Even the pedologic characteristics of these environments are unique as they have largely evolved in

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15. Billings, W.D.; 1985: op.cit; in Singh, T.V., and, Kaur, J.,(eds); op.cit; 43-71.

the absence of human intervention, with many of them also not having hooved animals. The intrusion of such aggressive organisms into these fragile environments have had disastrous effects on these ecosystems.

As in all ecosystems, the changes of operational energy from the environment to the biological community is carried on by green plants through photosynthesis. In alpine ecosystems these plants are small and are patchy in distribution. However, despite their smaller size and low temperatures they are comparable in terms of energy capture per growing season day to plants of other ecosystems. But, due to the short growing season energy capture on an annual basis is comparatively less, as they are productive only for 10-25% of the year. Alpine vegetation in extra-tropical and in some tropical areas is dominated by perennial graminoids (grasses and sedges) associated with herbaceous dicotyledons, dwarf shrubs, mosses and lichens. Most of these graminoids and dicotyledons have most of their biomass within the soil. Annual species are small and are not of much significance in the overall vegetational cover or productivity. The vegetational gradient at

any elevation is correlated to and controlled by snow and water availability in different segments of the mesotopographic unit, with the most productive and luxuriant vegetation in the meltwater meadows.

The perennial herbaceous plants break dormancy rather rapidly in summer and give off shoots and leaves through the translocation of carbohydrates and lipids from the perennating parts such as the roots and rhizomes. Respiration rates are high, thereby increeasing metabolism. Initially photosynthetic rates are slow due to the time taken in chlorophyll synthesis. This results in the net loss of dry weight in the first few weeks. With the synthesis of sufficient chlorophyll the net photosynthesis becomes positive. Most alpine plants follow the C_3 photosynthetic mode.[16]

Some instances of the special characteristics of some alpine plants that have allowed them to survive in such an inelastic environment are given below.

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16. C4 Muhlenbergia has been found by Harrison in subalpine parts of Wyoming, Canada. However, even if found, C4 species are so rare in alpine environments that they are insignificant in the overall plant productivity of these ecosystems.

1. Alpine weather shows frequent changes in temperature and light intensity as the sun can be frequently obscured by dark clouds. Species like Oxyria digna (alpine sorrel) have the ability to quickly adjust photosynthetic and dark respiration rates to environmental changes, thereby attaining a state of homeostasis.

2. Many plants have the ability to degrade the starch into sucrose and to translocate sucrose to storage organs at low temperatures. Most crop plants except some like potato, cannot do this.

3. Flowering in most alpine plants is generally from flower bud primordia formed atleast a season earlier. This permits them to flower quickly. Besides most plants can reproduce vegetatively through bulbils, rhizomes, stolons and bulbs; which are rich in carbohydrates, lipids and even proteins and are important as food for higher trophic levels.

Animal life, especially the herbivores, both resident and transient ones, are directly dependent on the plants. Food webs in alpine environments are very complex. In one instance, 22 species of mammals and 13 species of birds were an integral

part of this food web. This is further complicated by summer grazings of herds brought from the lowlands. Besides, organisms such as fungi, bacteria, protozoans, and innumerable invertebrates are present as decomposers which are essential for the recycling of carbon and other essential mineral nutrients. However, studies and data on these decomposers in high altitude environments are very limited.

Organisms of alpine ecosystems are well adapted to the severity of the alpine environment. The insects and animals dependent upon the plants have maintained a balance between themselves. Plants are also important in soil formation and its protection, and in turn derive water, nutrients and stability from them. It is the introduction of new organisms that are primarily responsible for disruption of this balance. Of this,human intervention is the most important, as high altitude ecosystems have evolved without the human component, as primitive men were only casual visitors to such environments. Only in a few cases, some primitive people after long residence have been able to come to tenuous terms with their environment, the links of which are as delicate as the environment itself. Any increase of

population pressure on and has invariably resulted in the degradation of the ecosystems and social systems.[17]

" Natural ecosystems are characterised by self-regulatory energy flows and food-chains and are in a state of equilibrium. However, these ecosystem equilibria are very sensitive to external stimuli, such as human activities promoted by socio-economic goals"[18] People inhibiting high altitude areas have adapted to the inelasticity of their environment and have developed social mechanisms to overcome ecological constraints, eg. polyandry, monasticism with celibate inmates, etc.

High-altitude environments with their pronounced relief and other characteristics related to geology, climate, vegetation and geomorphic processes peculiar to such areas, are highly susceptible to erosion and other hazards. Such hazards due to exogenetic processes are for example, water erosion, landslides,

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17. Billings, W.D.; 1985: op.cit; in Singh, T.V.,and, Kaur, J., (eds) op.cit; 43-71.

18. Bhasin, M.K.; Kumar, V.; and, Sehgal, A.: 1984: "Impact of Human Activity on the Ecosystem with Reference to the Sikkim Himalaya MAB (Man and the Biosphere) Programme, UNESCO; " Mountain Research and Development; 4(3); 267.

debris flows, rockfalls, and floods. Besides many mountain regions are tectonically active. For instance, major earthquakes occur in the Himalayas once every 30 years. Secondary effects of earthquakes such as landslides also cause severe damage. It is quite possible that many of these slope processes were active prior to the interference of the environment by man. However, with the begining of the human intervention, former dense forests were turned into depauperate forests and arable, grazing, and shrub land. With large scale construction of terraces the micro-relief was greatly modified, besides irrigation systems and changed vegetation types created drastic changes in the ground water and run-off conditions. Some of these changes introduced by this man-made landscape considerably increased slope instability and run-off, whereas changes such as terracing countered these destabilizing processes to some extent.[19]

High mountains have been variously defined. However, the focus of impacts related to resource

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19. Kienholz, H,; Schneider, G., Bichsel, M., Grunder, M., and, Mool, P.; 1984: "Mountain Hazards Mapping Project, Nepal. Base Map, and Map of Mountain Hazards and Slope Stability, Kathmandu - Kakani Area (with 2 Maps, Scale 1 : 10000)" : Mountain Research and Development; 4(3); 247-266.

exploitation and other human activities are generally not the high mountains, but rather the middle and the lower hills where intensive land-use is possible.

Mountains cannot be defined only on the basis of altitude. Altitudinal vegetation belts are more important than altitude or geologic structure for a discussion on the susceptibility of these ecosystems to human activities. Impacts of human activities normally brings about a continuous interaction between different ecological or vegetational belts. Considering this, all areas having more than one altitudinal vegetation belt should be considered as mountainous. For a discussion on the susceptibility of these ecosystems to continued and increasing human impacts, it is necessary that we define certain terms such as stability, vulnerability, fragility and instability.

" Stability implies the long-term sustainability in the use and exploitation of land and natural resources in each ecological belt, and also a sustained long-term interaction between the different belts." Vulnerability is used to characterize " a system for which stability can be maintained only by careful management and by a high input of energy".

Fragile " is used to imply that irreversible change, or damage, can be inflicted easily". "Instability is used in situations where damage, or change, is occurring not only in terms of the resource and land-use of each ecological belt, but also through the interaction between belts, or between highland and lowland systems".[20]

Human impact is the most important component in a rapidly changing mountain environment, though other factors such as climatic type, relief, altitude, geology and vegetation can not be neglected. Culture is derived from the Latin word cultura meaning agriculture. It was used by Cicero in an intellectual sense to imply that equal attention should be paid to the human spirit as to the field, thereby linking human and natural sciences. Culture is based on the natural environment, as culture is the result of a long human interaction with the environment. When this interrelation is forgotten we tend to bring about destabilizing effects on the ecosystem. Besides, the mountains being a high energy

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20. Messerli, B.; 1985.; op.cit; in Singh T.V., and, Kaur, J.; (eds) op.cit; 75.

environment, instability in one part can cause instability in other parts too, due to its downslope effects.

Alexander von Humboldt attempted a comparative study of mountains according to climatic types based on altitude and latitude. This was the beginning of mountain research. However, at that time human activities were still more or less in tune with nature and so Humboldt could not perceive the overwhelming effect of human impacts on mountain environments. However, in recent times the equilibrium and stability of these ecosystems has been threatened due to increasing pressure on land resources and in some areas due to the evils of unmanaged tourism.

Mountain ecosystems show varying degrees of development, which is the reflection of varying degrees of development in the adjacent lowlands. In industrialised countries there has been a noticeable trend of declining agriculturally-adapted populations and an increasing non-adapted tourism based population in the mountains. The mountains have become recreational areas for the people of the lowlands and have undergone large-scale changes to accomodate

the large seasonally transient population. This is in sharp contrast with the mountains in the developing world where a largely agricultural and subsistence population is experiencing rapid population growth, thereby creating unsustainable pressure on land and bringing marginal lands under cultivation. This has resulted in a rapidly deteriorating environmental balance together with large-scale outmigration in many areas. However, it should be mentioned that the developed countries faced a similar situation, until rapid industrial and technological developments in the 18th century brought about a new economy with innumerable opportunities to absorb the increasing population. It should also be mentioned that both these types of mountain systems are presently endangered and require immediate efforts to achieve a new stability. This, however, does not mean that the two systems lack their similarities, eg., steep slopes, varying precipitation with altitude, short growing period, higher seismicity, greater slope instability, higher percentage of area that can be called marginal land, and thinner soil mantle than the adjacent lowlands.[21]

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21. Messerli, B.; 1985: ibid; in, Singh, T.V. and, Kaur J. (eds); ibid; 72-97.

Above all, extreme caution should be taken in not making general statements on mountain systems until a comprehensive coverage of these regions are made, as great internal (physical and cultural) variations exist. This has often been overlooked, and single village studies have often been extrapolated to a general level. A greater mistake often committed, is that findings on a particular mountain system (say the Alps) is extrapolated to another mountain system (say the Himalayas).

Chapter - 3

DEGRADATION OF THE HIMALAYAN ENVIRONMENT : MYTH AND REALITY

Before we begin any discussion about the Himalayas, it is essential to differentiate between temperate-latitude mountains mostly located in industrialised countries and tropical and subtropical mountains of developing countries. Compared to the Himalayas (and other mountain areas of other developing countries), the temperate latitude mountains of industrialised countries present a rather different picture.[1] For instance, the environmental degradation in the Alps is primarily due to population increase and due to increasing affluence of people living in the adjacent lowlands. This has resulted in an increasing demand for the resources of the mountains, such as minerals, water, timber, and most importantly for recreational purposes. This last factor has resulted in rapid disruption of local cultures and also large-scale depopulation of areas that due to various reasons are either not suited for the tourist industry or are not competitive agricultu-

1. It is to be noted that such generalizations are only broadly representative at a global level.

rally, thereby bringing about a collapse of mountain agro-ecosystems. Depopulation and land abandonment usually results in a remarkable increase in soil erosion until new shrubs or forests are established which brings about a new stability. Besides, tourism especially if not properly managed increases pressure on the environment,thereby adding to the degradation of mountain environments.

What is of critical importance today is that this problem is not restricted only to developed countries, (which can afford to combat it through increased technological and capital inputs), as over the years mountain areas in developing countries too have been witnessing a massive expansion of tourism besides the large - scale exploitation of resources for the benefit of individuals or communities located outside these regions.

A synthesis of the literature dealing with the environmental supercrisis developing in the Central Himalayas has been put forward by

Jack D.Ives (1987).[2] The Himalaya-Ganga-Brahmaputra system can be considered among the world's largest highland-lowland interactive systems. The theory of Himalayan-Indo-Gangetic Plains' Environmental Degradation has been often cited to explain all natural catastrophes in this area. Population in the Himalayan region started growing rapidly with the introduction of modern health care facilities in the 1950's. For instance, Nepal experienced a poulation growth rate of 2.6 percent per annum between 1971-81, which in many areas exceeded 3.5 percent per annum, therby resulting in a total population of 16 million, as the population doubled in about 27 years. With 90 percent of the population rural and subsistence, demands for fuelwood (about 90 percent of Nepal's energy demands are met by combustion of biomass), construction timber and fodder increased remarkably. This led to rapid deforestration with the loss of half of Nepal's forests between 1950 and 1980, causing predictions that Nepal would be devoid of forest cover by 2000 A.D. The need to cultivate steeper and marginal land by cutting terraces increased

2. Ives,J.S; 1987:"The theory of Himalauan Environmental Degradation", Himalayan Research and Development, 7(3), 189-199.

soil erosion and disrupted the hydrological cycle. This resulted in increased run-off during the monsoons resulting in floods downstream, and the drying up of water points during the dry season. Besides, it increased reservoir siltation, changed river courses, covered fertile agricultural land by a barren cover of sand and gravel, and increased incidence of diseases downstream. Due to this continuous loss of agricultural land, more marginal areas have to be cultivated. This results in greater walking distances to acquire fuelwood, thereby causing more animal dung to be used as fuel. This deprives the soil of natural fertilisers, which lowers crop yields,thus necessitating more land to be brought under cultivation. Besides due to lack of this natural fertiliser, the soil structure deteriorates making it more vulnerable to landslides and erosion.

This is not all, the rapidly increasing population means accelerating sub-division of land holdings (at present in Nepal an average family of 7 members owns one hectare of land). Women have to work harder in collecting fuelwood, fodder and water, which adversely affects their health, which

has its effect on the next generation. Animals are essential in this subsistence mixed farming system for fertilisers and draught energy. However, with declining fodder availability, the capacity of animals also decrease. Thus, what can be seen is the operation of a series of interrelated vicious circles leading to a downward spiral, and the future demise of the Himalayan system, thereby resulting in a progressive shift from potential instability to that of massive actual instability. This also causes large scale out-migration to the terai area which already has tremendous pressure on its resouce base. The population growth rate of the terai region at present approximates as high as 4 percent per annum. Thus Nepal is said to be showing a transition from a highland-rural country to a low land urban one.

The net result of these processes in the Middle Mountains have been those of deforestation, lower crop productivity, increase in population, and an increase in the proportion of population dependent on subsistence agriculture, poor nutrition levels, mountain desertification, and rapid soil erosion. This rapid soil erosion has

decreased the life of reservoirs and dams through siltation, raised the river beds in the lowlands of India and Bangladesh, thereby decreasing the carrying capacity of the rivers and resulting in calamitous flooding, and destroying rich lowland farms by spreading sand and gravel when rivers breach their banks. Hence, it is quite correctly said that Nepal is exporting the commodity that it could least afford to part with (top soil), in the form that India could least afford to receive it. It has also been suggested that Nepal switch over from the Swiss technical aid to the Dutch one, to enable it to establish polders in the Bay of Bengal- a product of its own soil !!

This broad theory has been widely accepted. This has led to the idea that the few million hill farmers are holding the hundreds of millions in India and Bangladesh at ransom. This brings about the possibility that the downstream countries can justify economic, political and military reprisals. And if, there are no reprisals, Nepal could do well with the external aid it receives. Another convenient possibility is that of labelling the hill farmers as the cause of environmen-

tal disaster, thereby making him the scape-goat. However, this would be mistaking effect for cause.

An important component of the Himalayan environment is provided by the politics of the area, such as the border dispute between India and China, the belligerancy between India and Pakistan the frictions between India and Bangladesh over the sharing of river waters, the political unrest in Afghanistan, besides the political unrest within the Himalayan states of Jammu and Kashmir, Punjab, Uttar Pradesh, West Bengal and Assam within India over demands for acesss to natural resources by local and ethnic groups. In the western Himalayas of India, following the border war with China large-scale road construction was undertaken which has greatly increased soil erosion. The exodus of Tibetans to the Nepal and Indian hills during 1959-60 has caused large-scale impacts on the natural resource base of the mountains. The closing of the Tibet border also affected several activities such as transhumance and trade.

This is the Himalaya-Ganga problem as perceived widely. If we analyse it we can summarize

the following salient linkages and basic assumptions (Ives, 1987):

1. Population explosion started after World War II due to suppresion of malaria and other diseases with better health care;

2. An increased population led to (a) reduced land per family, (b) greater poverty, (c) large-scale deforestation;

3. Forest cover in Nepal at the present rate of use will be totally lost by 2000 A.D. which will cause greater slope instability;

4. All this will lead to (a) increased flooding in the Ganga - Brahmaputra plains, (b) extension of the delta and formation of islands in the Bay of Bengal, (c) siltation will greatly reduce the life of costly reservoirs (d) drying up of water sources during the dry season ;

5. Deforestation leads to climatic change such as decreased rainfall.

At a preliminary level all these assumptions look perfectly sound. However, for it to remain sound under careful analysis, it should show

sufficient causal relationships between the timing and degree of population growth, deforestation, loss of agricultural land, downstream effects, etc. It has been shown by Ives (1987) that most of these linkages are not supported by rigorous and reliable data. Many of the widely preferred assumptions are untenable. This is because problems are perceived according to the vested interests of persons involved. It is like a kaleidoscope which changes its pattern according to the angle of vision. For a beginning, extrapolation is to be resisted, as it creates unwarranted generalisations which in a complex region such as the Himalayas can be counter - productive and only serve to exacerbate the problem.

Ives(1987) gives an instance of how the mountain farmer has been made the convenient scape goat. The Asian Development Bank in 1982 indicated that rainfed terraces were poorly constructed and were outward than inward sloping and without a grass bund on the edge. The actuality is somewhat different. Such rainfed terraces suppo rt maize, millet, and buck wheat. Outward slope is to help prevent crop damage through waterlog-

ging. Also inward slopes would increase soil saturation which together with the weight of the impounded water would result in greater landslipping. Also, for inward sloping terraces the labour input for maintenance would be considerably greater. However,this does not mean that there are no poorly maintained terraces. During heavy monsoon downpours, labour input is concentrated in repairing the damage to irrigated fields which support paddy rice which is more vital for the survival of the subsistence family. During such periods rainfed terraces may be neglected for some time due to the shortage of available labour. This, however, does not reflect the ignorance of the farmer. The traditional wisdom of these farmers has often been seem to be highly knowledgeable and intelligent.[3] This according to Hatley and Thompson (1985) makes gift exchange more important compared to charity through international aid in controlling environmental degradation.[4] This does not suggest, however that these farmers are the most intelligent, or that all of them are

3. Ives, J.D; 1987: ibid; 189-199.

4. This point has been elaborated in a subsequent Chapter.

necessarily good farmers. It only shows that all impacts caused by them are not necessarily negative. Farmers in many instances have greatly reduced potential landslipping and soil loss by re-terracing slopes or through temporary deintensification of cultivation.

The causes of deforestation are simple. Demands on fuelwood have increased due to an increasing population. The important questions that need to be answered are, - the reasons for such a rapid population growth, patterns of migration and the socio-economic and political impulses required to stall this process. Besides, we need to ascertain with precision the rates of soil erosion under different soil covers and land-use types, at different altitudes, and the point sources of sediment transfer. We also need to differentiate between natural and man-made causes if effective counter-measures are to be attempted. This calls for an integrated approach (integrated in being not only interdisciplinary but also by being inter-agency, multi-national, and inter-personal). However, without even attempting to answer such questions we keep embarking on grandiose

large - scale development projects without even a second thought to the environmental implications.

Hamilton (1987) stresses the importance of the modes of tree felling and subsequent use of cleared land. According to him, if hand cutting and carrying is the primary mode of clearance and if the cleared land is replaced by well maintained terraces, then soil loss can be even less than that under a forest cover.[5] The cause of serious downstream flooding is heavy precipitation reaching the ground in a short period of time, which may well be unrelated to deforestation in the higher hills. Gilmour (1987) has also shown that reforestation may not necessarily result in a significant decrease in soil loss and flooding.[6]

The assumption that the misuse of land and forests in the mountains leads to catastrophic floods and other related events in the plains is

5. Hamilton, L.S; 1987:" What are the Impacts of Himalayan Deforestation on the Ganges-Brahmaputra Lowlands and Delhi? Assumption and Facts", Mountain Research and Development; 7(3), 256-263.

6. Gilmour,D.A., Bonnell, M.,& Cassells,D.S.; 1987; "The Effects of Forestation on Soil Hydraulic Properties in the Middle hills of nepal: A Preliminary assessment; Mountain Research and Development; 7(3), 239-249. (However, Gilmour, et.al's Worle was highly site specific).

now being challenged by many.

> In a historical sense we can say that the Indo-Ganga-Brahmaputra plains are underlain by upto 5000 metres of sediments derived from the mountains over several million years. Hence, the deposition of sediments is not a recent phenomenon. It can also very well be that the undesirable effects of flooding and sedimentation are due to human interventions in the flood plains itself.[7]

There now exists a copious literature on negative human impacts in the Himalayas. However, natural proceses are atleast equally important. It should be considered, that the Himalayas are a result of recent orogenic and mountain building processes, and are still active. This together with the steep topography leads to active erosional processes. With a rapidly increasing population in the Middle Mountains the demands on forest products has

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7. This does not mean that individua watersheds are not showing increased sediment transfer. Nor does it suggest that all human impacts in the mountains are unrelated to the problem of the lowlands, as for instance, badly constructed roads can greatly increase landsliding.

resulted in declining density and quality of forests, thereby causing large-scale deforestation. It has been commonly accepted that downstream low flows in the dry season and floods in the wet season are caused due to poor land-use practices in upstream areas. Following from this, it is also commonly accepted that this unilinear causal problem also has a unilinear solution, i.e. reforestation.

For some time there has been a lot of debate over resource depletion and ecological damage in the Himalayan region being primarily responsible for downstream flooding and siltation. The decreasing forest cover disrupts soil and water conditions. Besides, these forests are critical for the viability of the mountain economy. Due to these reasons it becomes important to understand the historical process of depletion of forests in these watersheds. Three major factors have been cited by Tucker (1987) in this context. These are the intrusion of modern political and economic systems during the colonial period, the growth of modern resource management agencies such as the Forest services, and

lastly the pressures of rural subsistence and population migrations.[8]

During colonial times political and economic development was initiated in the major river basins which were the areas of major population concentrations. However, the resource base for these areas included the southern slopes of the Himalayas. Though the mountains remained relatively peripheral, modern systems of resource exploitation and institutions gradually made their way into them.

This gradually led to the extension of agricultural land by felling forests. Initially this was slow as population grew slowly until 1900 and ;it was mostly through reclaiming land that had been deserted during the turbulent years of early 1800. In certain areas forests were replaced by plantations. The growth of the lowlands continually required resources from the mountains. This was accelerated from the mid 19th

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8. Tucker,R.P.;1987:" Dimensions of Deforestation in the Himalaya: the Historical Setting", Mountain research and Development, 7(3), 328-331.

century with the railway boom. For two decades starting from the 1850s, the sal and deodar stands were cut in an unregulated way. Later reforestation repaired the damage in the sal belt but not in the deodar one. The government then realised that hardwood supplies were not unlimited and hence, to provide a sustainable yield established the Indian Forest Service in the 1860s. However, enough damage had already been caused. After independence the forests were again ravaged for fulfilling the demands of newly independent nations.

Forest use in Nepal was different as Nepal did not adopt modern western systems until after 1950 when the Ranas were overthrown. However, even in Nepal landed elites exploited them for demands in lowland markets in India. However, no systematic study of Nepal's forest history has as yet been attempted.

The Indian Forest service was established to attain three objectives, namely to have a sustained yield of timber, to preserve forest cover in unstable watersheds, and to ensure that the indigenes had adequate supplies of wood and fod-

der for their subsistence needs. The first goal has been most effectively attained, and the third goal the least. The second goal has received less attention due to the national consensus that rapid economic development was more important. More recently, however, the importance of stabilizing these fragile watersheds has started getting more attention largely as a response to mass awareness.

The British established many restrictions on the use of forests by villagers. Earlier local rajas did not make attempts to limit access to commons and since population was less it is unlikely that villagers had in most places any collective regulations on them. By the late 19th century the British perceived that the natural resource base was inadequate to sustain both local and distant demands without limiting access. This initiated the idea that villagers were concerned only in satisfying their demands and not in the long-term sustainability of the forests. Where competing pressure was greatest political conflict was severe as that launched by the Chipko movement in the Kumaon. Migration has also

been an important factor. Outmigration from Nepal into the Darjeeling hills, large scale settlements in the terai in all regions due to various reasons, such as the resettlement of Punjabi refugees, and the migration into Assam of land-starved Muslim peasants from Bangladesh, have all been important in causing forest depletion in these areas.

After making a historical analysis of deforestation in the Himalayan region, it would be proper to analyse the oft-repeated causal relationship between deforestation in upstream areas and floods and sedimentation in downstream areas. There are many problems which impede the determination of the downstream biophysical impacts of deforestation in the mountain areas. The connections made are uncertain and are mere perceptions of cause and effect different from reality. As far as biophysical impacts are concerned, there are three serious problems, namely the vagueness of the term `deforestation',misinterpretation and misunderstanding of the relation between forests and climate, soil, and water; and, the problem of extrapolating site and scale-spe-

cific studies to large areas.[9]

The term `deforestation' has been used to refer to many different activities such as commercial logging, fuelwood cutting, shifting cultivation, forest clearing for cultivation, grazing, plantations, etc. Each of these activities have different hydrological and ecological effects. However, it is frequently generalised that deforestation due to whatever reason invariably results in erosion, floods, droughts, sedimentation and desertification. Such an anbiguous use of the term has made it almost meaningless for describing land-use changes. This calls for a less emotion-provoking and a more specific term, or the use qualifying adjectives or phrses. Effects of fuelwood cutting with manually carried products are greatly different from those of commercial felling using heavy equipments and vehicles.[10] Similarly, erosion can be greatly different between ill-maintained and well-maintained terraces. Despite these differences, `deforestation' has always been

9. Hamilton, L.S.; 1987; op.cit; 256-263.

10. In areas of commercial felling, trails and roads cover between 16-30% of the area.

perceived as destructive. Thus there is the need to be exact about the activity bringing about change in land-use. Only then can one differentiate between harmful and benign effects, as it is not the cutting of trees per se that causes erosion, but rather the mode of their removeal and the subsequent use and management of the cleared land. Harvesting of forests generally causes only temporary deforestation as except in very arid areas, most forests have a well-developed understory, or there is a prompt establishment of new reproduction. Thus only age and size structure of the forest is altered. The biophysical effects in this case will be greatly different from those caused by clearing of forests for cultivation or grazing. Besides, it has been seen, that erosion hazards are greater from burning and overgrazing, than from fuelwood cutting and fodder lopping. Thus it is inaccurate and naive to say that fuelwood cutting in the Middle Hills of Nepal results in deforestation which initiates erosional and hydrologic effects. The magnitude and complexity of the situation needs to be appreciated.

Through frequent repetition, certain misperceived impacts of forests have been widely accepted. Trees are said to be like sponges, soaking up water during the wet season and releasing it during the dry season. Thus it is logically believed that large-scale felling will lead to floods during wet season and droughts in the dry season. However, recent observations suggest otherwise. It has been seen that forest cutting increases the total water yield in streams, with the increase being proportional to the intensity of cutting. It is also seen that this increased flow occurred throughout the year, including the dry season. This is because, tall forests contribute to much greater water loss through evapotranspiration than other types of vegetation.

It is also often thought that, the upper forest canopy protects the soil from raindrop impact, thereby reducing particle detachment and splash erosion. Experimental observation indicates the reverse. Raindrop impact on bare soil under tree canopies of over 10 m in height is greater than on bare soil in the open. This is due to larger drop size and the achieving of terminal

velocity with height. What actually protects the soil is the organic matter, surface litter, and the understory vegetation. If soil erosion is to be checked, the soil-litter-vegetation interface should be carefully managed.

Another misperception is that decreasing forest area in the upper reaches of the Ganga and Brahmaputra has led to increased flooding in the lower reaches. Bowonder (1982) has studied the pattern of floods in India for a period of 25 years between 1953 to 1978, on the area affected, cultivated area affected, people affected, and total value of damage. The annual losses have undoubtedly increased. However, price inflation, greater occupancy of flood plains, better reporting of damage can also greatly account for this. Besides, rainfall cycles and unusual rainfall events can also be the explanations. It has been seen in north-eastern USA where the forest cover has been increasing since the beginning of this century, there has been no sign of decreasing flood severity.[11]

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11. Hamilton,L.S.; 1987; op.cit; 256-263.

Rigorously conducted water-shed research has been able to dislodge a number of myths. There are no valid reasons that forests can check major floods on large rivers, as there is no causal relationship. However, forest clearing followed by unmanaged agriculture and grazing can aggravate flooding. Hence, our focus should be on conservation farming. Floods are caused by too much rainfall or snowmelt in too short a time for the soil and the channel to handle and are etermined more by basin characteristics, river constrictions by roads and bridges, large non-absorbing surfaces in cities which increase surface run-off, glacial outbursts, inadequate levees, and increasing occupancy of flood plains.

It has been well illustrated that cutting of forests usually results in the free water-table moving closer to the surface as less water is lost due to evapotranspiration. (When the subsoil has considerable concentration of salts, it has been seen that the salt is brought closer to the surface, therby rendering surface water saline). This is just opposite to the popularly held view that forest removal leads to lowering of

water-table. This can be the case only in `cloud' forests that capture additional effective precipitation or if forest removal was accompanied by soil compaction by mechanical equipment or by over grazing, or by unmanaged cultivation. All these can result in less water infiltration.

Besides, tall forests have greater evapotranspiration rates due to greater canopy roughness and deeper root systems compared to other vegetation types. Except for `cloud' forests, greater removal of forests leads to greater water yields. Water yield decreases to pre-cutting levels in 6-12 years depending on the speed of canopy regeneration. Catchment research has also shown that forest removal has shown greater stream -flow through out the year including the dry season. Following forest cutting there is an increase in peak flow, an increase in storm-flow duration and volume. However, this can occur due to peak rainfalls too, as the soil has its capacity to store water, and the rest flows off. On sites prone to shallow landslipes, root decay following tree felling can increase slope instability until

root systems are restored. In mountainous areas removal of forests through dragging, skidding and roads accelerate erosion. Traditional shifting cultivation, gathering minor forest products, and fodder lopping have little impact. However, in the steep slopes of the Himalayas, litter collection accelerates soil erosion as it bares the soil.

This does not mean that unscientific farming and mechanical clearing does not increase soil erosion. However, it should also be known, that in the tectonically uplifting Himalayas erosion is natural. Human interference if unmanaged can aggravate the problem of erosion Soil erosion invariably increses sedimentation. This, however, is not evident immediately as initially sedimentation occurs in temporary storages in the watershed. It is also to be stressed that sedimentation is also largely connected with the absence of flood -plain forests as sediment traps, as there is a considerable contribution of sediments from floodplain croplands.

All these problems are further compounded by the inseperable difficulty of translating

impacts measured on small plots to entire large basins. At every higher level, problems increase exponentially as more factors enter into play and also variations of various factors being measured increase. For instance, erosion rates measured on a small plot are not the same for the entire basin. This is because eroded material moves into temporary storages in topographic depressions, footslopes, alluvial fans or in the beds of tributory drainages. These may be moved out during storm events or may be colonised by plants to form temporary relief features. The sediment delivery ratio[12] may be almost 100 percent for short steep streams. However, this decreases greatly with basin size. The Ganga-Brahmaputra in its lower reaches have very low sediment delivery ratios, of below 10 percent. Besides, most of these are from storages and channel erosion. Even a complete stopping of human activities in the hills will cause little change in the sediment of the lower reaches of these basins as storages of past erosion will provide a long-term supply.

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12. The ratio between erosion occuring on-site and sediment at a point in a stream.

Thus, at a micro-level, sediment load is influenced more by human activity than by stream discharge characteristics, though human influences are less important to natural processes for flood and sediment problems for the high Himalayas taken as a whole. At the meso-level, the reasons for downstream flooding and sedimentation are unclear. However, natural processes play an important role. At the macro-level, in large basins, human impacts in upper reaches are insignificant in causing low-land floods, low flows and sedimentation. However, human impacts in the lower reaches themselves are significant.

According to Carson (1985) :

> "Flooding and sedimentation problems in India and Bangladesh are a result of the geomorphic character of the rivers and man's attempts to contain the rivers. Deforestation likely plays a minor, if any role in the major monsoon flood events on the lower Ganges. Better management of existing forest lands and marginal agricultural lands is mandatory however, to ensure the continued livelihood of the Himalayan hill farmer".(13)

Floods are often thought of as being caused by deforestation. However, most floods are due to too much rainfall in too short a time. For

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13. Hamilton, L.S., 1987; op.cit; 262.

instance, the floods of June, 1985 which killed 237 persons in six Indian States were due to rainfalls of upto 414 mm in 24 hours when the soils were already saturated by monsoon rains.[14] With entire basins forested too, there would have been disastrous floods. Forests are perfectly functioning ecosystems with the capability of producing many products on a sustainable basis, and so they should be well managed. However, they will not prevent floods or sedimentation in the lower reaches of rivers. Almost all scientific evidence collected in recent decades by watershed researchers fail to link upstream `deforestation' with downstream reduced flows in the dry season and floods in the wet season.

Watershed research has demonstrated clearly that short-duration (5-minute) rainfall events generally cause more surface run-off on bare soils than on forested area. However, downstream flooding is caused normally by rainfall events of much longer duration. Bare surfaces could only result in soil erosion and flooding at a local level, and could not generate major flooding in such a far-off and such a large area as

the Gnaga plain. Deforestation and reforestation by themselves will not influence major flooding. These are primarily influenced by geomorphological and precipitation characteristics. These concepts, however, are applicable only for humid areas in the Himalayas, and not for semi-arid areas as processes in the latter areas are significantly different. Development of a well negetated soil surface will decrease overland flow from short-duration, high-intensity rainfall events. This will have little impact on major downstream flooding, though, it will significantly increase surface soil infiltration capacity, thereby reducing sheet and gully erosion because of reduction in surface run-off from short-duration high-intensity rainfall. It should, however, be mentioned that there is a great difference between local flooding and major downstream flooding in a large basin. It should also be noted, that it is likely to take several decades after the initiation of reforestation programmes before the soil conditions approach those of a near-natural forest.[15]

15. Gilmour,D.A., Bonnell,M., and Cassells,D.S.; 1987; op.cit.239-249.

Water is of tremendous importance in high-altitude environments. Very heavy rainfalls on the Himalayas cause highland and lowland floods, whereas droughts occur when rainfalls are low. Water as an agent of erosion reduces agricultural productivity in hihglands and causes increased sedimentation in the lowlands. Water can saturate the soil, thereby causing slope instability. Water resources if harnessed can facilitate economic development through the generation of hydroelectic power and its use in irrigation. Despite such great importance of water for the Himalayan region, the interaction between water and highland soils is still not well understood and hydrologic data limited. Data on climatic variables are limited and if present cover only a short span of time. Besides, there are only a few site-specific studies on snow-melt and stream-flow characteristics. Studies of run-off processes are important to evaluate the effects of land-use on hydrologic characteristics. We still tend to believe that slope denudation leads to less infiltration and groundwater storage and dry season low-flows, increases overland flow and flooding in the wet season. The hydrologic system is rarely so sim-

ple. Till now no empirical study conducted in the Himalayas has been able to establish these linkages. A study conducted on 1976 in the Dehra Dun region on paired basins indicated that reforestation significantly reduced annual as well as peak stream flows. It is unlikely that infiltration, soil moisture storage, and ground-water level will decrease due to reforestation alone. Almost all studies conducted on the hydrologic effects of forest removal have shown increase in low-flows. Deforestation if accompained by soil compaction can, however, have different results. To understand the hydrologic impacts of various land-uses in the Himalayas, hillslope and catchment hydrologic studies such as soil property investigation, plot studies, paired catchment experiments, evapotranspiration assessments and water balance demonstrations should be undertaken.

Till now there exists considerable uncertainty regarding the influence of land degradation on sediment loads of major rivers compared to the contributions made to the sediment load by natural slope processes and catastrophic events, that

contributed to by human activities are insignificant. However, proper management of land is important to maintain soil productivity and slope instability. But proper management can be brought about only after a thorough study of natural and human processes acting in the Himalayan region is studied. Due to the lack of this, experience from other areas have been applied. However, these have failed to account for the extreme rainfall, relief and erodibility witnessed in the Himalayas. There have been numeurous cases where measured sediment loads of streams and reservoir sedimentation rates have been much higher than the estimated values.[16]

Besides, intensification of forestry can mean different things to different people. It may be to increase provision of forest benefits. But for what ? To answer this we need a clear forest and land-use policy. This is a political process and beyond scientific, technological and economic parameters. Often forestry activity is in a policy vacuum. However, it aims and potential impacts

16. Kattlemann,R.,1987:Uncertainity in Assessing Himalayan Water Resources; Mountain Research and Development, 7(3), 279-286.

require to be studied before hand. Our choices and priarities should be clearly mentioned. It is essential to know whether we desire quantity or quality of forest products; whether we should go in for monocultural plantations or mixed species forests; or whether we should go into forestry activities for commercial or subsitence purposes. It should also be considered for what purposes we need forests - for fodder, fuel, timber, manufacturing, or for checking situation. These needs have to be established qualitatively and quantitatively. Besides we should study the rate of biomass production of various regimes. Also, if it is for subsistence purposes, we should achieve proper linkages between development activities and local knowledge and support.[17]

Though deforestation per se might not lead to flooding and increased sedimentation downstream, soil erosion in many Himalayan areas is attaining increasingly menacing dimensions. According to some estimates, the annual average soil loss from the Himalayn hills is around 28.2 tonnes ha^{-1} yr^{-1}

17. Griffin,D.M.; 1987: Intensified Forestry in Mountain Regions; Mountain Research and Development, 7(3), 254-255.

The annual silt load of Karnali catchment is around 75 mi.cu.m. which is equivalent to a 1.7mm thick layer of soil spread over the entire catchment. Besides, the Kasi and the Ganga rank at the top of the World's greatest sediment carrying rivers.[18]

18. Naraya, V.V.D.; 1987: Downstream Impacts of soil Conservation in the Himalayan Region; Mountain Research and Development; 7(3), 287-298.

CHAPTER 4

CHANGING MAN - LAND RELATIONS IN THE HIMALAYAS

To start a discussion on man - land interactions in the Himalayas it would be rather essential to begin with a preliminary overview of the cultural disparity and geographical diversity of the region. The ruggedness of the Himalayas and its varied climates have affected population distribution by inhibiting communication in ancient times, and has thereby caused cultural isolation and differences among its inhabitants. Variation in climate and terrain have necessitated variation in cultural adaptations. This has resulted in the region's varied ethnography. The Himalayas can be broadly divided into four cultural regions,[1] ie., Hindu(Indic), Lamaist Buddhism (Tibetan), Islamic (Afghan-Iranian), and animistic (S.E. Asian). It is thus clear, that cultures migrated into the Himalayas from South, North, West and East, thereby making the Himalayas into a complex cultural area.

Generally, the Indic culture is dominant in the sub-Himalayas and the Middle Himalayas. To the north

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1. Areas within which life-styles are generally distinct and homogenous.

of this in the High Himalayas the Tibetan cultural region exists. In an area from 6000-8000 ft (1829-2439m) and in some places even upto 10,000 ft (3048m) altitude in Central Nepal, the Indic and Tibetan cultures have intermingled to form a distinct cultural region. Elsewhere these cultures meet directly without a transitional zone. People of Western Kashmir have Afghan - Iranian cultural traits, and those in the eastern Himalayas show traits of S.E.Asian culture (Karan, P.P.; 1987).[2]

Geographically the Himalayas can be conveniently divided into three macro-regions from South to North, with each region having its distinct man-land characteristics. The piedmont plains or Terai accounts for only 10% of the Himalayan area, but as much as 35% of its population and nearly 70% of its cultivated area. The Middle Mountains with its several large valleys accounts for around 60% of the area, 55% of the population and 28% of the cultivated area. In this region, the population density is high and per capita cultivated land extremely low. The high mountains constitute 30% of the area, but account for only 10%

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2. Karan,P.P; 1987: "Population characteristics of the Himalayan Region", Mountain Research and Development, 7(3), 271-274.

of the population and 2% of the cultivated area. Though cultivated land per capita in this region is low, the people have supplemented their incomes through traditional activities such as livestock rearing and trade,as well as such modern day activities as tourism (Karan,P.P.; 1987). However, the closure of the border with Tibet in the 1950s brought an end to trading activities, and with it the traditional way of life of many mountain people from Ladakh to Bhutan. This also meant that people of Tibetan Buddhist cultures living in the Himalayas were cut-off from the intellectual heartland of their religion, Lhasa.

Mountain regions which are "regions of difficulty" due to environmental conditions are the "regions of refuge" of cultures which have been continuously pushed by more dynamic people from the plains. In many areas in these mountains, people have still maintained their archaic pre-industrial lifestyles. These people have adjusted demographically and socially to environmental limitations, as there is little potential of expanding or intensifying human activities. To such environmental limitations and to the encroachment and incursions of

lowland peoples, they have adjusted by means of a defensive isolation or "encapsulation".(Goldstein, 1981; Brush, 1982) Hence, the man-land adjustment patterns in these areas, are not just an adaptation to the physical environment. This necessitates an understanding of the cultural ecology of these areas. Hence, although isolation and withdrawal are the characteristics of these "regions of refuge" and "encapsulated areas", its present pattern can only be understood in its linkages with the outside world. The Himalayas located on the periphery of regional and inter-regional development, thus has to be understood with the aid of the core-periphery concept and the dependency theory. Sociocultural, economic as well as ecological change in the Himalayas should be examined on a cross-cultural basis with due consideration given to both internal and external forces.

Mountain areas have a series of altitudinal zones as niches, the resources of which can be used in different ways. To utilize the potential of the environment, (which due to environmental conditions are already limited), which are vertically stratified, man has to be mobile, eg. the practice of transhumance. The economy in the mountains is basi-

cally based on pastoralism and agriculture which are separated in time and in space. The practice of transhumance could well have been due to population pressure that gradually forces people to utilize resources of higher altitudes. Population thus becomes an independent variable, which stimulates the intensive use of the environment. This is somewhat a variant of Boserup's (1965) hypothesis that population growth leads to technological change. However, economic activities in the high altitudes in the Himalayas reached its zenith with the practice of transhumance as well as trade when Tibet was a buffer in the "Great Game" between Great Britain and Russia. This has presently declined following the take-over of Tibet by the Chinese and the delineation of more or less well-defined borders between the neighbouring countries.

The altitudinal zonation of mountain ecosystems facilitate different economic activities - a high-altitude zone of extensive pasturing, a lower zone of unirrigated farming of tubers and hardy cereals, and a zone of intensive irrigated agriculture. Such zones could be adapted for human use in atleast two ways: (1) by an extended family or a group in diffe-

rent seasons, or (2) by particular groups which exploit resources of a single zone but exchange products with groups utilizing other zones.. However, it should be mentioned at the very outset that such man-land adaptations are basically ideal types, and have been profoundly modified or remain only as vestiges, and actual adaptations can be varied and complex. Besides, as in the Himalayas, apart from altitudinal variations, regional variations in resource availability and use are also important. There are innumerable examples of varied ecological niches produced by micro-climates or accidented terrain, eg. north and south-facing slopes, rain-or-snow-shadow slopes, etc.

Such types of land-use is essential in these areas where level land is at a premium. However, it might be wrong to assume all such adaptations as a result of population presssure, as it can very well be a strategy in minimizing risk in a difficult environment, as crops can be destroyed by freak snowfalls, hailstorms and cold spells. Such a system also ensures a balanced spatial and temporal division of labour, as peasants are often concerned at maxi-

mizing labour input besides increasing productive output (Skeldon, 1985)[3].

An analysis of the breakdown of these systems is difficult to attempt, as that might imply that prior to the process of breakdown there existed a stasis or an equilibrium in man-land relationship. However, if at all the life-styles of mountain peoples was changing it was doing so very slowly. This was changed with the arrival of the Europeans when radical changes occurred. The pace of transformation has been particularly rapid during the present century. Infant nation states were gradually born when the colonial powers withdrew. However, the process of transformation continued unabated, and in fact was intensified. Mountain zones, like other buffer zones were incorporated within more or less precisely defined borders, and political pressure was used on these areas to bring them effectively under central control. It became necessary to defend these areas, as well as to dampen any secessionist activities, (if they existed), as they threaten the integrity of the

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3. Skeldon, R.;1985: "Population Pressure, Mobility and Socio-economic change in mountain Environments: Regions of Refuge in Comparative Perspective", Mountain Research and Development, 5(3), 233-250.

infant nation states. Besides, various "development" activities were initiated in these areas to draw these people into the mainstream. Such changes resulted in population growth in these areas due to both internal and external forces, the former due to population growth of the indigenes, and the latter due to migaration of lowland people. However, these processes are inter-related and cannot be understood singly, as external forces can influence internal processes, eg. modern scientific farming practices and modern medicines are important in influencing the population growth of indigenous people.

Many high mountains though densely populated were, until recently, relatively secluded areas, and their external relations with the mainstream cultures of the lowlands was only partially developed. The socio-economic integration of these peripheral areas started with labour out-migrations due to increasing populations and subsequent pressure on land. With integration came the flow of income, goods, and services.[4]

It is convenient to understand these processes in the light of Friedmann's (1966) centre-periphery model and Zelinsky's (1971) mobility transition hypo-

thesis. Mountain areas are peripheral to the overall system. There are few large cities in these areas, and even if present have limited spheres of influence in intermontane regions, eg. Srinagar and Kathmandu. However, these mountains have within them different levels of peripheral locations according to transport and communication development.

Theories of core-periphery are essentially economic ones with their abstract concept of space. Space is considered as a homogenous socio-economic field, but the components of physical and ecological forces, which are refelected in the degree of accessibility, communication, settlement, and the importance of historical process have not been considered. For our present discussion it would be helpful if we define the periphery as "to include those relatively less-developed regions which, together with their dynamic urban centres, form a spatial system which depends politically and economically on the centre and receives innovative impulses from

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4. This, however, is not fully applicable to the European mountain areas, as there the integration process was accomplished much earlier.

it".(Grotzbach., E., 1984;pp.230).[5]

Friedmann(1966) distinguished the four stages of development as : pre-industrial, transitional (with incipient industrialization), industrial maturation , and post-industrial. The pre-industrial spatial structure is characterised by small independent local centres with no hierarchy and weak interaction. Such areas existed in high mountain areas as in the mountains of Central Asia. According to Zelinsky (1971) in such a pre-modern transitional society there is little migration. During the second stage of incipient industrialization a single strong centre emerges together with an emerging periphery. This centre becomes the focus of mass immigration, in the early transitional society of Zelinsky (1971). This also results in the creation of regional imbalances. This increased mobility of labour according to Friedmann (1966) is important as it brings the mobile factor of production, i.e labour, towards the centre. Such cases are predominant in many mountain areas of the developing world. In the next stage of industrial spatial structure there develops a single na-

5. Grotzbach, E.; 1984: "Mobility of Labour in High Mountains and the Socio-Economic Integration of Peripheral Areas", Mountain Research and Development, 4(3), 229-235.

tional centre but many large peripheral subcentres together with the reduction in the size of the periphery. In this late transitional society there is declining but still a major migration towards the centres. In the penultimate post-industrial stage all parts of the state are functionally integrated. In such an advanced society migration is largely inter- and intra-city together with an increase in commuting and tourism, as is the case with mountain areas in Western Europe.

The Alps and other mountain areas in Europe were integrated into their regional economic systems very early due to the mobility of labour, the prosperous transit trade, and the development of transport networks. Heavy out-migrations from some over-populated areas exceeded the natural growth of population. Besides, the carrying capacity of the mountains increased considerably due to employment opportunities in tourism and industry. In comparision, in the mountain areas of Asia, Africa and Latin America the pre-modern stage continued upto the middle of the 20th century. Mobility though it existed, it was on traditional lines. The integration of these areas started with the more or less exact boundary demarca-

tion between neighbouring nation states. This brought about a population explosion in these areas due to improved health care facilities.[6] The population pressure on land thereby created, eroded the self-sufficiency of these areas. As a result, to supplement incomes migration to neighbouring cities began in a big way. Incomes were supplemented by working in industries, in irrigated agriculture in the lowlands, and even by joining the armed forces as in Pakistan, Garhwal, and Nepal. The in-remittances created a "money-order economy" in many areas and resulted in a monetised economy in the mountains. It is to be noted, however, that such migrations can be temporary, quasi-permanent, or permanent, depending on the socio-economic factors of regions and individuals. Due to the presence of quasi-permanent migration, Friedmann's and Zelinsky's stage models have only limited validity in this case. Grotzbach (1984) has thus introduced four types of mobility processes for densely populated mountain areas which have a long history of human habitation. These are not evolutionary stages in the strict sense.

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6. This aspect has already been discussed at length in the previous chapter, and so does not require a repetition here.

Grotzbach's (1984) Type 1 includes a quasi-static agricutural system. There are few external contacts but strong intra-montane mobility. This is a pre-industrial type and is today present only in relics. His Type 2 is agricultural with supplementary non-agricultural income. This is the dominant type in the Himalayas. Due to increasing pressure on land, people are forced to out-migrate leading to high inter-montane mobility. Incomes are supplemented by temporary migration for work. Besides, return migration there is also mobility towards the mountains essentially in the form of tourism. Type 3 is agricultural-regressive together with a decaying periphery. This is prevalent in the industrialized countries, as in the Southern Alps and parts of Pyrenees. Because of the lack of alternative employment, there is large-scale out-migration, which in many cases has resulted in declining population in these areas with a predominance of aged people. This also results in a decrease in agricultural land utilization and mobility. Some out-migrants do come back for vacations or to spend retired life in these areas. Type 4 is dynamic with non-agrarian incomes dominating. This is the case with highly developed mountain areas as in large parts of the Alps, and

partly so for some parts of the Himalayas, for example the Khumbu area. Mass tourism and commuting has become important in such areas. Though permanent migration in these areas continues to be important, it is largely to the numerous urban centres that have developed in the mountain areas themselves. In-migration from the lowlands is also significant locally which is primarily connected with tourism. This type of mountain areas have become fully integrated into their regional systems (Grotzbach, 1984).[7]

Population growth and changes in adaptation patterns of local land-use are directly related. The pressures of population on land has been one of the most intractable problems in many developing countries. This is so in many mountain areas too. Middle mountains in many parts of the world were inhabited very early, due to their relatively disease-free environment, conducive climate with reliable and often high rainfall, usually fertile soils, and the protection they provided against intrusions. In the past population explosion in these areas was generally the result of immigration from adjacent lowlands.

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7. Grotzbach,E.;1984: op cit; 229-235.

In the last century with increasing pressure on land in these areas, however, the movement has been reversed. This is the case in the Himalayas as well as in many other mountain areas of the world.

For a long time population growth for Nepal was around 1% per year. With enough land still uncultivated , more food could easily be produced by converting forests into arable land. However, in the present century, improved health care reduced the mortality rate from 38.0 to 16.6 per thousand between 1951 and 1985. However, with fertility remaining almost unchanged, population growth increased to around 2.7% per annum, and is expected to be around 3% per annum by 2005. Nepal's population has thereby grown from 8.3 million in 1951 to 16.7 in 1985 and is projected to be around 30 million by 2005. Between 1901 and 1981 the population of the entire Himalayan area from Kashmir to Arunachal Pradesh tripled from 11 million to over 33 million. Present estimates place it at 50 million. With the economy growing slowly, most of this growing population had to be accomodated in the agricultural sector, with already 85% households in Nepal in 1985 being dependent on agriculture.

There are two possibilities to feed this growing population, i.e., either to increase the area under cultivation by converting forests into farmlands, or to increase the intensity of cropping. However, the first option is greatly limited. Though Nepal has about 730,000 hectares, (in addition to the present cultivated area of 2,410,000 hectares), that could be brought under cultivation, there are other constraints. Forests cannot be entirely done away with as 90% of Nepal's energy demands are met though the combustion of biomass. Besides, forests are essential to provide fodder and forest litter to supply organic matter to arable lands. In such areas where little inorganic fertilisers are in use, each hectare of cultivated land requires to be supported by 2 to 4 hectares of forest land if soil fertility is to be maintained. In view of these constraints and also considering the area that will be lost due to the increase in the area under settlements and roads, it is estimated that only another 160,000 hectares could be converted into farmlands, i.e., only 7% of the present cultivated area. Hence, the second option of increasing the intensity of cropping should be looked into. Over a period of two decades between 1965 and

1985, cultivated area increased by 31 % from 1,840,000 to 2,410,000 hectares, and the annual cropped area increased by 100% from 1,995,000 to 4,002,000 hectares. This means, that the cropping intensity[8] increased from 108% to 166% over the same period. However, yields have not increased, and it is this that needs to be looked into urgently (Hrabovszky, J.P. et.al; 1987)[9].

The ultimate resource to increase production is technological change, which will mean imports of some maufactured products and other inputs. However, at present this is not much in evidence in Nepal with only 4% of total plant nutrient replacements being provided by inorganic fertilisers and with only 10% cropped area under improved crop varieties. Under such conditions when land resources are limited and technology stagnant, societies adapt in different ways. In Nepal, as in many other mountain areas it has been through out-migration. Population from the Middle mountains have gradually been moving into the

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8. Annually cropped area/cultivated area x 100.

9. Hrabovszky, J.P;and;Miyan,K.; 1987: `Population growth and Land-use in Nepal "The Great Turnabout;' Mountain Research and Development, 7(3), 264-270.

intermontane valleys and the Terai. This migration is both rural-to-rural as well as rural-to-urban. However, migration also takes various forms such as seasonal, temporary, single person, group migration, etc. Though generally the Nepalese used to migrate to India in search of employment, in recent years there has also been an increasing Indian immigration in the Terai and the urban centres of Nepal.

It is necessary to intensify land-use forms not only in agriculture, but also in grasslands and forests. Agricultural areas for this purpose may be differentiated into high or low potential areas, and with good or bad accessibility. In areas of poor access, primarily reliance need to be placed on local inputs, with the produce primarily meant for local consumption. However, some cash crops can also be grown. Cultivation in areas with good accessibility and irrigation facilities should be intensified, and high yielding inputs utilized. These areas will require to produce a marketable surplus required by urban populations, agricultural processing industries, and for exports. This activity will be primarily in the Terai, however, with improvements in life-styles and increasing urbanization the middle

mountains will also be important due to growing demands for fruits and vegetables. This can considerably relieve the pressure on marginal areas which can be utilized for less degrading activities such as tree-crops, pastures and forests.

Grasslands are presently under uncontrolled grazing practices by low productivity animals which also suffer from high morbidity and mortality. Grasslands are to be properly managed, besides, higher pproductivity animals need to be introduced. Agricultural by-poducts for animal feed can be better utilized, for example through straw treatment for better digestibility. Soil fertility can also be increased by growing short-term leguminous fodder crops. However, due to the great demand for foodcrops this will be limited. Measures should also be taken to limit animal numbers to the absolute minimum. Forests should be categorized and managed likewise. Forests with protection function need to be preserved, commercial forests should be optimally utilized, and community forests should be maintained to provide maximum sustainable output for the local people's diverse needs. Thus, all types of land-uses need to be utilized more intensively. Land-uses should be

the most productive as well as the least degrading. The most productive and least degradation-prone areas need to be utilized intensively, so that pressure on original lands is reduced, and so that these lands can be put to appropriate non-degrading uses. It is also very essential that we appreciate and understand better the various linkages in this system. Agriculture depends on animals for motive power, and animals depend on forests, grasslands and crops for fodder. Livestock also influences forest regeneration (negatively) through grazing and lopping in forest areas. However, forests are the ultimate providers as they provide land for cultivation and grazing, fodder, litter, timber and fuelwood.(Hrabovszky, J.P. et.al., 1987).[10]

With large-scale migration into the Terai there are going to be major changes in the regional distribution of population in Nepal. Changes in land-use will also occur due to an increasing population with a subsequent lowering of land per person ratio. It is estimated that per capita cultivated area will decrease from 0.14 hectare in 1985 to 0.09 hectare in 2005. Though cropping intensity will increase from

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10. Hrabovszky, J.P; et.al; 1987; ibid; 264-270

163% to 182% over the same period, the annually cropped area per person will decrease from 0.24 to 0.16 hectare per capita. Yield increases will account for 90% of the increase in output and fresh land under cultivation will account for the remaining. Increases in yield will be largely due to the extension of irrigated area. It is to be noted, that about 45% of the final total cultivated area of Nepal can be irrigated. At present only one-third of this potential is being utilized. It is also important to note the balances between production and requirements of food by ecological regions. The Middle Mountains and High Himalayas will show an increasing deficit. Though this can be met by the Terai surplus, the actual transfer of food might be difficult (Hrabovszky, J.P. et.al., 1987).[11]

The grain availability position for Nepal showed a surplus of 66,921 metric tons in 1971 and a deficit of 108,278 metric tons in 1981. In 1981 the Terai was the only region with a grain surplus and even there it was predicted to be eliminated by 1987. In the Middle Mountains, the deficit of 70,697 metric tons of 1971 increased to 123,755 metric tons by

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11. Hrabovszky, J.P.; et.al; 1987; ibid; 264-270

1981. This has resulted in the requirement of food aids. However, local food deficit and increased aid may as in Africa, have negative effects such as corruption, distribution problems, decline in maternal and child health due to decline in self-reliant agriculture, etc. Hence, outside agencies can aggravate problems by denigrating traditional society, like for exa mple, by monetising a traditionally non-monetised eco nomy and encouraging modern consumption patterns.This might cause unwise changes from tradition. For instan ce, the Magars used to bridge food deficit in the months preceding the monsoons by consuming forest pro ducts such as yams, berries, and hunting and fishing. Monetisation of the economy and the shrinking of forests has created difficulties. Now, during this period the Magars fall into debt. For instance, 90% of all debts in Nepal are for consumption items and interest rates are as high as 32%. In Middle Mountains an estimated 35% of households are in debt. These debts are in stark contrast with those of a tra ditioinal society where it is a redistributive mechan ism, and is a prerogative of rank (Pitt,S.C, 1986).[12]

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12. Pitt, D.C.; 1986; "Crisis, Pseudocrisis, or Supercrisis : Poverty, Women and Young People in the Himalaya. A survey of Recent Developments", Mountain Research Development, 6(2), 119-131.

Outside interference has been most severe and traditional resistance least effective in the environmental field. This has been as traditional tenure rights for common lands were not clearly marked. This made exploitation by external agencies easier. This also brought about a demise of traditional eco-philosophy, which is as fragile as the environment itself. Earlier forests provided many resources such as herbal medicines and foodstuffs. However, with the introduction of modern medicines and foodcrops, forests were increasingly felled to provide primarily for fuelwood needs.

If we have a look at some figures for Nepal then the picture certainly looks bleak. Nepal ranks 5th to last in the list of LDC's ranked according to GNP per capita figures compiled by World Bank for 1981. The agricultural production growth rates during 1960 to 1979 was 1% per annum. Infant mortality rate was 145 per thousand in 1982 compared with the figure of 87 per thousand the average for low income countries in 1981. The literacy rate for 1984 was 24% and only 9% of the population had access to safe drinking water. However, these figures have limited relevance under the present circumstances. GNP as an indicator of

poverty, or even development, includes only quantifiable elements and the entire sustainable economy is virtually excluded. Due to this reason it is quite meaningless especially in Himalayan states where the subsistence and non-monetised economy is substantial. An estimated 70-80% of the total production in Nepal is accounted for by the subsistence sector. Physical quality of life indices are also not fully representative, as not all births and deaths are registered. Besides, concepts like literacy are ethnocentric and have little relavance in oral cultures(Pitt, D.C., 1986)[13].

Such figures can be interpreted variously to arrive at different conclusions. Hence, according to some the Himalayan region is experiencing a crisis, and according to others the crisis is more apparent than real. To understand the problems in the Himalayas statistics are not overtly helpful as the aggregate data, are site- or time-specific, and by themselves do not explain the causes and the dynamics. Population growth is often said to be responsible for increasing poverty. This might be a gross over-simplification, as it is a social product condi-

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13 Pitt, D.C.; 1986;ibid; 119-131.

tioned by the economic and social structure. Population growth may be a symption of the system and not a cause.

However, it is to be recognised that contemproary land-use in the mountains has undergone large-scale changes due to external interventions. Migration, mechanisation, and modernisation brought about largely by the the construction of roads have integrated formerly remote areas. Commuting, tourism, and short-term migration have altered the traditional circulation pattern which was related to terrain limitations. Such accessibility has enabled farmers to free themselves from the need to be self-sufficient, but rather engage themselves in monetarily more lucrative activities. There was no longer the need to grow foodgrains and grass became the principal crop with the growth of animal husbandry and dairying. Besides, in many areas various types of plantations became important. Abandonment of farms in inaccessible areas and migration enabled consolidation of farm holdings. Hence, the tiered belt model of mountains became obsolete.[14]

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14. This is particularly representative of the Alps. However, such processes at varying degrees are underway in most other mountain areas.

Such a relatively simple technological operation of road construction has been responsible for many of these changes. In this connection it can be mentioned that most mountain roads built in south Asia have not been built for economic development but for political-strategic purposes because of the belligerant attitudes of contiguous nations. However, whatever the reasons for construction, mountain roads have major economic-ecological impacts. Nepal is the only country in this region which has not gone in for massive mountain road construction as it has reasonably amicable relations with the neighbours. Ironically, the same country has suffered tremendours environmental damage! In Afghanistan, Pakistan, and India these roads have acted as arteries to relieve excessive pressure on land through large-scale out-migration. Thus, instead of a growing low level intensity of mountain land use, there has been an increase in its intensive use. This has been possible with the introduction of new crops and the facilities and ease of marketing crops which cannot be grown in the lowlands in summer. In the case of Nepal an increasing population has increasingly resorted to plundering the forests for resources. Now, only when the law of diminishing returns has become

fully operative, there is a noticeable trend of out-migration (Allan N.J.R, 1985)[15]

People in Nepal's mountain areas traditionally had a complex pattern of movement based on trade-exchange of Tibetan rice for Nepalese grain. With the closure of the border this trade has been terminated. Also the construction of roads from the low-lands has made possible the distribution of salt from the south. However, such "development" has also irreparably damaged the economic basis of people of high-altitude areas such as Humal and Mugu (Haimendorf,1974), as all have not been as fortunate as the sherpas of Khumbu who have found an alternative in the tourism and mountaineering business. Some villages earlier dependent on trade have recorded population decrease, for instance, the population of Tukche in the Dhaulagiri zone declined from 495 in 1962 to 223 in 1976 (Haimendorf, 1981). People practising transhumance now move their flocks to the lower hills rather than the higher altitudes. These

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15. Allan, N.J.R.; 1985: "Periodic and Daily Markets in Highland - Lowland Interaction Systems : Hindu-Kush-Western Himalaya", in Singh, T.V. and Kaur, J.(eds): Integrated Mountain Development; Himalayan Books, New Delhi, 239-256.

people who earlier identified themselves as Bhotias, as distinct from the people in the Middle hills, now wish to be identified with the main hill-groups such as the Chhetris and Gurungs. In Nepal there has been a progressive physical and psychological movement downwards from the high altitudes. The Gurungs in the 19th century were high-altitude pastoralists besides carrying on trade with Tibet. However, since the beginning of the present century they started to move down into the Middle hills and have since become sedentary rice cultivators. But it is also to be noted that the cessation of warfare after the 19th century added to population pressure on land, thereby necessitating intensification of the economy. However, at present, these Gurung villages are facing problems of land availability due to their natural increase, the continuing immigration from higher altitudes, and the decline in army recruitment (both British and Indian armies) This situation might worsen and thereby increase umemployment, inequality, malnutrition, landlessness and ecological imbalance (Mac Farlane, 1976)

Though the Sherpas have prospered due to tourism-related activities, they have suffered internal dis-

ruptions. Tourism being more lucrative, agricultural production has received less importance and hence is no longer self-sufficient. Besides, tourism has added to deforestation. Traditional practices of limiting fertility have broken down and has led to population increase and land fragmentation in some areas.(Goldstein, 1981). In other areas, birth rates have become lower than death rates as even females porters can earn substantially during the trekking and mountaineering season (Pawson, 1984). Besides, the attitude towards the environment has shifted from long-term conservationist to a short-term exploitative one. As in the Alps, the Khumbu area also shows depopulation in the more isolated areas and population increases in the tourist centres. A stage-wise migration can be seen in Nepal, from the high-altitudes to the Middle hills, the Terai, and the urban centres. Gradually Nepal society is becoming a predominantly lowland-urban one. The situation in the Middle hills is the most precarious with increasing population pressure and environmental degradation. Such crisis can possibly leave the hills in Nepal as areas of remanent cultures and wasted landscapes.[16]

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16. Skeldon, R.; 1985; op.cit; 233-250

The Khumbu region underwent a rapid transformation from subsistence to a cash economy together with substantial improvements in living standards. This has been due to the influx of tourists into the region. Between the early 1970s and the 1980s the annual number of tourists visiting this ares rose from a few hundred to over 5000. However, much of the environmental damage hitherto attributed to tourist - related activities actually had started before the increase in tourism. It was due to the introduction of potato in the late 19th century allowing more population to be supported on the land than that was possible from traditional roots and tubers. With this increased requirements for fuelwood and construction timber increased, thereby reducing the earlier thick juniper forests to a combination of grasses, dwarf junipers, and dwarf rhododendrons. Regeneration of forests was made difficult due to increased need for agricultural and grazing land.

The establishment of the Sagarmatha National Park at Jorsale in 1976 has been very effective in monitoring tourist flow and activities. This has also enabled to enforce strict regulations on incoming outsiders to bring their own cooking materials.

Besides, with a declining population growth rate in the area, (as has been occurring) the demand for fuelwood is likely to lessen. An average Sherpa household in the area consisting of 8-10 persons burns 25 kg of firewood daily, which at the 1982 population level works out to be 2781 tons annually for the entire population. This is below the estimated yield of commercial forests of the area which is 5126 tons. The development of hydroelectric power in the area will further decrease demands on fuelwood. The area has an estimated hydro-electric power potential of atleast 11.84×10^{9} KWH per year, which is equuivalent to 1.38 million metric tons of coal.

It is also to be noted that there are few signs of widespread erosion in the Khumbu region due to excessive wood cutting. Damage has been mostly caused by natural geologic events such as the glacial lake overflow near Dablam in 1977. Erosion has been greatly controlled due to the growth of shurbs such as Cotonoeaster microphyllus, Rhodendron setosum, and R.anthopogon that finds the topsoil. As regards environmental degradation, more important than tourist-related fuel use has been waste disposal, which despite stipulations on waste removal by visitors has

increasingly led to many areas being covered by litter and many streams become polluted (Pawson I.G, et.al.,1984).[17]

Besides, it should be noted that the impact of tourism in the area has varied from village to village, with maximum development in Namche Bazar the focal point of tourist traffic, with numerous tourist lodges, grocery stores, a bank, and a telegraph office. In contrast, villages away from the main trekking routes have changed little, with considerable depopulation in certain areas, eg. the village of Thami which is located along the main trail to Tibet across the Nangpa La. However, with the Chinese government considering a partial opening of these old trading routes, it is possible that even this area will gain in economic significance.

Concern has invariably been increasingly for the physical environment and the social environment has been neglected. Despite the remoteness of these areas the social structure of these people have been

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17. Pawson,I.G.; Stanford,D.D; Adams, V.A. and Nurbu,M.; 1984; "Growth ofTourism in Nepal's Everest Region: Impact of the Physical Environment and Structure of Human Settlements", Mountain and Research Development.; 237-246.

greatly transformed, together with an increasing dependence on exogenic forces. Like the Khumbu region, M.C. Goldstein (1981) has brought out very well the effects of exogenic forces on his study of the Tibetan population of Limi in northwestern Nepal.

Limi has a Tibetan population and the population traditionally practised fraternal polyandry, though there was no rule of primogeniture and each male member of a family could demand his share of land. However, generally younger brothers did not separate as it was not economically viable to set up an independent family. However, due to the Chinese occupation of Tibet several changes occurred. In 1960-61 many Tibetan nomads crossed over to Limi with their herds to seek refuge in India. Limi is the southernmost point before the monsoonal alpine zone. Hence, the nomads were forced to sell their herds cheaply and many animals were simply abandoned. Many in Limi acquired substaintial herds and hence a new economic resource. This allowed for land fragmentation and population increase.

The Limis traditionally traded with Tibet, but with the Chinese occupation this was restricted, forcing the Limis to try their luck in the markets of

Kathmandu and India where they found that their beautiful wooden eating bowls were very popular and much in demand. They also discovered markets with great demand for Tibetan exotica. Following the Chinese occupation, these art items had become practically worthless in Tibet. The Limis acquired these and sold them to make excellent profits. This economic opportunity also led to separation of families.

Limis traditionally used the pastures in Tibet for transhumance. They use the pastures today by paying pasture fee to the Chinese which can however be paid only in exchange for goods and not in money, the nature and value of goods being decided by the Chinese. Limi wood products such as bowls, saddles, tent pegs and poles, jars, beams, pillars and planks have always been in demand in the adjacent Tibetan areas. Traditionally house-building materials were from from birch wood. But as birch tends to warp, the Chinese demanded for fir lumber. But fir is not available in Limi, hence the Limis started cutting the fir forests located on slopes three days walk from Limi (Goldstein, M.C., 1981).[18]

18. Goldstein,M.C., 1981:"High-altitude Tibetan population in the Remote Himalaya - social transformation and its Demographic, Economic and Ecological Consequences"; Mountain Research and Development, 1(1), 5-18.

The impact of eogenous forces in bringing about socio-economic transformation can be cited throughout the length and breadth of the Himalayas. We can here make a brief study of such processes in Ladakh, a traditionally encapsulated environment. After independence, India's border in the north-west became turbulent. This required a permanent stationing of 40,000 Indian troops in Ladakh which had a population of 110,000 (Snellgrove and Shorupski; 1977). With the closure of the border with Tibet, and opening of roads and airstrips Ladakh has become totally dependent on outside forces. With a new democratic government at present in Pakistan, peace can be negotiated between India and Pakistan. However, with political stability even the military assistance will decline leaving Ladakh impoverished. Besides, the intake of Ladakhi recruits into the army may decline. Tourism can be an alternative, but that will increase dependence on outside forces, as a sudden decrease of tourist traffic, say, due to global recession, can have a greater catastrophic reaction in the tourist centres than in areas which are peripheral to the tourist trade. With the increase of tourist arrival from 200 in 1975 (when the area was reopened to tourists) to 15,000 in 1978, outsiders (Kashmiris in

this case) have immigrated to take advantage of this lucrative business (Norberg-Hodge,1981). M.C.Goldstein (1981) has also made an interesting study in the socio-economic structure of the Ladakhi society. His study is based on the Tibetan population of Keylong.[19]

Keylong in Ladakh has 75% of the population Buddhists and 25% Muslims. The Buddhists are of Tibetan origin, and traditionally have the corporate stem and fraternal polyandrous family. Traditionally, all males could demand their share of land, but the system of fraternal polyandry was the mechanism which restricted its occurrence. This prevented land from being fragmented and maintained a core of males in the family. Though many younger brothers in a family would have desired to marry monogamously, they did not do so as they did not stand much chance of maintaining a satisfactory life-style after splitting from their natal family. However, in Ladakh there was further preventive measure, that of primogeniture, i.e, only the eldest son inherited land. However, this meant that many females remained unmar-

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19. Goldstein, M.C., 1981; ibid; 5-18.

ried and were systematically removed from the breeding pool unless and until they married a Muslim.

With the end of World War II several changes occurred. India became independent in 1947 and primogeniture was made illegal. This gradually led to younger brothers in Ladakhi Buddhist families demand their share of family property. This led to a population explosion. Ladakhi main families are called "khang-chen" and fissiparous ones as "khang-bu". In Keylong about 100 years ago, 64 Khang-chens existed which owned most of the land. But since India's independence as many as 79 khang-bus have come up. Thus, modernization in India has had devastating effects on the Ladakhi social structure.

However, though primogeniture was no longer legal, younger brothers still had to consider whether they could survive economically after splitting with the main family. A series of external forces made this possible. After independence, India abolished the jeudal corvee tax, whereby each family had to send a adult male with food and animals for four months in a year for transport services between Leh and Srinagar. This made monogamous marriages difficult. The abolition of the corvee tax thus indirec-

tly helped fission of families. Also, the conflagration between India and China in 1962 highlighted the strategic importance of Ladakh. Military bases, airfields and border roads construction started, and Ladakhi villagers obtained jobs in these activities. Many Ladakhis also joined the army. Extra resources from these new economic opportunities provided the economic viability for independent families.

The influence of electoral politics has also been significant. The Muslims in the area were originally immigrants and did not practice polyandry and primogeniture. Many Muslims also married Buddhist females. However, with the birth of parliamentary democracy the size of the population became a critical factor. Most Buddhists like the Muslims had to depend upon extra incomes, and these economic opportunities are controlled by the government. With voting being essentially communal the number of Buddhists and that of Muslims became critically important. To prevent a Muslim supremacy, Buddhist leaders launched a major pro-natalist campaign urging Buddhist females not to marry Muslims and asking all males to marry monogamously and reproduce maximally. This led to the demise of fraternal polyandry.

This has led to the rapid transformation of the traditional encapsulated system and has linked it with the broader world politico-economic system. The system is no longer at homeostasis. The Ladakhis now have a high population growth rate of over 2% per annum, and declining per capita land holdings. The future well - being of the society is dependent on events and processes occurring beyond it, and traditonal norms and values have become non-functional. This has led to ideas that the environment is for exploitation and not conservation. Large inputs will be required to compensate for the growing ecosystem disequilibrium.

The fragility and sensitivity of high-altitude mountain ecosystems and their spiralling deteriaration has led to increasing concern for the physical environment. However, an equally critically dimension, the social environment needs to be given equal importance. Despite the remoteness and the apparent traditionalism of many inhabitants of the Himalayas, they have or are in the process of major transformations in their social structure. This is because traditional social adaptations were as fragile as the environment itself. Besides, these were functional

in an encaptulated environment.[20] However, exogenous influences have de-encapsulated the environment and the traditional system has undergone various demographic, ecological, and economic transformations.

The sustenance of a sophisticated civilization for over 1500 years in the Himalayan region is a great achievement in human adaptation. Considering the harshness and sensibility of the environment, and the possibility of irreversible damages to the environment, this achievement is all the more impressive. This traditional ecosystem homeostasis is however in the process of disintegration due to numerous exogenic forces. This has not only caused environmental deterioration, but also social dislocation.

Despite their isolation many high-altitude areas in the Himalayas have been greatly influenced by exogenic forces which have brought about profound ecological, economic and sociological changes, and as a result has destroyed the traditional homeostatic adaptation with the environment. Modernization and

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20. Encaptulation is a situation where an increase in energy production through exploitation of new areas or through intensification or exploitation of resouce use is virtually nil. Thus, the ecosystem has limited potential for energy extraction and the population has to adjust to it.

development in adjacent areas have led to instability and dependence in these areas. There has also been a disconcerting drift in the attitude of the indigenes towards the environment from that of long-term conservation and management to that of short-term exploitation and manipulation. The social matrix of these people have been irreversibly changed, and shall continue to require large-scale external inputs to balance the loss of the homeostatic system. The traditional social system is breaking down and new socio-economic problems are emerging, with an increasing dependence on new resources. Such populations are under the throes of major transformations.

CHAPTER V

ENVIRONMENTAL AWARENESS AND CONFLICT SITUATIONS IN THE HIMALAYAS : AN EVALUATION OF THE CHIPKO MOVEMENT

Conflict situations arise primarily due to varying levels and directions of awareness and perception. Before we can discuss something on environmental awareness it becomes necessary that we try to understand how people perceive their environment.

Intense degradation of the environment and loss of natural resources is having a profound and increasing impact on many societies, and especially so in the developing countries. The 1960s marked the rise of global concern regarding man-land relations. This concern has generated considerable research activity focussing on environmental quality, natural hazards, resource scarcity, pollution, and development activities. This wave of interest has been variously termed as "the environmental movement," "environmentalism," "the ecological paradigm," etc. Perception generally refers to images, memories, preferences and attitudes which affect human behaviour, and also help

us to explain, predict, and accomodate future behaviour patterns.[1]

Hence, environmental perception research is an inter-disciplinary field encompassing psychology, sociology, anthroplogy, architecture, and environmental planning. This has also altered the geographical perspective fundamentally by providing new ideas and techniques. Modern studies of man-environment relations are based upon a theoretical framework of cognitive psychology and environmental behaviourism, and consider that man reacts to his environment as he perceives and interprets it through his past experience and knowledge.

However, as mental images of individuals are neither holistic nor monolithic, it is not easy to say whether it is possible to derive a single objective image of the environment. As regards cognitive psychology, there is a controversy about the nature of mental images of the environment. However, whether it is possible to understand or

1. Bjonnes, I.M.; 1986: "Mountain Hazard Perception and Risk-avoiding strategies among the sherpas of Khumbu Himal, Nepal"; Mountain Research and Development; 6(4), 277-292.

measure environmental images or not, it is largely correct in saying that man-environment relations reflect cognitive processes which are essential in understanding human adjustment strategies. Cognitive processes are involved in the way people conceptualize, understand, and organize their environment. It is here that culture becomes an important element in influencing human behaviour. Thus, environmental perception as a discipline assumes that environmental cognitions of people may be different from the "objective" world. It is also an interactive model in which individuals respond and shape their physical and social environments. Thus, environmental perception is necessarily inter-disciplinary, making use of various physical and social sciences.[2]

The existence of conflicts over the use of resources is widely acknowledged, with resource management and environmental planning being largely concerned in identifying and resolving such conflicts. Conflicts arise over the nature of resource utilisation and their uses and allocations. It has traditionally been held that these

2. jonness, I.M; 1986; ibid; 277-292.

conflicts are primarily due to the scarcity of these resources. A slightly different though not essentially contradictory perspective would be to say that these conflicts are due to varying and often diametrically opposed values and decisions taken in utilising these resources. The two most contending perspective are, (1) those who believe that economic efficiency is most important and markets are the best allocative mechanism, and (2) those who consider social equity, and environmental conservation to be more important. It should however, be mentioned that these two perspectives are not always irreconciable.

Before we embark onto discuss conflicts over resource utilisation, it would be useful if we clarify what we mean by "resource". The word "resource" implies something that is useful to humans. Hence, an element of the natural environment becomes a resource only once we recognise its potential or actual utlity. There should also be the technical know-how to extract and utilise it in an economically feasible manner. Besides, a

demand for it or services rendered should be present.[3]

It is also imperative that we understand the idea of a resource base. Variations in our conception of resource occur in time and with changes in scientific knowledge and technology. Hence, gradually our resource base gets widened. Also within a society different groups and individuals perceive resources in different ways. Cultural diversity also results in different cultures placing different values with regard to resources. However, the greatest potential conflicts are located in such areas where groups with conflicting interests and differing cultural origins require the same resources. This is the case in the Himalayas where the superior external political and economic powers have been able to subjugate the indigenes.

However, even within the same cultural group attitudes towards resource use can differ. This is primarilly because of differences in ideologies

3. Cocklin, C.;1988:"Environmental Values, Conflicts and Issues in Evaluation"; The Environmentalist; 8(2);93-104.

between individuals. An ideology is a set of beliefs and values with political intent. An environmental ideology provides an individual with guidelines to respond to environmental issues.

The two opposed perceptives or ideologies with respect to resource use are the technocentric and ecocentric ones. It should be mentioned, however, that what follows is an idealized and simplified discussion on these ideologies primarily for the sake of convenience. The technocentrics consider man supreme to nature, promote "value-free" scientific reasoning,and believe in the over-whelming power of technology. The origins of this perspective can be ascribed to the mechanistic beliefs of Bacon, Descartes, Locke, and Adam Smith. The ecocentrics have a strong affinity with nature and strive to maintain balance and harmony in nature. The origin of this perspective can be found in the romantic transcendental thinking of Thoreau, Catlin, Emerson, Marsh, and Olmstead.[4] The econcentric ideology has also been termed as Humanistic by some researchers. It is also said that technocentrics sub-

4. Cocklin,C.; 1988; ibid; 93-104.

scribe to centralised decision-making, whereas the ecocentrics emphasize decentralisation and participative decision - making.[5]

The temporal and spatial dimensions of conflicts over resource use should also be considered as important. The temporal dimension is that the effects of our actions generally last over an extended period of time. Besides, some impacts have greater significance than others at some points of time relative to others. The spatial dimension comes in when different impacts manifest themselves in different spatial scales. Environmental impacts may be localised, while economic benefits may accrue to the whole region. Alternatively, economic benefits might accrue to one area while the environmental and social costs are borne in another area. Both cases can lead to conflict situations.[6]

Conflicts over the use of resources can be analysed in terms of differing environmental value

5. Miller, A;1985:"Ideology and environmental Risk Management", The Environmentalist; 5(1); 21-30.

6. Cocklin,C.; 1988; op.cit; 93-104.

sets. Both individuals and groups can differ on their perspective regarding resource use and allocation. This often results in conflicts. Hence, to achieve acceptable compromises, it is highly imperative that we account appropriately for various concerns. Thus, a multidisciplinary perspective is required to accomodate disparate metrices.[7] Though different disciplines do provide us with higher levels of understanding of particular inter-dependencies, more eclectic approaches are required in natural resource planning as it involves multi-dimensional phenomena including biophysical, economic, and social aspects. This requires us to develop analytical techniques capable of effectively synthesising all the varied aspects and arriving at an acceptable proposition.

Developmental activities are increasingly proceeding on a resource-intensive path. Contemporary societies are continuously increasing man's access to and the rate of consumption of natural resources. This has inevitably resulted in conflicts related to resource use. Both within the

7. Daly,H.; 1968: "On Economics as a Life Science"; Journal of Political Economy; 76, 392-406.

Himalayas and without there has been the emergence of a multitude of ecology movements which attempt to redesign the pattern and extent of the usage of natural resources and bring about social equality and environmental stability and sustainability. These movements have questioned hitherto dominant concepts of economic development.

Indigenous civilizations were sensitive to natural ecosystems and well-defined social norms guided the management and utilisation of natural resources, thereby maintaining a state of stasis. This, however, underwent a drastic change in the Himalayas due to the demands of the colonial rulers. Forests in the sensitive Himalayas were felled indiscriminately to build battle-ships or to make railway sleepers. This led to conflicts with the local people over the use of natural resources. In the Himalayas and its adjacent foothills it resulted in several forest movements, which gradually merged with the national struggle for independence. However, even with the attainment of independence, there was little change in the colonial institutional framework. These newborn nation states started using the same institu-

tions and concepts though, for diametrically opposite objectives as compared to the colonial rulers. A western capitalist economic development strategy was adopted to fulfil the enhanced aspirations of these newly independent nation states. However, what was not realised, was that such a process had suceeded in western Europe due to the resource exploitation of its colonies, and such methods if practised by a country based on its own resources, would result in large-scale environmental instablility. Such resource insensitive development practices led to ecological degradation and economic deprivation. It is important to understand this to facilitate an immediate reorientation of our development priorities and concepts. The various ecology movements are bringing to light the hitherto invisible externalities and striving to internalise these into our development policies. The need has arisen to seriously consider the effects of our unlimited development aspirations based on a limited resource base on the marginalised periphery.[8]

8. Bandyopadhyay, J., and Shiva, V.; 1988: "Political Economy of Ecology Movements"; Economic and Political Weekly; 23(24); 1223-1232.

Increasing predatory exploitation of our natural resources in the name of development has narrowed down the availability of natural resources to the impoverished and to those sections of the population living in the partially monetised subsistence sector. Ecology movements have been the people's response to the threat to their survival and their vital life support systems. The best known ecology movement has been the Chipko movement of the Uttar Pradesh hills to prevent exploitation of forest resources by rapacious contractors. In the Himachal Pradesh hills ecology movements have been largely to prevent mono-culture plantations of commercial chir pine (Pinus roxburghii). Even outside the Himalayas we find such ecology movements, such as the Appiko movement of South India, the opposition by Jharkhandis in Bihar, Orissa and Madhya Pradesh to tree felling, and even in the Aravallis in Rajasthan.[9]

Besides, the exploitation of mineral resources in the sensitive watersheds of the Himalayas

9. Bandyopadhyay J., and Shiva, V; 1987; The Ecologist; 17(1); 26-34.

as in many other parts, has also greatly affected the ecological equilibrium. This has caused large-scale land dereliction. Dereliction has been defined by S.H. Beaver (1945) as :

> "Land which has been so damaged by extractive or other industrial processes or by any form of urban development that in default of special action it is unlikely to be effectively used again within a reasonable time, and may well be a public nuisance in the meanwhile".(10)

An important cause of land dereliction in the Himalayas is the large-scale extraction of industrial minerals. Though complete cessation of mining and quarrying to prevent dereliction seems to be the least likely means of solving the problem, it should be considered that dereliction is not an inevitable accompaniment to mineral extraction. Hence, the solution is to be found within the possibilities of conservation, management, and reclamation.

Though statistics on the volume of mineral production may be available, this alone does not provide us with any clear picture of the pattern and volume of dereliction. This is because, there

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10. Wallwork, K.L. 1974; Derelict Land; David Charles; London.

is no constant relation between the mineral output and the amount of dereliction, as the extent and degree of dereliction, depends on the geological structure, extraction techniques, and methods of waste disposal related both to technical competence and to the economics of alternative modes of operation. The degree of dereliction due to surface mineral working[11] depends upon,

(1) the amount of overburden to be stripped,

(2) The ratio of usable mineral to waste, and

(3) the areal extent and depth of workings.

Several ecology movements in the Himalayas have opposed the reckless extraction of minerals.

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11. "Surface mineral working includes all forms of mineral extraction carried at exacavations open to the sky." These words describe these mineral workings, but lack of precision in the meanings leads to ambiquity. "Quarry" normally means an open excavation for building stone, slate or other `hard' rock with no metalliferous or combustible content. "Pit" is used to describe open workings in `soft' or unconsolidated deposits, such as clays, sands, and gravels, and originally related to their shallowness. "Mine" is used to descrive excavations working fossil fuels and metalliferous ores, frequently with a qualifying adjective, eg.opencast mine, strip mine, patch mine, etc. Both pit and mine are terms also applied to underground mineral workings'. (Wallwork, K.L; 1974; ibid.).

The most successful of them has been the movement against the quarrying for limestone in the Doon valley. The movement succeeded to bring about a major Supreme Court order to restrict this quarrying. However, such successes are rare and rampant mineral exploitation continues in many parts of the Himalayas, such as Almora and Pithoragarh.[12]

Another threat to many areas in the Himalayas and in many other similar sensitive watersheds, is the construction of large river valley projects. This results in large-scale submersion of forests, pastures, and agricultural land, the dislocation of people and increased seismicity in the area. The opposition to the Tehri dam project in the Uttar Prdesh Himalayas exposes the possible threat of large-scale destabilisation of land by seepage and strong seismic movements that could be induced by impoundment. Another problem faced by such projects is the proper rehabilitation of displaced people on a land-to-land basis, especially considering the fact that land resources are already

12. Bandyopadhyay,J.; and shiva, V; 1985: "Conflicts over limestone quarrying in Doon Valley", Environmental Conservation; 12(2); 131-139.

overused. The displaced persons become destitutes as they are rudely moved from their homes and environment, and forced to face a new economy, society, values and norms, all in the name of "development".

While discussing ecology movements in the Himalayas it is most essential to understand and evaluate the implications of the Chipko movement of the Uttar Pradesh Himalayas. The Chipko movement meaning "to embrace the tree" was an attempt to resolve conflicts arising out of opposing demands on forest resources through the means of non-violent non-cooperation. The Chipko movement was initially based on the politics of the distribution of benefits of resource utilisation. However, subequently it broadened its objective and became an ecological movement concerned with the distribution of ecological costs.

Traditionally, forests were common resources and strict informal social mechanisms kept a check on over-exploitation to ensure their sustainability. Forests were carefully husbanded and village woodlots developed scientifically by selecting

local species. However, since the colonial times management and utilisation of forests showed marked changes. The Zamindari system converted common lands into private property, thus, leading to their decimation. Thus, local demands had to be satisfied by turning to previously unused natural forests, which resulted in their degradation too. Besides, commercial demands for shipbuilding and railway sleepers aided in large-scale felling of natural forests. Finally, when the need to control over-exploitation of forests was felt, a forest bureaucracy and reserved forests were created to conserve forest revenues and not the forests themselves. This created conflicts between local and commercial interests as the locals were deprived of their traditional rights. Besides, as the new emphasis was concerned with revenues and not with ecosystem stability, unsound silviculture practices were introduced, thereby transforming a renewable resource to a non-renewable one.

Forests are critical elements in the ecosystem. Natural broad-leaved and mixed forests have

been responsible in maintaining water and soil stability, thus sustaining the agro-pastoral econo my of the region. Traditional forest resources provided for :

(1) leaves and grasses for fodder ;

(2) twigs and branches for fuel ;

(3) timber for construction and agricultural implements ; and

(4) fruits,nuts, fibres, hemp etc.

As these common resources were converted into a commodity, people dependent on the forests for their basic needs started satyagrahas in the 1930s. Besides the Himalayas, they were successful in the Western Ghats and the Vindhyas. Though, the satyagrahis were brutally repressed by the British, (eg. the Gonds, and the massacre at Tilari, Tehri Garhwal on 30.5.1930), finally the movement achieved partial successes by being able to restore traditional rights though the commercial utilisation of forests continued. Paradoxically, after independence, the ruthlessness in the exploitation of forest resources has continued in the name of "national interest", thereby, bulldozing local needs and aspirations. This has caused

destabilisation of mountain ecosystems and subsequent losses of life and property through floods and droughts. The people responded to the crisis through non-violent resistance. This was born as Chipko movement in the early 1970s in Garhwal and later spread to Himachal Pradesh, Karnataka, Rajasthan, Bihar, and Central India.

In 1850 an Englishman by the name of Mr.Wilson was given lease to exploit forests of Tehri-Garhwal for only Rs. 400. Many forests were clear - felled. Besides, forests were also cleared to grow food-crops to feed the population of newly established hill-resorts. When the economic importance of forests was realised, the Tehri State took up the management of forests into its own hands in 1895 and restricted their use by villagers. This resulted in many organised revolts. Small concessions granted by the king failed to satisfy the population, and contradictions between the basic needs of the people and the state's revenue requirements continued. In 1930 satyagraha was started to protest against forest laws. Many satyagrahis were massacred in this movement. The movement was strengthened by

the nationalist movement then on in the rest of the country. Regions such as Saklana, Badiyargarh, Karakot, Kirtinagar declared themselves to be independent. Finally, on 1st August 1949, the Kingdom of Tehri became an integral part of India.[13]

In post-independence India the people's struggle for social justice and ecological stability was strengthened by Gandhians such as Mira Behn, Sarala Behn and Dev Suman. Sunderlal Bahuguna was influenced by Dev Suman. Some other prominent figures are Chandi Prasd Bhatt, Dhoom Singh Negi, and the folk-poet Ghanshyam Raturi.

However, even in post-independence India, conflicting demands for forest resources between the marginalised majority, and commerce and industry persisted. This brought about a progressive encroachment by public and private enterprises on the rights and privileges of people who have traditionally been dependent on forest resources.

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13. Shiva, V.; and Bandyopadhyay, J; 1986: "The Evolution, Structure, and Impact of the Chipko Movement"; Mountain Research and Development; 6(2); 119-131.

The Chipko movement started with the movement of April 1973 when the people protested against the felling of ash trees in Mandal forest. In March 1974, women protested against felling. Subsequently, the government stopped the contract system and established the Uttar Pradesh Forest Corporation. In June 1977 Sarala Behn planned a meeting of all activists to consolidate resistance to excesive felling and resin collection from chir pine trees. In December 1977 the Adwani forests were supposed to be felled. Dhoom Singh Negi undertook a fast in the forest itself, and women guarded the forest from 13th to 20th December. The axe-men returned with the police on 1st February 1978, but each tree was guarded by three embracing volunteers. Hence, the police had to withdraw. In March 1978 and December 1978 felling in Narendranagar and Badiyargarh areas could be foiled by volunteers undertaking fasts, courting asserts, and guarding trees. All this finally resulted in Mrs. Indira Gandhi, the then Prime Minister, declaring a 15-year ban on commercial green felling in the Himalayan forests of Uttar Pradesh.[14]

14. Shiva,V; and Bandyopadhyay,j.;1986;ibid;119-131

The Chipko movement arose as ecological destabilisation and declining soil fertility and water resources made food imports necessary for earlier self-sufficient villages. Besides, "natural disasters" became common, such as the Alaknanda disater of 1970 which flooded 1000 sq.kms and disrupted transport arteries, the Towaghat disaster of 1977, and the Bhagirathi disaster of 1978.

Commercial forestry stresses fast growth of commercial wood, thereby destroying biomass of lower commercial value, but which may be important for local demands and for maintaining ecological stability. Such silvicultural practices resulted in the replacement of ecologically important oak forests by commercially more viable conifers.

The Chipko movement is multidimensional in approach - scientific , technical, economic and especially ecological. It is not a narrow conflict demanding more local share in the immediate benefits accuring from the exploitation of forest resources. It brings this out clearly by proclaiming that the main products of forests are not

timber, resin, etc., but soil and water that subsists the local agropastoral economy. The Chipko movement is the response of a whole culture to its central problems of protecting forests, preserving culture, and maintaining livelihoods.

The Chipko movement was influenced by the Gandhian ideology of non-violent resistance through satyagrahas. Satyagrahas have been mystified as belonging to a political philosophy which is subjective and spiritual and not objective and material. Gandhian philosophy has been misinterpreted as not dealing with the material contradictions in society. However, this is fallacious as Gandhi himself used satyagrahas to oppose material poverty and underdevelopment caused by the economic system, thereby causing contradiction between the economics of sustainable development and the captalist production based on profit making. Gandhi did just this at his satyagrahas in Champaran, Dandi, and Ahmedabad. Gandhi focussed on such fundamental contradictions in society, by trying to understand the material bases of the problems faced by the invisible and mariginalised masses.

Chipko challenged the methods of exploitation based on modern values and preferences. This has been through the practice of Indian philosophy with its reverence to Nature. This has been our age old Aranya culture as put forward by Tagore. Our ancient culture sees God in Nature and in all forms of life. Gandhi highlighted the need to conserve Nature for our own well being. Gandhi called for a new society where neither man nor nature is exploited or destroyed. He said, "the Earth has enough for everybody's need but not for everybody's greed."[15] Chipko has germinated a devotional attitude towards the forests as they are closely intertwined with the the very existence of the hill people.

Initially Chipko was based on economic considerations. Men saw that they were deprived of the benefits accuring from the exploitation of the resources of their homelands. However, men in these areas mostly migrate to the plains in search of employment. Hence, only the women face

15. Bahuguna,S.; 1987:"The Chipko-A people's Movement", in Raha, M.K.(ed); The Himalayan Heritage, Gian Publishing House, Delhi; 238-248.

the reality, and they tend to feel differntly, as it is they who have to fetch and collect fuelwood, fodder and water. Reality for them is a struggle for existence. It has been estimated by the World Bank that Newar women spend 0.69 hours daily, i.e. 6-7 percent of their time to collect fuelwood, and similar time to collect water. In Kangra district women spend ·55 percent of total time collecting fulewood and water. Deforestation causes women to walk further to collect fuelwood and water as wells and acquifers dry up on eroded terrain. It also affects time women can devote in agriculture, as women account for 57 percent of all adult input time into subsitence agriculture.[16] The active participation of women in the movement has been an eye opener to the menfolk, as the latter gradually came to realise the critical importance of forests.

Initially, the movement was ridiculed by the elites, powerbrokers, urban people and the laboratory scientists. However, their ideas that the

16. Pitt, D.C.; 1986:"Crisis, Pseudocrisis, or Supercrisis: Poverty, Women, and Youn People in the Hi,alaya. A Survey of Recent Developments", Mountain Research and Development; 6(2); 119-131.

ignorant rural masses lack the capacity to think about their own problems was soon smashed. The movement has gradually succeeded in impressing on all, that uncontrolled over - exploitation of forests will lead us to surrendering our future posterity for short-term economic gains.

Though forests by themselves may not be as important a factor, as thought earlier, in storing water and controlling floods, they certainly are economically essential for the subsistence of the people living traditionally in forested areas. The social, economic, and cultural milieu of the Himalayas is largely dependent on the local forests which provide for fuel, food, and fodder needs of the local people.[17]

However, vested interests have mainly presented the Chipko movement as a contradiction and dichotomy between "development" and "ecological concern". The former being related to objective and the material bases of life, and the latter

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17. Bhatt, C.P.; 1987:"The Chpko Movement-Strategies, Achievements and Impacts"; in Raha, M.K.(fd); ibid; 249-265.

with subjective and the non material factors, such as scenic beauty. Such deliberately introduced false dichotomies have marked the real dichotomy that exists between ecologically sound development and unsustainable and ecologically destructive economic growth. Only genuine development based on ecological stability can guarantee the continuation of life support systems of the marginalised masses and thereby ensure a stable material basis of life.

The actual differences within the Chipko movement lies in the differences in philosophical views of sunderlal Bahuguna and Chandi Prasad Bhatt.

According to Bahuguna livelihoods and economic productivity are dependent on the life support systems. Economic crises can only be solved by solving the ecological crises, for instance, by restoring equilibrium to the hydrological and nutrient cycles. Ecological rehabilitation will thus necessarily involve a temproary moratorium on commercial green felling tc allcw regeneration. This entails minimizing ecological costs and maxi-

mizing sustainable productivity for basic needs.

The other school of thought of Bhatt explains poverty in the Uttar Pradesh hills due to the absence of processing industries and not the impoverishment of the environment. He accepts modes of present resource use, and feels that poverty has a technological solution in contrast with Bahuguna who calls for an ecological solution, as according to Bahuguna material benefits arise from lowering ecological costs and increasing productivity of natural and man-made systems. Bhatt considers that with modern scientific knowledge, productivity and material conditions of life can be improved. Production processes do not include ecological processes, and productivity is determined by technological productivity of labour alone. According to him cooperative felling and utilising trees for local use will regenerate the economy. Ecological limits to commercial exploitation of natural resources are not considered by the political economy of ecodevelopment as opposed to the theory of ecological development. This neglect of the ecological perspective

in this model results in the neglect of strategies to stablise soil, water, and other natural resources. It also does not account for the impacts of economic activities, including afforestation programmes. Hence, ecodevelopment aims towards new distributive processes to distribute goods produced by existing resource-intensive and resource-wasteful technologies, whereas ecological development aims towards resource-prudent and resource conserving technologies, besides distributing both the benefits and costs created by ecological degradation. In the latter view, productivity is not equated only with labour productivity, as an increase only in it may be counter-productive. This will lead to greater consumption of resources to produce less useful products and will also replace labour in an area which already has a labour surplus and been witnessing outmigration for a long time.

Growth for growth's sake has made human life critical in delicate ecosystems such as the Himalayas. The Chipko movement is not just trying to save the forests, but with it the entire life support systems. The Chipko movement is of global

significance, because ecological crises thereaten societies irrespective of their industrial status, hence the urgent need for a different world view aimed at creating a sustainable world.[18]

Present day development policies are based on the ideology of a linear theory of progress based on the historical evolution of 18th and 19th century Western Europe, which has unfortunately been internalised throughout the rest of the world. This linear theory has made certain fallacious pre-suppositions, such as equating development with economic growth, economic growth with expansion of market economy, modernity with consumerism, and non-monetised economies with backwarness. The diverse traditions of the world with their particular socio-economic and cultural structures have been made to converge onto a homogenous monolithic order modelled upon the history of their evolution in the west.

Though ecology movements are geographically localised, their impacts are broader in import.

18. Shiva.V; and, Bandopadhyay, J.; 1986; ibid.; 119-131.

They are rooted in the cognitine gaps of our development planning. Dichotomies in perception exists primarily due to the existence of two worlds. Every development activity requires resources, however, there is a competition for the resources between the two worlds which leads to conflicts. In such an asymmetrical competition invariably the loser is the less powerful but more populous micro-economy. The threat is either through resource transfer or resource degradation. Though, these ecology movements focus the plight of the marginalised, what is of greater essence, is the fact that they make visible the invisible externalities of development based on a particular economic ideology by revealing its inherent injustice and non sustainability. They bring out the dire need for justice with sustainability, equitywith ecological stability.

Such ecology movements can no longer be ignored as they externalise the various adverse impacts and short-comings of our myopic exploitative development policies with short -term commercial gains as their only criteria. They question the very fundaments of politics, economics, scien-

ce,and technology which together have created the present day paradigm of development and resource use. The ecology movements have been able to reveal how current resource-intensive development programmes have ecological destruction and economic deprivation in-built in them. What is of great relevance is that these movements are in the process of re-defining our concepts regarding development, economics, technological efficiency, and scientific rationality. They are attempting to create a new economics for a new civilisation.[19]

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19. Bandyopadhyay, J.; and, Shiva, V.; 1988; op.cit.; 1223-1232.

CHAPTER VI

ETHNOCONSERVATION : A WAY OUT OF THE IMPASSE

Having thus far discussed that a crisis situation does exist in many parts of the Himalayas, and could well be developing in other parts as well, we now urgently require to formulate a new paradigm to arrest this downward spiral. Having acknowledged the fact that present development policies have been primarily an internalisation of the linear theory of progress based on the Western European model, we now need to explore new avenues to bring about an ecologically balanced development in the Himalayas and other mountain systems of the world.

We have rather forcibly made the diverse traditions of the world with their particular socio-economic and cultural structures to converge onto a homogenous monolithic order. We have fallaciously equated development with economic growth, economic growth with expansion of market economy, modernity with consumerism, and non-monetised economies with backwardness. We have also acknowledged the fact that contrary to our earlier assumptions, local people are certainly to a great extent highly aware of their environment. Their traditional life-styles

always maintained an equilibrium with the natural environment, which had guaranteed sustainability. If they are not being able to do likewise at present, it is because they are helpless to the more powerful social, economic, and political forces originating from outside these mountain environments. Herein, lies a great possibility of using local perception, awareness, and methods in regenerating the environment. Local culture[1] need to be fused symmetrically with modern technology to regenerate a stasis level in the environment. This will necessarily require a transfer of power to the powerless and the marginalised.

Ives(1987) for instance shows how the mountain people have been made convenient scapegoats in this environmental crises.[2] The Asian Development Bank in 1982 indicated that the reason for high soil erosion

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1. Culture has been defined by E.B. Tylor (1871), as " that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of Society".
(MC Neely, J.A. ; and Pitt, D.(eds.); 1985 ; Culture and Conservation : The Human Dimension in Environmental Planning ; Croom Helm : London)

2. Ives, J.D.; 1987: "Theory of Himalayan Environment Degradation" ; Mountain Research and Development ; 7(3); 189-199

was because rainfed terraces were outward rather than inward sloping, besides lacking a grass bund at the edge. However, the reasons to these are somewhat different. These rainfed terraces support maize, millet, and buckwheat that are vulnerable to water-logging that would result with inward sloping terraces. Besides, inward slopes would increase soil saturation and with the weight of the impounded water would result in greater landslipping. Also, inward sloping terraces require less labour input. This is important as during the monsoons labour input needs to be concentrated on irrigated fields which support paddy rice. This does not mean that there are no poorly-maintained terraces in the Himalayas, as there are bad farmers just as we have bad scientists. This only suggests that, the traditional wisdom of these farmers is more knowledgeable and intelligent than we had previously thought it to be, and that all impacts caused by them are not necessarily negative.[3]

It would not be irrelevant if we mention one more similar situation. During a MAB study in the Kakani area near the Kathmandu Valley during 1978-79,

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3. This paper has already been discussed at length in an earlier chapter.

the landscape could be seen to be scarred with landslides. Ordinarily such a situation would invariably have drawn the conclusion that the area was on the brink of a catastrophe. However, a visit today will show a stabilised landscape reclaimed by villagers through the construction of terraces.[4] Local people have frequently demonstrated that environmental stability can often be restored through certain practices such as terracing or a temproary deintensificatioin of cultivation. This clearly brings forward the importance of ethnoconservation methods in restoring environmental equilibrium.

In the previous decades, research was and understandably so directed towards directing global awareness to the dangers of environmental degradation in the Himalayas (and other mountain areas as well). This objective has been successfully attained. Now what we urgently require today is to formulate a research design, a paradigm, that will integrate research and development, through a holistic, cognitive and evaluative process.

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4. Ives, J.D ; 1985 : "The Mountain Malaise Quest for an Integrated Development"; in Singh, T.V; and, Kaur, J.(eds); Integrated Mountain Development ; Himalayan Books; New Delhi; 33-42.

Contact with a dominant society, if allowed without precautions makes acculturation prejudical to these marginalised people. Development planning till recently has not addressed the sociocultural aspects of this acculturation process. Basic needs of these marginalised masses should be acknowledged and accomodated if these `development' projects aim to benefit these people. The rights to autonomy, participation, cultural identity, territory, and self-determination should be guaranteed.

The fundamental way to ensure the survival of these cultures is to guarantee the continued use by them of their land resources. The sociocultural systems of these people are woven around the utilisation of the land, which is essential for the perpetuation of their way of life. It should also be mentioned here, that in such a tribal[5] way of life,

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5. `Tribal people, `tribal', or `tribe' have not been employed in any pejorative or derogative sense, but employed to "characterize a specific type of population typically having stable, low-energy, sustained yield economic systems", with the following characteristics. :

   1. Completely or semi-isolated geographically,
   2. Unacculturated or only partially so into the mainstream,
   3. non-literate, or lacking a script,
   4. non-monetised or partially so,

lands include not only areas which are presently inhabited but also the lands which are used intermittently in supra-annual cycles. In many instances, when such land thought to be uninhabited wastelands have been acquired by outside agencies, the traditional human-land equilibrium systems have been severely disrupted. The impact of exogenous expansion into tribal areas have caused the decimation and even extinction of many tribal people in areas that traditionally supported greatly larger number of indigenes.[6]

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5 independent or only partially dependent on the national economy,
6. ethnically and liguistically distinct from mainstream,
7. common and identifiable territory,
8. economic base restricted locally,
9. political institutions not well-developed.
(McNeely, J.A. ; and Pitt, D.(eds.) 1985; *ibid.*)

6. Indigenous peoples have been defined by the United Nations Human Rights Commission as, "the existing descendants of the people who inhabited the present territory of a country wholly or partially at the time when persons of a different culture or ethnic origin arrived from other parts of the world, overcame them and, by conquest, settlement or other means reduced them to a non-dominant or colonial conditions, who to-day live more in conformity with their particular social, economic and cultural customs or traditions than with the institutions of the country of which they now form part, under a state structure which incorporates mainly the

Neither modernity nor primitivism should be enforced. The former, however, well-intentioned proves detrimental to the oppressed societies. This can be done through a forced resettlement of people in a radically different ecological setting, or by a sudden transformation from a nomadic to a sedentary life-style, or even by determining changes in their cropping patterns, etc. The latter has often been practised on tribal reserves to promote tourism as "primitive" houses, costumes, and crafts are tourist attractions.[7] Whereas enforced `primitivism' is always damaging, elective `primitivism' can be beneficial. All cultures however primitive they may seem are dynamic, and hence need to be provided with adequate conditions for their development in a natural and progressive manner. Though cultural continuity should be encouraged, the choice of whether to

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national, social and cultural characteristics of other segments of the populations which are predominant".
(Clad, J.C.; 1985: "Conservation and Indigenous Peoples : A study of Convergent Interests", in, Mc Neely, J.A.; and Pitt, D;(eds) ; ibid; pp.61)

7. Goodland, R. ; 1985 : "Tribal Peoples and Economic Development : The Human Ecological Dimension", in, Mc Neely, J.A. ; and Pitt,D.(eds) ; ibid ; 13-32.

continue or modify traditional life-styles[8] should be left to the tribal people themselves and should not be imposed upon them.

Acting otherwise becomes coercive or contrived, and becomes as paternalistic as the imposition of economic development. Forced economic development has destroyed many cultures. This `ethnocide' has been coterminous with the rape of the ecosystems through indiscriminate mining, forestry, and land settlement programmes. A process of coerced acculturation[9] only serves to create cataclysmic upheavals

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8. The International Union for Conservation of Nature and Natural Resources(IVCN) has defined"traditional lifestyles" as follows : "The ways of life (cultures) of evolved locally and are based on sustainable use of local ecosystems ' such life-styles are often at subsistence levels of production and are seldom a part of the mainstream culture of their country, though they do contribute to its cultural wealth".
(Clad, J.C ; 1985 ; op.cit; 47)

9. The World Bank has distinguished four stages in the process of acculturation :

   1. completely uncontacted tribes,
   2. semi-isolated groups in intermittent contact,
   3. groups in permanent contact, and
   4. integrated groups retaining a residual sense of tribal identification.

(Clad, J.C. ; 1985 ; ibid ; 54)

within indigenous societies, thereby shattering the meticulously nurtured traditional equilibrium between man and the physical environment.

Besides, rapid social changes create other problems, such as loss of self-esteem. This may result from explicit or implicit devaluation of the traditional values and culture of these indigenous people. With the change in roles, role conflict and ambiguity results. New values such as independence, opportunism, and initiative are introduced, the transition to which is often traumatic. Besides, these people invariably end up as wage or debt-bondage labourers to the outsiders, and in the process become totally dependent on them. Also, due to rapid social change, the gap between aspirations and ability to achieve them widen as traditional means to achieve ends are now defunct. This leads to various social tensions.

For successful survival of these indigenous people it is essential to retain their autonomy : cultural, social, economic; and their continued control over their own institutions. `Development' stratgies have invariably assumed that there were no viable institutions in these indigenous societies to

foster development, and hence resorted to large - scale transfer of mainstream institutions. Besides, the freedom to decide what to change and how much to change have not been permitted. This has adversely affected the identity and stability of these societies.

The right to self-determination should be provided to these people, and the imposition of external systems are to be minimised. Only such an approach will help these beleaguered societies not only to survive but also to become a productive contributor instead of being a ward of the state. Besides, an immediate integration of these societies will only add to the numbers of the poor which is already a problem in developing societies. These societies should instead be maintained as viable and productive ones.

There always existed a sort of love-hate relationship between man and nature. As man lived off nature's resources, nature also threatened him with various dangers which concerned his very existence. Man gradually adapted himself to this situation by evolving social mechanisms and technology to allow

him to live in some sort of an equilibrium with nature. These `primitive' people who could live so well by on using so little as at the stone Age level have thus been called as "the original affluent society". People at present who continue to live at this traditional level within the limits established by the environment are called "ecosystem people". With the beginning of agriculture, however, large-scale changes occurred when many favourable areas were converted into agricultural land. However, many areas expecially in mountain areas retained their natural environment and their traditional ecological people. But with the industrial age, large-scale changes occurred even in these areas, as the previous ecosystem people became "biosphere people " who drew resources not from one single ecosystem, but from the earth's entire biosphere reserves. This was because the local ecosystems became closely interlinked covering the entire world.[10]

Earlier conservation was possible as technology was at a low level, and cultural restraints restricted over-exploitation. With modern technology and increasing human needs, many areas have been severely

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10. Mc Neely, J.A. ; and Pitt, D ; 1985: op.cit.

threatened by large-scale environmental degradation. Hence, various mechanisms and programmes have been launched to arrest this downward spiral and to bring about conservation. According to I.U.C.N.'s World Conservation Strategy, conservation has been defined as, "the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations".[11] According to its, a threefold conservation strategy has been underlined :

(1) maintain essential ecological processes,

(2) preserve genetic diversity,

(3) ensure sustainable utilisation of ecosystems.

However, cultural dimensions of conservation were largely ignored. Fortunately, this was recognised at the IVCN session at Christchurch in 1981, and the importance of cultural heritage of traditional cultures was stressed. Environmental planning should exhibit sensitivity to local needs and cultures, as traditional resource use is generally environmentally sound. One may, of course rightly argue that this is not always so. But until such allega-

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11. Mc Neely, J.A. ; and Pitt, D ; 1985; ibid.

tions are made, it must be understood that present resource use patterns of these traditional people which might no longer be environmentally sound, could have been produced by current population pressures, modern technology, and interaction with more"advanced people"., It can be said that traditional conservation practices may be as fragile, if not more, as the environment itself.

Hence, it is essential that we take account of prevalent traditional knowledge, philosophy, and experiences. We should also provide sufficient means to the indigenes to ensure their participation in formulating and implementing programmes. Above all, we need to ensure that benefits percolate to the local people. Neither should local interests be compromised, nor the long-term environmental future threatened. The ultimate aim of conservation projects should not only be for the people, but also a maximum effort should be made to work with the people.

This has been very successfully implemented in the Sagarmatha National Park in Nepal with the assistance of New Zealand (New Zealand had earlier been very successful in managing its Maori reserves).

This was made possible through a constant liaison with local people, restoration of religions places, maintaining traditional water supply schemes, retaining firewood as fuel instead of introducing other types of fuel, employing local people as rangers, revival of traditional forest-use control mechanisms, prohibiting tourists to use local firewood, etc.

Man does not interact directly with his environment. Perception and cognition(seeing and knowing) brings man together with his environment. As man is a social being and knowledge is a social product, his relation with the environment is connected through various sociocuoltural practices and institutions.

Perceptual mismatches have existed between institutions and the environment in its actuality, whose further degradation is being attempted to be arrested by the former. Most attempts try to stall further environmental degradation, however, with the assumption that forests are renewable resources and should be conserved, as they are a convertible resource. Grandiose schemes have frequently been launched but with limited success. Such programmes can succeed only when there is a shared understanding of the

problem and there is a complete understanding of the underlying causes. Such plans which are appealing at the macro-level are often not so when seen at the micro-level. This is due to institutional heterogeneity and diversity in resource perceptions. Hence environmental management and environmental planning should be formulated and implemented at the local level.

Perception is important. If for instance we distribute fuel-efficient ovens to save firewood to local people, it would be useful to the beneficiaries only if they consider the forests as a source of fresh agricultural land. This makes "appropriate technology" inappropriate. Appropriateness can be distinguished from inappropriateness only by understanding present institutions and the interrelated political, economic, and cultural processes.

It is often said that the problem of deforestation at present in the Himalayas is similar to what Switzerland faced 100 years ago. In the latter case strict forestry laws solved the problem. But will it have similar results in the Himalayan states which are climatically, politically, economically, cultura-

lly and institutionaly different from Switzerland in the 1880s? A sensitivity to local contexts is essential. Our "grand designs" have often cut across several contextual boundaries to often prove counter-productive.

Such single problem - single solution approaches have often been inappropriate in a multiple problem-multiple solution situation. In a single problem-single solution approach, if the problem and the solution has been defined, then it calls for implementatiuon of correct principles and the eradication of all misperceptions. However, in a multiple problem - multiple solution situation, a plurality of solutions is a part of the solution. This removes from contention of what is right or what wrong, but what is appropriate under what conditions and how to converge at a macro - level from plurally perceived problems.

The institution - context approach provides the conceptual framework, but needs to be brought to an implementational level. The areas in the Himalayan resource base causing most alarm are those that are communally exploited, and hence it is termed as the tragedy "of the commons". The tragedy is not inherent with the commons, but rather to our insufficient and

inappropriate institutions, and the inexorableness of forces responsible together with our powerlessness.

If the institutions were appropriate and adjusted to the Pareto optimum,[12] then all we could have done was to wait and see if the tragedy was inescapable. However, this is not the case in the Himalayas. Though institutions are the reality and we have to work with them, fortunately they are not immutable. Thus, we need to identify feasible institutional changes and the degree to which they need to be changed to bring about desirable changes.[13]

Due allowance has to be made to local knowledge and perceptions. Only the acceptability and adaptability by local people of new ideas and concepts will indicate whether a programme has been successful or not. For instance, the attempt to introduce triticale (a wheat-rye cross) in a Nepalese village shows just that. The project conceded the necessity of success from both the provider's and the recei-

12. A conceptual point beyond which any change makes one as both parties worse off than before.

13. Thompson , M.; and, Warburton, M. ; 1985: "knowing whose to hit it : A conceptual Framework for the sustainable Development of the Himalaya", Mountain Research and Development ; (5) ; 203-220.

ver's viewpoints. The former judged it a success, as it grew and ripened well and on time. However, success from the latter's side would only result after its favourable comparison with local varieties of wheat. Thus, the hill farmer's satisfaction with triticale might transform the wonder-crop to another of his local species. This is his contribution to the development process, through his culturally and biologically based knowledge and skills. Though the villager might not be the repository of all wisdom, he certainly is the respository of some wisdom.[14]

As far as forests are concerned, we should remember that they are not only a biological entity, but to the indigenes also a social entity, as they have been semi-domesticated. But domestication is a two-way process as it requires mutual accomodation. The structure of the forest reflects the needs and preferences of the people dependent on it and the people also modify the forest according to their needs and perceptions. This is to be understood while launching any programme for reforestation.

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14. Hatley,T. ; and, Thompson,M. ; 1985 : "Rare Animals Poor People and Big Agencies : A Perspective on Biological Conservation and Rural Development in the Himalaya"; Mountain Research and Development ; 5(4); 365-377.

Local knowledge and expertise needs to be elicited by a naturalist scientist who can decode local expertise and formulate his own science giving sufficient allowance to the local knowledge that he has decoded. Such a scientist can be an ethnoecologist, a cultural biologist, or a social forester. This will allow us to frame our development strategy according to a natural-cultural template.

Social movements are bound to occur whenever policies are unresponsive to them or when serious mismatches at various institutional levels exist. Development theorists have preferred to remain blissfully unaware of social requirements. At one time efficiency was their goal, now it is equity. But whatever be the objective, the attitude is that the development will be provided by them. They have not known the importance of consent.

In developmental work agencies will have to cultivate a high level of adaptability commensurate with a high level of failure that they are found to encounter in such a diverse environment as the Himalayas.

CHAPTER 7

CONCLUSION

What we can conclude is that there is not a single problem but a multiplicity of problems affecting the Himalayas, which take their shape from the particular social and cultural contexts. Deforestation, erosion and flooding are not just technical problems, as behind these the myriad social, political, and economic processes, and hence can be understood only in such a perspective.

From what has been discussed in the previous chapters, we can arrive at certain systemic connenctions. If we assume that environmental degradation is inherent to the Himalayas, and human nature is what it is, then we have two options before us. Either we allow further degradation of the Himalayan environment, or we change human nature. The first option is coercive utopian in nature. The former is supposed to bring about"development", and the latter to be against it. However, those not predisposed to any of these options point cut that both options fail to understand the social and

cultural institutions and the historical processes of their development. Hence, both these views are partial and partisan, and a more suitable solution would necessarily entail:

1. Providing definite territory to a definite people;
2. encouragement to establish small-scale village-level institutions;
3. Partial privatization with family territories, which are closely interrelated with communal control mechanisms;
4. Shared system of knowledge according to which the status of the environment is assessed[1].

If we examine the local institutional structure we can see institutions that are either rigid or flexible. The former resists change, but change is inevitable, hence it brings about its own demise as another structure builds up external to it,

1. Thompson, M.; and, Warburton, M.; 1985: "knowing where to Hit It : A conceptual Framework for the sustainable development of the Himalaya."; Mountain Research and Development; 5 (3); 203-220.

thereby leading to structural collapse. However, the flexible insitutions are mutable and absorb and incorporate changes, thereby leading to structural transition. A complex system such as the Himalayas contains both these types of institutions. What is hence required is a sensitive understanding of these institutions and to indentify the progressive elements. However, our attempts to do so have only been peripheral.

Growing poverty is being engendered in the Himalayas by a rapidly growing land-based population. Increasing pressures on land makes the farmer accept other less rewarding alternatives, and faces an ultimate limit where there is a total lack of alternatives, i.e., the structure becomes increasingly rigid and fragile. This leads to spiralling poverty, as poverty is simply a lack of options.

Alternative options when utilized as by the Sherpas and Tamangs in livestock rearing and trading in the Kathmandu valley,Manangbhotias in their trade with Bankok, the Newaris in the carpet industry, and

the Rais as porters transporting foodstuff supplies to the Khumbu area have led to improved life-styles. Such flexibility and adaptability holds possibilities of an escape from poverty. In other words, if land and wealth are considered synonymous, then with an increasing population we have a negative-sum game, an escape from which is possible either through a stabilization of population or by increasing productivity, or both. But if the relation between land and wealth is severed, it may lead to a positive-sum game. For this very purpose alternative possibilities for every area have to be identified.

However, prior to embarking onto such an exercise we should keep in mind that these Himalayan micro-regions are not closed systems. The different regions of the Himalayas are interrelated and interdependent. Those in the middle Himalayas practice a low risk-high reward option of trading, livestock rearing together with some farming. Despite this bifurcation of risk-handling strategies, both depend for their viability upon each other. The small surpluses produced by the cautious cultivator

is batered or sold to the more adventurous people of higher attitudes. This interdependence will break down if the present population explosion in the Middle Mountains continues unabated, as no longer can grain surpluses be produced. This will lead to cataclysmic socio-cultural upheavals in the entire Himalayas. Thus the need to identify alternative vocations becomes urgent[2].

Facts in history clearly show that the great empires were not able to bring the peoples of the Himalayas under their complete control, and if so at all for not very long periods. The Mughals could not convert the Himalayan Rajput Kindoms in Kangra, Kulu, Garhwal, and Jumla. The British and the Russians failed to subjugate Afghanistan. The British gave up their attempts to incorporate Nepal, and the Chinese then could only lay token claims on Tibet. Geopolitically, the Himalayan region is not a power vacuum, for then it can be filled. Rather, it is a political margin where the great empires lose

2. Thompson, M.; and, Coarburton, M; 1985 ; ibid.

their sting, thereby leaving the area as a vast partially controlled tract. In such a circumstance the game of politics is maintained by skillfully playing off one superpower (or international agency) against another . Hence, Himalayan politics is not a game of power but that of powerlessness. Due to this very reason of powerlessness, most development policies are not related to anything, thereby not succeeding in attaining their objectives. These could succeed only if the political systems of the Himalayas themselves were involved in the exercise of power.

With this geopolitical scenario, the environmental problem should also be viewed in a centre-periphery model[3] - the empire and the margin. The basic problem is that "the power lies in the plains but the problem lies in the hills"[4]. Throughout history the centre has reacted to such problems in one of the two ways, - imposing or

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3. This has been attempted in more detail in chapter 4.

4. Thompson, M.; and Warburton, M.; 1985; op.cit; pp.212.

interposing. Establishing forest corporations and reserved forests are incorporative in nature and are an example of the former. On the other hand the judicious and cost - effective fostering of buffer states thereby maintaining their autonomy is an example of the latter. However, these are not permanent and we have seen in one being replaced by the other in many parts of the Himalayas, as for example the young husband expedition to Lhasa and the incorporation of Sikkim by India.

Impositions and interpositions have ascillated with the waxing and waning of the fortunes of the great empires. Several examples can be cited, for instance with the Chinese occupation of Tibet in the 1950s, Indian troops were concentrated along the borders, with the subsequent loss of autonomy of these areas. On the other hand Nepal managed to remove the Indian Military Mission in the 1970s. More recently India incorporated Sikkim in 1975. With the removal of Tibetan guerillas from Nepal they moved into Ladakh, spiti, and Rupshu thereby helping India in gathering intelligence and allowing it to

move its own forces to lower attitudes. Ever since the conflagration between India and Pakistan over the Kashmir issue, both countries have maintained large armed forces in the areas thereby eroding the autonomy of the buffer Jammu and Kashmir. Throughout history these areas whenever incorporated into the great empires exerted their rights to be autonomous entities. Movements like Chipko, Uttarakhand, Gorkhaland as well as the movements in Kashmir and north-eastern India are just such manifestations of the need and urge for autonomy.

The environmental problem is to be seen in this dimension. The problem in the periphery affects the centre, eg. through flooding. To alleviate this a compact is required between the centre and the periphery, though it might be asymmetrical. However, if the centre gets what it wants then there is a possibility that it might not impose itself on the periphery, thereby maintaining the latter's autonomy. Thus, the periphery will also take keen interest in solving the problem, lest economic sanctions or even military intervention is imposed upon it. However,

this assumes a direct relationship between deforestation and flooding which has atleast been partly repudiated in chapter 3. But as the governments of the lowlands believe in such casual relationships at present, it is the political reality though the physical reality might be something different.

This would lead us to two options, either to change political reality or to accepting the casual relationship between deforetation and erosion and flooding. However, the first option is highly limited as to change political reality we need to more thoroughly examine the biophysical reality, and if the two happen to be different, then we need to apply sufficient pressures on the governments to change their line of thought according to scientific findings. However, at present our state of knowledge about the biophysical world of the Himalayas is abysmal. In this context have already mentioned that for instance, the estimates of per capita fuelwood consumption for Nepal vary by a factor(not percentage)of 67. On the other hand if we accept a

casual relation between deforestation and flooding we cannot rule out either an imposition of sanctions by lowland powers on the Himalayan regions, or an asymmetrical compact between highland and lowland powers.

It is here where the institutional approach becomes significant. Though it is difficult to find physical facts, fortunately it is not so in the case for institutional facts. This does not mean that we abandon our attempts to comprehend the physical facts. On the other hand an institutional approach will help us greatly to understand which physical fcts are most important to be known and our capability to know them.

However, while applying the institutional approach we should remember the following. The "delivery" level of a project is the village and the "provider" level is the government or agency. This can lead to institutional mismatches with a project enjoying macro-institutional support but not at the micro-level, or vice versa. Besides, these institutiona are not homogenous themselves, eg. at

the village level landlords may support a scheme but the tenants may not, or at the macro-level the international agency may support it but the Ministry may not. Hence, we need to take cognizance of istitutional contention. Besides, implementation shall be successful only if there is sufficient coordination and mutually between the two flows of the movement of authority from the top to bottom and the movement of consent from bottom to top.

Development projects have tended to be a uni-directional flow of alms. This has made it impossible to achieve a fruitful dialogue between the providers and receivers of development aid. This has been the primary reason for the failure of deforestation programmes in the Himalayas. For instance, between 1976 and 1985 the nations of the world spent or promised as much as to Nepal for deforestation programmes but $ 189mi little success has been achieved.

According to the social principle of Reciprocity there are three essential processes, - obligation to give, obligation to receive, and the obligation to

reciprocate. This reciprocation through gift-exchange, though the value of the gift can vary according to one's status. However, for reciprocationto occur, it is essential that each party believes that the other has something worth giving. When this is absent and one party refuses its obligation to receive as it perceives that the other party has nothing worth giving, then gift-exchange becomes alms -giving. This is esactly what is happening in scientific circles. The developed world considers its knowledge and expertise to be sufficient, thereby not requiring the under-developed world to reciprocate. However, to attain the goals desired by both, the former should ask a feed-back from the latter, as the latter can provide expertise inencoding man-nature relationships, and in the evluation of ethno-science and ethno-practice. Only such an accomodation and reconciliation by the former can transform the present cold transfer of alms to a

possible warm gift exchange[5].

Mountain environments should also be understood not only on the ecological basis of local cultures, but in ther interactions with the outside world. Complex cyclical movements within the mountains have yielded place to those based around a central village site, which itself has been increasingly oriented to centres outside the mountains. In the Himalayas there has been a movement away from the higher altitudes as these areas have been denied of their traditional economy by changed geopolitical conditions. Present land-uses have tended to be "horizontal" compared to the traditional "vertical" one. This has resulted in the local people becoming cut-off from the resources of different altitudinal resource riches. This has caused an increase in the intensity in the usage of local resources, and anincrease in the penetration of the "modern" sector in the traditional economy that has brought about a

5. Hatley, T; and, Thompson, M.; 1985 :"Rare Animals, poor people, and Big Agencies : A perspective or Biological conservation and Rural Development in the Himalaya ;" Mountain Research and Development ; 5 (4) ; 365-377.

progressive demise of the highland economy, and depopulation in many high-altitude areas[6].

What is common to all mountain areas is their dependence on the lowland powers. The accidented nature of mountain terrain does not allow for unity among mountain peoples and ties with the outside world tend to the stronger than internal linkages. Besides, links between regional elities and lowland powers exacerties will continue to atrophy on the fringes of the more developed world, dependent for their fate and survival on powers far beyond their regional boundaries.

However, till today processes accelerating unstable conditions in the mountains are not well understood. This will require more intensive ecological research and a fuller understanding of natural and human processes of these regions at a loal, regional, and super -regional scale. It is to

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6. Skeldon, R. ; 1985 : "Population Pressure, Mobility, and Socioeconomic change in Mountain Environments : Regions of Refuge in comparative perspective ; "Mountain Research and Development ; 5 (3); 223-250.

be understood that environmental deterioration is a cumulative result of slow-acting,long-lasting, and a slowly - accelerating uncontrolled process. A holistic approach to this problem will require specialized contributions from different disciplines. The natural scientist can contribute to the nature of climate, water, soil, biota, pollution, etc. The social scientist must highlight the socioeconomic and ethnic characteristcs. The economist should bring out the effects of the market economy, the relations between highland and lowland economics, the degree of self-sufficiency possible, the natural resources that can be utilized, etc. And above all, all such studies will finally require to be co-oriented and synthesized, as it is often said that the whole is more than the sum of its parts. An integrated interdisciplinary research is imperative to arrest or even reverse the trend towards increasing environmental degradation.

High-altitude systems result from the linkages between several sub-systems. The socioeconomic system influences the land-use system which in turn

influences the natural system. Accomodation of all these processes will bring about a normal feedback between the different components. Such an integrated model will facilitate the understanding of the system as a whole and will help in predicting responses.

However, first of all this will require a clearly defined ideal landscape desired and the degree of stability required for a long-term sustainable land-use. After this, an evaluation can be made whether the natural system has the capacity to achieve these ideal objectives, and the consequences and alternatives to present socioeconomic processes. This will allow us to decide whether the high-altitude systems should strive for local self-efficiency or a market orientation, and whether high-or low-energy inputs should be attempted, or even a compromise somewhere between such alternatives.

Besides, scientists should seriously consider the decision-making process, and strive hard so that their research reaches the decision-making level, as otherwise a research work which is not implemented is

of little practical purpose[7].

After this discussion it would be apt to ask whether a crisis exists or not. The actual scenario is that a crisis is developing and it should be regarded as a potential supercrisis. What is suggested is to avoid disguising it by over-simplification of exacerbating it by generalization. It is important to note, that among the vicious cycles in operation, there are virtuous cycles too, and through a community approach together with a sensitive external cooperation, such a downward spiral can be transfored to an upward mode. This requires urgently a fuller understanding of problem to facilitate a radical change in our development policies[8].

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7. Messerli, B.; 1985 : "Stability or Instability of Mountain Ecosystems : An Interdisciplinary Approach; " in Singh, T.V.; and, Kaur, J. (eds.); Integrated Mountain Development; Himalayan Books; New Delhi; 72-97.

8. Ives, J.D.; 1987: "Theory of Himalayan Environmental Degradation"; Mountain Research and Development;7(3);189-199.

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