

EN002

ENVIRONMENTAL
ASPECTS
OF OUR CONCERN



Informal Sector Service Centre (INSEC)
Kathmandu, Nepal

FOREWORD

This modest publication to arouse mass-interest and awareness regarding our environment has been made possible with help of Asian Cultural Forum on Development (ACFOD). The write-up and compilation of pertinent information was assisted by Mr Bharat Sharma who is native environmental planner. We appreciate his inputs.

Lastly, it will encourage us if it helps to promote our national cause.



Informal Sector Service Centre (INSEC)
P.O. Box 2726
Kathmandu, Nepal

ENVIRONMENTAL ASPECTS OF OUR CONCERN

An environment is not just beautiful garden or something to be preserved in a museum. It is an ENTITY on which we all depend and subsist.

It can be defined as a life sustaining complex system and sum total of all social, cultural, economic biological and physical factors which compose the intimate surroundings of human beings.

This is further reinforced by the Stockholm declaration that man is both creature and moulder of this environment which provides him physical sustenance and avail him opportunity for his well-being in terms of intellectual, moral, social and spiritual growth.

The total environmental system composed of man-made as well as natural elements is essential for human welfare. As such human beings are the managers of this fragile system consisting of ACTION and SUBSEQUENT REACTIONS, and decisions of ACTIONS are directly proportionate to ecological situations because ecosystem is nothing but a self-contained system of organisms.

In Nepalese context the ACTION-REACTION scenario is very evident. Though endowed with tremendous scenic assets Nepal is poor in many natural resources other than water. It is said that if wealth is to be measured in terms of natural beauty, Nepal will be the richest country in the world, but that is not the case and the Stark Truth is that it is one of the poorest countries in the world. With the population explosion difficult geographical features and very limited arable land, Nepal's situation is becoming more precarious day by day.

In environmental context which is life-line of any nation, our goal and collective determination means the use of our collective actions, designed to transform the society so as to lift all of the together. It is more true in Nepalese context.

Hence streams of individual initiatives therefore should flow along collective channels to safe-guard our environment. The odd against it could be enormous and daunting as our society presents itself to us as an arena of so many conflicting social forces.

These forces mainly are (I) Great disparity in ownership (2) Poverty and (3) Democracy. Though people learn from past, they live in present not in the past as such, discontent arises from knowledge of the possible as contrasted to the actual. The disparity is very big in Nepal.

The discontentment is aimed at something very definite and obviously it is wealth (natural and others) because by possession of wealth one could have dominating influence on the society in particular and on national policy in general.

Society is never a protean mass moulded by only dominant ideas but it is rather a vibrantly living organism absorbing ideas and giving varying degrees of vitality to some and rejecting others.

Social, and specifically political intentions should be secular in its approach so as to deliver goods to the society without any discrimination. This will help to pull people together to achieve our goal of protecting the environment.

Our Social Institutions or Educational Institutions could play vital roles to initiate and snowball the concept of "Collective Responsibility" of sharing the burden of protecting our environment.

As such our social and educational institutions should be geared to above mentioned notion of collective survival through unity and sensitivity in our actions to realize the essence of living with the society at large and the mother-nature.

1. To date our social or educational institutions were not geared to impart the very useful and meaningful roles of making the society aware of environmental dimensions of our actions. They played rather very limited roles of imparting regimented and stereotyped type of non functional knowledge only. These very powerful media did not do what they ought to be doing long ago. The names carried the phoney importance only.
2. Hence it could be very categorically said the "social or Educational Institutions" are what they do, not necessarily what we apparently believe what they do. That is why, it is the "Verb" that matters not the "Noun".

Environmental problems do not exist in the isolation. They are defined terms of their impacts on "Humanity"

In order to fathom the depth of the problems or to measure success of policy, reference should be derived from how environmental "Goods" and "Bads" are distributed among the people. As such, environmental issues are not separate and can be seen as integral part of then prevailing political-economic processes. Analysis of these depict light on the origin of environmental problems and their possible reactions.

With limited availability of resources (mainly natural in our case), the major task of political-economic systems is to share out the proceeds. Basically it can be seen as problem of fair distribution of goods and services.

In fact environmental problems crop up not due to breach of simple civic norms of the society. It is deeper than that. They are outcome of resource use in very unequitable manner. Hence it would be no exaggeration to say that ENVIRONMENTAL DEGRADATION GOES HAND IN HAND WITH SOCIAL INJUSTICE WHICH IN DEED IS BY-PRODUCT OUR SOCIO-ECONOMIC AND POLITICAL FORCES.

As such we have host of questions to ourselves such as, what decisions (policies) affect the environment ?, who are the decision makers ?, and what are socio-economic and political forces behind them ?.

Obviously environmental problems are human or societal problems, in the sense that they are defined by the people in terms of their effects or impacts on themselves. As such basically environmental problems are not acts of god, which were quite often attribute to.

"We have to very clearly understand that whenever the social costs are shovelled on to economically and politically weaker strata of our society without concern for their plight, an act of definite injustice is done on them, which in turn precipitate and generate anger, anguish and frustration and eventually rebellion and defiance. However an endeavour to define various situations on the general

causes of environmental problems and issues is very meaningful on going exercise. Broadly environmental problems are associated with the following aspects.

1. Individual morals.
2. Prevailing cultural and value systems of a society.
3. Scientific and technological development and the extent.
4. Structure of political-economic systems.

The following elements are deeply associated and vital to solve the deeply rooted environmental problems.

1. Attitude and behaviour of individuals in the society.
2. Prevailing cultural norms desired revolution if any.
3. Application of SCIENCE AND TECHNOLOGY.
4. Society's decision making processes, desired reforms if any.
5. Political-economic state, its change and dynamism.

Individuals attitude and behaviour could be regarded as right steps in social processes, as environmental problems are out-comes of social precesses.

As stressed by "Ivan Illich", "The solution to environmental crisis is hinged on the shared insight of the people that they would be happier if they could work together and care for each other."

Hence "EACH PERSON MUST BE MADE RESPONSIBLE FOR THE PRESENT AND FUTURE WELFARE OF THE SOCIETY". To accomplish this it is prescribed that the changes in individual attitudes should be structured at the level of society as a whole. This could be described as a sort of cultural change with ethics and theology of the earth.

Perhaps the most important task ahead should be clearly one of restructuring economic norms, values and habits so as to move away from an economic model of high consumption resources to a model that limits growth in such trends.

As stated earlier there is a sense of injustice in our society and this constantly induces a feeling instability which is likely to blow up into geysers of socio-political disturbances.

However, whatever has been stated so far is something to be deeply thought by a society or a nation. It is a long drawn struggle as there are major issues involved and naturally they take time to be ironed out. In Nepal we have to take it as evolutionary process which has to be on going for years to come. But there has to be strong determination on the part of the people in TOTALITY ENCOMPASSING THE WHOLE SOCIETY BOTH HORIZONTALLY AND VERTICALLY.

In Nepal with limited options perhaps the "SPADE WORK" could be initiated by "TEACHERS" and NGOs as strong generators of environmental awareness amongst the cross-section of the mass. On the basis of technicality they have to be oriented

before they launch environmental campaign. Some written texts and some visual materials (posters etc.) could do wonders to deliver the message.

Though every one in the society, however "Real Target Groups" have to be marked out in advance so as to make the campaign more fruitful.

The influence and impacts of the drive should be both upward and outward coming from the Grass-Root.

Some of the primary areas of prime importance and concern to start with could be:

1. Land use Practices
2. Forestry
3. Water Related
4. Socio-Cultural Aspects of Environs
5. Soil and its Protection
6. Pollution and Domestic Hygiene
7. Attitudinal Change to Help the Environment.

HOW TO ACTIVATE THE ACTORS ?

Though formal institutional infrastructures such as primary schools and high schools are developed through out country, they are not tuned to environmental task.

Perhaps some NGOs and political people with non political, secular role and affinity should come forward to work as catalysts or environmental activists to help spread consciousness amongst the target groups.

This requires lot of determination and selflessness on the parts of the actors. At the same time it is long-drawn struggle also.

NATIONAL BACKGROUND

Although Nepal has serious conservation problems, it also has considerable assets. For example, more than one-third of the country is either forested or contains land capable of growing healthy forests. In addition, Nepal has considerable potential for increasing the productivity of its agricultural and grazing land.

Yet, much of the forest and pasture is under productive due to inadequate management and over-use caused by a rapidly growing population. The average crop yield per hectare is less now than in the previous decade.

Too much reliance has been placed upon government to improve the situation, while insufficient opportunity and responsibility to manage local resources in a

sustainable and environmentally sensitive way has been given to the users, collectively or individually. For example, in spite of the key role that women play in crop production, animal husbandry and forest use, they are under represented in resource development projects, conservation training programmes, and employment in the field or resource administration and management.

For centuries the Nepalese farmer has moulded the inherent properties of land, water, forest and livestock into a cohesive and productive whole. However, institutional frameworks for resource administration have tended to separate resource use and development planning according to sectors. This sectoral approach recently focuses attention on the effects of environmental degradation, ignoring the causes. The causes are less obvious, more complex and difficult to address, especially, as the needed responses cross administrative boundaries.

Continuing development of natural resources is required to meet the present and future needs of the Nepalese people. This development must proceed in a way which conserves and enhances the natural resource base. The process of environmental planning should seek to provide the framework for such development. The preparation of plan should enable balanced development to occur with an understanding of the natural resource potentials of the area studied, the inter-sectoral linkages and the environmental implications of alternative resource uses. Environmental plan must enable communities to shape development according to their needs and within recognised local environmental and resource constraints. These environmental plans need to reflect the local knowledge, experience and aspirations of village communities.

*The process of total environmental planning at the local level should embrace:

- a. Good information of local needs and of the local resource base.
- b. Accurate and useable ways of assessing environmental impact of development before it proceeds.
- c. Trained local villagers who are aware of the long range environmental impact of their daily activities.
- d. Local organisations who can assist in articulating local community needs, in assessing the potential of the local resource base and in monitoring environmental quality.
- e. A governmental framework that supports local community efforts while ensuring adequacy, consistency and coordination at the regional and national levels, especially in such areas as forest use, watershed management and agriculture.
- f. Environmental activists in forms of Teachers, Students etc.

* N.C.S.

PREAMBLE

A properly executed environmental planning process and the development of a series of well-conceived and publicly supported land use plans are needed to improve the management, hence production, of Nepal's land resources. For the implementation of these plans political support is very necessary.

Environmental Programme should carry the following objectives:

- i. To make the local people aware of the consequences of environmental degradation.
- ii. To motivate and hope local people solve their environmental and resource use problems.
- iii. To identify the options for sustainable development of natural resources.
- iv. To develop and protect the natural resources of areas covered by district and village resource management plans.
- v. To serve as an ideal model for village based environmental efforts.

Evolution

An important first step in the process of environmental management is the development of environmental plans. A plan should be based on a socio-economic profile of a village, on natural resource surveys and on assessments of current land-use patterns. Degraded lands and environmentally sensitive areas should be identified, and alternative land and resources uses determined. In this respect the planning process is as important as the plans. A village plan, once prepared and adopted by the local community and government, should be integrated into the district environmental planning efforts.

Environmental plan needs to consider the followings:

1. Take into account the natural values and properties of the land base.
2. Incorporate the knowledge of local communities and others familiar with the planning area.
3. Be based upon adequate inventories, analysis and pertinent factors affecting land use.
4. Provide, from its inception, the effective participation of local community and elected people at both the local and district level.
5. Take into account the social and cultural values of the local people.
6. Involve educational infrastructure consider all of the components of the resource base, for example, agricultural land, pasture land, forest land and settlement land, etc. In identifying future resource use, the plans should designate land for various purposes according to land capability and should form the basis for resource conservation in terms of:

Agriculture

- * to provide for the cultivation of lands that are suitable for the production of annual and/or forage crops.
- * to improve and, where necessary, restore grazing land capability through more intensive management.

Forestry

- * to maintain and ultimately increase the sustained yield of fuelwood and timber supply for local and public uses.
- * to integrate, where appropriate, the cultivation of agricultural and horticulture crops, medicinal plants and compatible trees.

Pasture land

- * to restore highland pasture on which forage productivity has declined.
- * to improve highland pasture capability through more intensive pasture land management.
- * to reclaim waste land for the production of fodder

Watershed management

- * to manage and development the soil and water resources in an area in order to sustain quality and quantity of water yield and to control surface erosion and subsurface discharge.

Other resource values

- * where appropriate and where local considerations warrant it, environmental plan should consider biological diversity, wildlife, fisheries, mineral, recreational and cultural resource values.

The problem of proper management of environmental resources cannot be isolated from the problem of the overall development of a given area. Nepal is an agricultural country where the economy of over 93% of the population is derived directly from land resources. Land use has been changing rapidly in order to meet increasing demands for food, fodder and fuelwood. Forested areas and marginal land on steep slopes are being converted for purpose of agricultural activity, while the productivity of agricultural, forest and pasture land is decreasing at a rapid level. This decreasing trend in land productivity is mainly due to improper management of land resources, with a consequence of high rate of environmental deterioration. For a predominantly agricultural economy such as Nepal's, it thus becomes a priority to increase production and, simultaneously, to preserve the environment. Proper land use planning is a prerequisite for protection and preservation of the environment and optimising agricultural production.

In a country with such a diversity of mountainous terrain and lowland plains it is not surprising to find extreme variations in climatic types—from arctic through alpine, subalpine, cool and warm temperate to sub-tropical over an elevation range from about 8,000 m down to 200 m.

Annual rainfall varies from less than 300 mm in the dry inner Himalayan valleys north of the Annapurna and Dhaulagiri Ranges (where saline soils - Aridisols-occur) to more than 3,500 mm on the southeastern faces of the high mountain ranges.

Temperature

Studies of altitude effects on mean maximum and minimum temperature by LRMP show decreases of about 0.52 C per 100m increase in altitude and with an altitude range of 200 m to almost 9000m. These temperature changes are sufficient to give a wide range of climate types—solely dependent on altitude. First becomes an important agro-ecological factor at altitudes above 1,800 m and in some lower enclosed valleys.

3. Intermediate and basic igneous rocks (dikes) are found in several parts of Nepal and there are also some ultrabasic occurrences. These are thought to be of true igneous origin rather than melts of older rocks.
5. Geology
 - (a) General
36. The geology of Nepal is well described in the LRMP Geology Report (1986) based on the work of the LRMP survey team and the Geological Survey Departments. They produced geological maps of the whole country at 1:125,000 scale to supplement other more detailed maps.
37. The geological strata of the country are mainly reflected in the physiography, with the major differences being on a north-south axis and an east-west uniformity. The youngest rock formations, the Siwaliks, form the southern edge of the Mountain belt. Further north are older mildly metamorphosed sedimentary strata; with still further north, older schists and gneisses. The sequence is rather like a giant overturned fold of strata of increasing age caused by a thrust northwards of the Indian plate towards the Tibetan Slab. The geologists believe that an active north-dipping fault zone (the Main Boundary Fault or MBF) exists between the northern Siwalik mountain front and the older rocks northwards. Intrusions of volcanic rocks occur in two groups; granite of the High Himal and granites, syenites, syenites and diorites of the Middle mountains. The High Himal granite (which forms the summits of the highest mountain peaks including Everest) invades. Cretaceous and older strata—with isotope dating around early Eocene. Many granitic bodies are aligned along the south side of the Middle Mountains including the Kathamandu area.
44. Population growth in Nepal has been rapid in recent years. The 1981 census population of about 15 million grew to some 17 million in 1986, and is projected to reach (according to various high, low and median projections) between 25 million and 30 million in 2005. Thus Nepal will have to feed a population increasing by between 50 and 80 percent over the 20 year period, 1986-2005 (see Table C3).

COUNTRY BACKGROUND

1. Physiographic Divisions

14. Until about 1980 there was only one generally used system of physiographic division in Nepal. This divided the country into three belts running more or less continuously across the country from east to west. These were:
 1. Mountains- the northern belt of high mountainous areas, stretching up to Himalayan peaks, and in some areas beyond into that part of Tibetan Plateau within Nepal's borders (mainly Mustang District);
 11. Hills- the central belt covering, from south to north, the Siwalik Hills, and the areas between them and the Mountains, including Kathmandu and Pokhara Valleys and many smaller ones;
 111. Terai- the southern plains belt between the Siwalik Hills and the Indian border.
15. For practical purpose it has been assumed that the boundaries of each belt follow the administrative district boundaries. Since, in fact, a district may cover physiographic areas of more than one type, data gathered on the basis of the physiographic belts is, of necessity, approximate.
16. These divisions were more or less universally used, until the beginning of the decade, for mapping and, in combination with the various administrative divisions, for socio-economic and land use data collection and planning. They are still used by most departments of government and much data is presented on the basis of these three-belt division.

The Land Resources Mapping Project (LRMP), the Department of Soil Conservation and Watershed Management and others have produced maps showing five (instead of three) physiographic belts representing well known and well defined geographical areas with district physiography, bedrock geology, geomorphology and climate. The five physiographic regions are, from north to south, High Himal, High Mountains, Middle Mountains, Siwaliks and Tarai. Certainly they define much more clearly the physical characteristics of the land than is the case with the three-belt division. However little, if any, data are currently collected on or presented using the five-belt division by most departments of government.

Development Divisions

There are five development regions, each containing two or three zones; these are Eastern, Central, Western, Mid-Western and Far Western. Each is aligned north-south from the Chinese to the Indian borders. The boundaries of each encompass the main trade routes which are roughly equivalent to the major river drainage systems.

Climate

The climate of Nepal has been well described by Cnyurlia (1984) in the Water Resources Report of LRMP, and from the forestry view point by Jackson (1987) in his Manual of Afforestation in Nepal.

POPULATION PROJECTIONS BY PHYSIOGRAPHIC REGION (1981 -2005)

(Thousands)								
Region	1981 ¹	Option ²	1985	1990	1995	2000	2005	Growth
Mountains	1303	A	1396	1546	1417	2019	2363	81%
		B	1417	1556	1734	1964	2244	72%
		C	1437	1566	1721	1908	2125	63%
Hills	7163	A	7787	8741	9974	11579	13519	89%
		B	7672	8457	9440	10613	12157	70%
		C	7557	8173	8906	9647	10795	51%
Terai	6557	A						
		B	7522	8874	10399	12130	14101	115%
		C	7394	8623	9967	11453	13090	100%
Nepal	15023	A	7266	6371	9534	10775	12079	84%
		B	16705	19161	22120	25728	29983	100%
		C	16483	18636	21141	24029	27491	83%
			16260	18110	20160	22330	24999	66%

(b) Recent Economic Trends

46. Economic growth in the first half of the 1980's was substantial (see Table C4) averaging more than 3 percent per in real terms, and outpacing the rapid population growth of about 2.6 per cent per year between 1971 and 1981. However in the financial year 1982/83 adverse weather condition reduced output substantially, leading to a decline in GDP for that year, a large balance of payments deficit and a fall in foreign exchange reserves. despite recovery in the following years with high real GDP growth rates, the balance of payments and level of reserves continued to fall until 1984/85.

Population and Migration

Population growth in Nepal continues to be very rapid. However growth is by no means uniform throughout the country. One of the divisions used in the 1981 Census is that between physiographic belts-Mountains, Hills, Terai-with a further sub-division between development regions - East, Central, West, Mid-West and Far West (See Volume II of 1981 Census,

¹1981 Census Data, Bureau of Statistics.

²A and C are APROCS high and low fertility projections respectively, B is the median of the two projections results.

Source: Perspective Land Use Plan, APROCS, 1987.

Geographic Regions Tables). These tables show significant demographic differences between physiographic/development divisions. Mountain areas show not only much lower population densities than Hill and Terai areas, but are also typified by a substantially slower growth rate. Since the data show no significant difference in fertility rates for the different areas, the different growth rates indicate a substantial rate of migration from Mountain to both Hills and Terai and a less substantial though still significant migration from Hills to Terai.

However it is doubtful if these projections really take into account sufficiently high level of north south migration in view of likely future pressures. Even the lowest projections assume an increase, over the 1986 median estimate, in the Mountain belt of some 650,000 by 2005; this is equivalent to a total increase of about 47 per cent. The main factors militating against such increases in upland areas are linked to the increase in food productive capacity which would be required.

They are:

- I. Virtually all cultivable uplands are already under cultivation;
- II. The opportunities for further irrigation are quite limited in upland areas;
- III. The cost of supply of fertilizers for increased production) or food (for food deficit areas) to many areas without metalled road access are prohibitive; (plans do exist to build roads into some upland areas but capital costs are extremely high and progress is bound to be limited over the next 20 years);
- IV. The trade-off between high cost capital and operating inputs into the upland areas and lower soft inputs into Terai areas, in a situation of scarce national resources, is bound to favour the latter.

Such considerations are highly relevant to future land use planning. They must be taken into account not only in strategic and economic planning, but also in detailed decisions as to how much land is needed to be set aside for food production, irrigation and forestry in each physiographic belt. For instance, should further forest lands be excised in the Terai to provide more irrigated food production areas? or should forest reserves be limited only to Mountain and Hill Areas with low agricultural productive capacity?

Present Land Use

After reviewing all the information sources, the National Planning Commission published in the Seventh Plan the officially recognized land use data for 1984/85 as shown in Table D1. These areas are not the same as those measured by LRMP, probably because of differences in definition and because LRMP had not completed their measurements when the Plan was written. The estimated areas of forest are roughly similar (5,533 and 5,617 Kha) as are the areas of grazing land (1,979 and 1,702 Kha). The "Himali" Plus water plus towns and roads of NPC also roughly correspond

to the ice, rocks, lakes, rivers, abandoned land, urban areas, etc. of LRMP (2,306 and 2,729 Kha). The major differences are in agricultural land (2,653 NPC) and 4,011 (LRMP) Kha), probably because LRMP included some land classified as "others (barren etc.)" by NPC as agricultural land, but mainly because LRMP counted 'inclusions' of non-agricultural land too small to be mapped at 1:50,000 scale as agricultural land.

Land Use 1984/85 ³	
(000 ha)	
Category	Area
Total	14,717
Agriculture	2,653
Grazing	1,979
Forestry	5,533
Himali	2,246
Water	406
Urban & Roads	103
Others (barren, etc.)	1,803

The way the area calculations were made by LRMP is fully explained in the Land Utilization Report pp 37-44. The 4.01 Mha is a mapped area of cultivated land within which there are non-cultivated inclusions such as small areas of forest or grazing areas in more heavily populated regions. Estimates of these in each district reduce the "mapped cultivated area" by about 29 percent, giving a gross cultivated area of 2.86 Mha. This should be equivalent at the 2.65 Mha agricultural area of NPC (Table D1). Furthermore the LRMP gross cultivated area includes "internal loss" areas due to risers, bounds, paths, minor irrigation canals etc. Which reduce the actual cropped area by a further eight percent giving a net area of productive land of 2.54 Mha-very similar to the census area of 2.46 and the NPC area of 2.65 Mha. Several readers of the LRMP Reports seem to have misunderstood their data regarding agricultural land. The terminology could have been improved to avoid these misinterpretations.

There are several sources from which one can obtain factual data on farming systems in the different physiographical and ecological zones. The most comprehensive are the data collected by LRMP.

Farming Systems

It is important to understand what agronomists mean by cropping patterns, cropping systems and farming systems. Cropping patterns refer only to the sequence of crops grown on the same piece of land Annually. The most important patterns in Nepal Are(a) Paddy followed by a Second Crops of

³Source: HMG (1986) Seventh 5-year Plan.

Paddy or Wheat or Pulses or Oilseeds or fallow on the flat banded Land(khet) (b) Maize, followed by maize, wheat, pulses, oilseeds or potatoes on the 'upland' (pakho) un irrigated areas. Sometimes the second crop is planted before the first is harvested (relay planting) and sometimes two crops may be sown together (mixed cropping or intercropping, depending on the special arrangement). It is occasionally possible to grow three crops in a year when the land is irrigated.

The LRMP surveys (Land Utilization Report 1986 Tables 17 and 18) show the percentages of land in the five physiographic regions which are single, double or triple cropped, but their data are misleading in that both relay and mixed crops have been included as double cropped. This is incorrect for mixed cropping, in that a proportional factor is always needed. For relay crops the competition effect between crops depends on how long their growing periods overlap.

2. FORESTRY

102. As already mentioned the forested land area accepted by NPC (5,533 Kha) is similar to that measured by LRMP (5,617 Kha). Its distribution is fairly equal between all the development regions, but by physiographic regions there are large differences in the percentages of forested land:

The low percentage forest in the Terai and High Himal would be expected. The 78 percent forest in the Siwalik reflects not only the steep terrain but also the poor nutrient status and moisture retention of the soils making these areas unsuitable for agriculture.

On a country-wide basis the forest land areas are 15 per cent conifer, 53 per cent hardwood, 21 per cent mixed conifer and hardwood and 11 per cent shrub. However many of these forests are of low density. For the legends to the LRMP land utilization maps, crown density is given in four classes <10%, 10-40%, 40-70% and >70% expressed as the areas covered by the crowns. It also gives species type (four tropical and six temperate and alpine) and maturity class.

In addition LRMP recorded 690 Kha of shrub land. In the report they compared 1978-79 air photography-derived forest plus shrub land area figures with those quoted in the Water and Energy Commission's 1983 report for 1964-65 and found a net reduction of about 388 Kha or six per cent. While the area in the High and Middle Mountains had not significantly changed, the reductions in area in the Terai and Siwaliks were about 24 per cent and 15 per cent respectively. Care should be taken however in projecting from the past what reductions in forest area may take place in the future. In the Siwalik, for instance, past reductions reflect settlement into the relatively limited areas of the dun valleys; little if any land suitable for agriculture now remains under forest in the Siwaliks.

Reduction in forest area is only part of the picture; more important is the loss in canopy cover that has taken place over the past two decades. LRMP have compared their 1978-79 air photography derived figures with the 1964-65 data prepared by the Forest Survey and Research Office. They found that there had been an increase in shrub area of 235 Kha and a

decrease in the area covered by tree crowns in the remaining forest area of 344 Kha.

There are no reliable figures for the fodder, fuelweed poles and timber removed from the forests each year. Only a very small fraction of the production from the forests is effectively controlled through the operations of the Timber Corporation of Nepal, the Forest products Development Board, the Fuelweed Corporation and the Forest Department's district offices. The bulk of the material removed is by people living in the vicinity of the forest areas who have the right collect each day, free of charge, headloads of fodder and fuelweed. Only in some of the national parks and reserves are these rights curtailed.

THE URBAN-RURAL INTERFACE

Although land use for urban development is very small when viewed as a proportion of the total area of the country or even of a district, it is quite important in the town municipality of which there are 33 in the country. A study has been made by PADCO using the LRMP maps of likely developments around the capital over the next 25 years. This shows that all the best agricultural land (class 1) will disappear for housing industry and roads within the period if there are no controls.

Losses of agricultural land to urban development are inevitable, but some method of recording the changes of use need to be put in place to quantify the problem.

In the land capability classification, slope, soil depth, flooding hazard and climatic limitations were the principal determinants, with substantially less consideration being given to soil texture, permeability and water holding capacity classes, sub classes and sub divisions are as follows:

Nepal, with its rich biological diversity and spectacular landscape, lies for the most part on the southern slopes of the Himalaya.

Extending 800 km along northwest-southeast axis, its 140-km width separates the arid Tibetan highland on the north from the fertile Ganga plain to the south.

The western half of the Tibet (People's Republic of China)-Nepal boundary stretches north of the Himalayan axis and there Nepal lies in the trans-Himalayan area-transition zone between the Himalaya and the Tibetan Plateau.

It is in this zone that many of the Himalaya's highest peaks are located, including Annapurna I to IV (8090-7525m), Dhaulagiri (8167m) and Manaslu (8156m). In the eastern half of Nepal, along the Tibet-Nepal border, are found the highest peaks including Kanchanjunga (859m), Makalu (8476m) and Sagarmatha -- Mt Everest (8848m). In all, Nepal contains more than 200 peaks that are 7000m or higher.

Nepal comprises the following distinct ecological zones: tropical and subtropical, ranging in elevation from 75 m to 900m and including the Tarai and the Churia Hills; temperate, rising to 2750m, including the upper part of the Mahabharat range above 915m and at the Hills; and alpine, covering all of Nepal above 2750 m. about 1.6 percent. During the period 1971-1981, this figure reached 2.6 percent. Recent estimates suggest that a very modest reduction in population growth has occurred in the past six years.

The distribution and density of population is not uniform among the Mountain, Hill, Inner Tarai and Tarai divisions. The mountain and Hill divisions, comprise 77 percent of the total physical area and 50 percent of the total cultivated area, contain 56 percent of the total population. The Tarai and Inner Terai divisions, with 23 percent of the total physical area and 50 percent of the cultivated area, are inhabited by 44 percent of the population.

If population density is considered in terms of cultivated land—an appropriate measure in view of the fact that most Nepalese people earn their livelihood from agriculture -- the Mountain and Hill divisions are more densely populated at 0.12 ha per person than is the Tarai at 0.21 ha per person. In terms of available agricultural land, Nepal is one of the world's most densely populated countries. In the near to mid-term, this situation will become more acute. Even assuming a large measure of success in controlling future population increase, it is very likely that the population will exceed 21 million by the year 2000.

Since the 1950's Nepal has experienced an ever increasing flow of internal migrants, mainly from the Mountains and Hills, to the Tarai. Between 1961 and 1981, the proportion of lifetime migrants increased from 4.5 percent of the native-born population to 8.6 percent. The deteriorating environmental and economic situation in the Mountain and Hill divisions, coupled with relatively better socio-economic conditions and the eradication of malaria in the Tarai and Inner Tarai, have been the main causes of internal migration.

While adequate data are yet to be collected before any definitive statement can be made, evidence suggests that the annual rate of immigration has been increasing in recent years.

Nepal is largely a rural society with only seven percent of population currently living in 33 urban settlements. By the year 2000, the urban population is expected to be about 2.3 million, some 11 percent of the total projected population.

Population pressures and distribution and settlement patterns are, and will continue to be, key factors in conservation considerations.

Population and Human Settlements

Since 1952, Nepal's population has doubled and, at current rates of increase, the present population of approximately 17.5 million will double again in about 25 years. Adding to the problems associated with rapid increment is the fact that the distribution of the population is uneven and settlement planning is inadequate.

Several factors, such as high fertility rates, declining death rates, a decreasing infant mortality rate, women's low off-farm earning power and lack of education and training, illiteracy, poverty and immigration contribute to the rapid population growth. With respect to the latter point, a 1983 survey (Task Force on Migration Report, National Commission on Population) showed 6.9 percent of the total Tarai population as immigrants.

Marked differences in land productivity, climate, economic opportunities and social amenities have increasingly contributed to internal migration and an imbalance distribution of population among the Mountains, Hills and Tarai.

The pattern of internal migration is characterized primarily by an increasing flow of people from the Mountains and Hills to the Tarai. In addition, a gradually increasing flow of migrants from rural to urban areas is occurring.

Consequently, the population is becoming more and more concentrated in the Tarai, valleys and urban areas. The deteriorating environment, resource base and economy of the Hills are the main push factors. Despite the rising rate of out-migration, the total population of the Hills has increased substantially in the past 30 years.

Rapid population growth, internal migration and immigration in turn, have led to unplanned settlement patterns and often illegal occupation of land, encroachment on forests and marginal lands and congestion in urban areas. Similarly, Nepal is experiencing an increasing flow of international migrants, particularly in the Tarai and the urban centres of the country.

With few off-farm employment opportunities, the increasing pressure upon the land and forest has grown beyond the carrying capacity of many areas.

People have to feel the need to stabilize population growth and to realize a more balanced distribution of population in order to achieve the objectives of future Development Plans and the goals of the Basic Needs.

Every Nepali has to recognize that a rapidly increasing population is the manifestation of a set of very complex social, cultural and economic factors, and that to tackle the problem simply by encouraging family planning is unrealistic. A comprehensive and multi-sectoral population strategy should incorporate the followings:

- integrating population with development programs
- raising the social and economic status of women
- according high priority to fulfilling innate demands for family planning services
- Increasing the participation local people and non-government -- in population programs

Conservation Awareness

Conservation: The wise-use of natural resources and the preservation of cultural heritage--begins with improved understanding.

Conservation initiatives, to be successful, must first take into account the social and religious patterns and the often severe economic constraints with which the individual has to contend. That alone, however, is not sufficient. The individual's basic level of understanding must be raised if the conservation objective are to be achieved.

Conservation is largely a matter of perception and attitude concerning the inherent capacity of nature to produce and reproduce, in response to careful stewardship, to meet the needs of mankind.

For this reason, successful conservation depends upon an informed public. In turn, this depends upon the free flow of information through all sectors of the community.

One of the best returns on investment is conservation education disseminated through the public school system. If concepts such as wise or managed use of land and resources and the importance of religion and culture to the well-being of the community become part of the motto of the country's youth, the possibility is greatly enhanced that, as future decision-makers, they will make more informed judgments.

Improving the level of awareness also means reaching the individual farmer through extension services; the local decision makers through training, seminars and public information programs; the administrator, technician and manager through in-service training; and the decision-maker, politician and religious leader through sustained exposure to conservation principles and their fundamental importance in the attainment of national development objectives.

Finally, a free flow of information does not mean linear, one-way or sectoral communication. If we agree that conservation is attitudinal, then we must also agree that there is not one authority or a single repository for conservation intelligence from which all knowledge flows.

The transmission of information is the spring of conservation consciousness. The farmer, the scientist, the historian, the industrialist, the politician, the bureaucrat, the business owner, the teacher and the householder should contribute effectively.

The distinction between the popular term, 'people's participation', and the actual and effective participation of community members in the decision-making process is frequently blurred; the most highly disadvantaged have the least effective voice because they are the least organized, yet they often have the most to gain when fair decisions are made

The tendency of government to be virtually the sole implementer of conservation programmes, to the exclusion of non-government groups and individual citizens, results in the loss of many opportunities that would incur very little or no cost by government

The literacy rate increased from 23 to 29 percent between 1981 and 1985; during the same period, however, the illiterate population rose from nine to ten million; although the successful exchange of information does not rest solely on an ability to read or write, a substantially increasing illiterate population is a serious constraint to improving the general level of understanding; indicative of the magnitude of the problem is the fact that, by the year 2000, some 10,000 new schools and 90,000 more teachers will be required to provide minimum primary education in Nepal.

The Role of Women in Resources Conservation

Essential to the successful attainment of either conservation or development objectives is an informed public with real opportunities to articulate needs and participate fairly in the decision-making process.

There is a need for a concerted effort if the public at large is to become well-informed about conservation issues. A special effort will be necessary where women are concerned.

The current national literacy rate is 29 percent whereas, for women, it is roughly half that. Although, in absolute terms, women lag behind men in education, in relative terms, female education is making substantial advances. In 1981, twelve percent of females six years of age and over were literate. In the case of adult formals, 14 years of age and over, the percentage of literacy was 9.2. Over 44 percent of literate females were in the 6 to 14 age group, indicating a recent spread of education among the female population. A major contributing factor has been HMG's policy with respect to the decentralization of education facilities.

As more women assume responsible positions, particularly in government, their role in policy-making and program design and delivery will effectively contribute to the overall role of women in resource conservation.

Considering the major role women play in resource activities at the village level, one could expect that they would eventually assume a larger, if not dominant, role in efforts to improve resource conservation.

The time spent by women in field work, animal husbandry, food processing and fuelwood, fodder and water collection is nearly double that of men -- 4.9 compared to 2.6 hours per day. When income-earning activities and domestic work are added, the average work day for women is 10.8 hours and for men 7.5 hours.

The Role Women in Resource Conservation

Much of women's daily activity centres around activities, related to water, land, fodder, crops, livestock, the food, cloth making etc.

Against this background, it is obvious that the National Conservation Strategy, to be successful, must clearly involve and target rural women. To do this, it will be necessary to reach women at the farm household level. Since society outside of the village, that is government bureaucracy, politics, the private sector and commerce, is dominated by men, it will take a concerted and determined effort to achieve this objective.

Drinking Water Supply and Sanitation

Prior to the First Five Year Development Plan in 1956, the total population of the country served by a piped water supply numbered less than 300,000. By the end of the Sixth Plan in 1985, that figure had risen to more than four million. The Decade Plan had, as one of its targets, to increase water supply coverage from 11 to 70 percent of the total population by 1985. Due to an increase in population beyond the original estimate, doubling of costs and shortfalls in implementation, this target was modified downward in line with existing conditions.

The difference between drinking water coverage and sanitation coverage is notable, however. In 1985, approximately 25 percent of the rural population had access to safe drinking water but less than three percent to adequate sanitation facilities. In the urban centres, the figures were 70 percent and 17 percent respectively.

Agriculture

The Mountains, Hills and Tarai constitute Nepal's natural splendour. At the same time, because of their ecological diversity and potential, they have, if properly managed the productive capacity to meet the food needs of the country's rapidly growing population.

Cultivated land accounts for approximately 2.65 million ha.¹⁰ The average area of cultivated land per capita is just 0.15 ha.

There are more than two million farms in Nepal and the farming population constitutes more than 90 percent of the total population of the country.

Small subsistence farms predominate in the Hills, where more than 60 percent of them contain less than one ha of land. The average size of these holdings is less than 0.5 ha, and many of the farms are divided into several plots in different locations. The average farm in the Hills operates at the subsistence level, being too small to generate a marketable surplus.

Landholding in the Tarai average more than two ha per family. More than 60 percent of the families have holdings larger than one ha and most of these farms are capable of producing a surplus.

In the Hills, crop production is practised on the valley bottom land, small areas along the river banks and on terraced slopes. At least 80 percent of these slopes consists of rain-fed upland terraces; the rest are partially irrigated valley bottom lands along river banks. The small and scattered nature of land holdings in the Hills, combined with very limited transportation facilities, make commercialization of crop production difficult and, in most cases, impossible. In comparison, richer soils, flatter topography, a relatively well developed transportation and irrigation system, combined with a more favourable man-land ratio, enable many Tarai farmers to produce a surplus of food and cash crops.

Although, on a national basis, the total production of food crops has steadily increased, agricultural productivity in the Hill and Mountain areas has not been sustained.

Rice, maize and wheat account for nearly 90 percent of the total cropped area of Nepal and, in each the average yield per ha in the decade 1971/72 to 1980/81 was less than in the previous decade.

For rice, which covers over 50 percent of the total cropped area, the reduction in yield per ha was two percent. For wheat and maize, the comparable figures were five and ten percent respectively. The reasons for the decline in productivity include increased cultivation of marginal lands, particularly in the Hills, and inadequate replenishment soil nutrients.

In the Tarai where irrigation facilities exist and agricultural development activities, such as block production programs, are concentrated, yields have been significantly increased.

Some of the obstacles or constraints to the agriculture, as well as conservation, are as follows:

1. Land ownership

In 1981, 50 percent of the total number of households owned less than 0.5 ha each, representing about seven percent of the total cultivated land, 12 and to date, the land reform measures have been marginally successful in rectifying the situation.

Most tenants have few legal rights; the land tenure system, however, is such that both landlords and tenants feel insecure and, in particular, the tenant has little incentive to make any extra efforts when he is unsure of his rightful share.

ii. Farming practices

Due to the rapid depletion of forest resources and the consequent use of crop residues and dung for fuel traditional farming practices are not being maintained and, in many cases, agricultural productivity has declined.

Improvement in cropping patterns is hindered by inefficient water management, inadequate irrigation facilities and insufficient integration crop farming with other resource sectors, such as livestock, fisheries and forestry, which, in turn inhibit improvement in productivity.

Lack of transportation and marketing facilities improper storage facilities result in annual losses of up to 15 percent of total production.

Inadequate research efforts to develop scientific dry farming agriculture systems suitable for the Hills.

Lack of sufficient linkage between extension and research activities.

Increasing population pressure in the Hills, resulting in use of marginal lands for crop production, and uncontrolled grazing by an increasing livestock population beyond the carrying capacity of the forest and pasture land.

Irrigation

Nepal's water resources are considerable, with surface run-off in the order of 200 km³ annually. About 80 percent of the annual precipitation occurs during the monsoon period-June to September in general, there is very little between January and June is often insufficient for many crops. Considering this, the main potential benefits of irrigation are:

- i to decrease the risk associated with production due to the vagaries of rainfall while aiding crop production without increasing dependence upon fertilizer and pesticide.
- ii to allow production and harvest times to be staggered and thereby better matched to the availability of labour and marketing opportunities.
- iii to afford crops, such as early paddy, the advantage of premonsoon sunshine hours when growing would otherwise be impossible due to lack of moisture.

In addition to surface water, Nepal's ground water resources are extensive. The available overall water resources, if fully harnessed, theoretically would permit irrigation greatly in excess of the total cultivated land. Given topographic and other constraints, the potential irrigable areas, subject to economic viability, would be about 1.9 million ha (Asian Development Bank Agriculture Sector Study 1982).

The total area of cultivated land in Nepal is approximately 2.65 million ha. of this amount, roughly 700,000 ha or 26 percent are irrigated. Farmers and non-government projects account for slightly more than half of this. The rest has been developed by government.

In the Tarai, there is an estimated 1.6 million ha of potentially irrigable land of this, slightly less than one-third, or 500,000 ha, is irrigated -- half by the government and half by the farmers.

The potential irrigable areas in the Hills are estimated to be approximately 300,000 ha. Exact figures are not available, but it is estimated 200,000 ha are currently irrigated of which about 150,000 ha have been developed by the farmers. These systems are mainly for supplementary irrigation of the monsoon crop and consist of seasonal structures with individual service areas, usually ranging from a few to less than thousand ha.

To date, virtually all of the irrigation systems in Nepal use surface water. Due to low stream flows in the dry season, this permits only supplementary irrigation during the wet season. There is considerable potential, however, for ground water development in Tarai, and the government has recently initiated such projects.

Pertinent Points

- i. irrigation projects that are poorly designed and managed and inadequately maintained have led to inefficient or inequitable distribution of water and siltation of canals, at times making such facilities inoperable; similarly, lack of effective monitoring and improper control of the use ground water can lead to an irreversible loss in the aquifer's capacity
- ii. insufficient priority has been given to providing the technical and financial assistance needed by privately controlled irrigation facilities, which are nearly 60 percent of the total, to improve their efficiency and productivity
- iii. failure to involve farmers in all phases of public projects including planning, design, operation and maintenance; as a result, farmers show little interest in government-sponsored schemes or in paying water charges; hence, the potential benefits of such projects are often not realized.
- iv. in the planning and design of new irrigation systems. Insufficient attention has been given to potential cross-sectoral implication; poor design can lead to increased erosion, waterlogging and drainage problems, situation and the wastage of irrigation water; conversely, poor land use practices leading to forest depletion, soil loss and the loss of water supply can have a detrimental effect upon the operation and life of the irrigation scheme.

- v. defective planning and design of tubewell irrigation in the Tarai have led, in some cases, to the deposit of sandy soil on fertile land.
- vi. lack of common objectives concerning resources management and conservation among line-agency departments leads to interdepartmental conflicts; similarly, lack of clearly defined mandated and roles for government agencies leads to duplication, conclusion and omissions.
- vii. conservation information concerning irrigation practices is not readily available to farmers, nor is it clear which agency, or agencies, has the responsibility or capacity to disseminate it; improper use of water may lead to soil salinity or leaching, and the inadequate replacement nutrients may eventually lead to less, rather than more, productive cropland; farmer-managed projects characteristically have high per ha water application rates.
- viii. the Department of Irrigation is primarily concerned with the design, construction, operation and maintenance of irrigation schemes; very little attention has been given by the Department to conservation issues, such as land management, soil regeneration and water application. It is responsible, however, for conservation related issues such as river training and flood control; to assume a greater role in conservation, its mandate needs to be broadened and its technical expertise expanded; administrative procedures would have to be established as it assumed additional conservation responsibilities.
- ix. emphasis is placed on the development of large irrigation systems, and too little attention is paid to the development of small, farmer owned and operated irrigation schemes such as shallow tubewells and small canals
- x. emphasis is placed on the construction of new irrigation systems, while the maintenance and timely delivery of water through the existing systems has received insufficient attention; the linkage between irrigation and drainage development receives only limited attention, leading to the problem of salivation of irrigation areas; consequently, the full benefit of irrigation investment in raising agricultural productivity has not been realized.

Livestock and Pasture Management

Livestock production represents a major portion of nepal's economy. In 1984/85, it contributed about 17 percent of the total Gross Domestic Product (GDP) in the form of milk, meat, ghee and skins, and 28 percent of the total agricultural GDP. In addition, livestock provides almost all of the power for cultivation and, in many areas, is the only means of replenishing soil nutrients.

Until relatively recent times, Nepal's abundant forests easily maintained a relatively large livestock population which, in turn, provide manure nutrients to maintain soil fertility.

This is not case today. Rapidly increasing human and livestock population are exerting demands upon forest land that cannot be sustained given the current

levels of management. Even at present livestock population levels, the percentage deficiency in feed nutritive requirements is high (see Annex VI)

Twenty percent of the total cattle population, compared to less than one percent of the buffalo population, is unproductive. While making heavy demands upon already scarce feed resources, its only contribution to the farming system is the provision of manure.

The feed deficiency in the Tarai is, for each component, somewhat less than in the Hills. With a serious depletion in the animal feeding base throughout the Hills, the productivity of livestock has fallen substantially. In essence, the livestock consumes most of its energy in the search for food rather than in production.

While the livestock population is degrading the forest, it is at the same time compacting the soil which, in turn, leads to the suppression of vegetation and to erosion problems.

Soil Conservation and Watershed Management

Soil loss is probably Nepal's single most serious resources conservation problem. It must be noted, however, that the problem cannot be totally attributed to human intervention. Natural or geological erosion rates are very high in Nepal. Over the last century, the proportion of the erosion induced by growing population pressures on a limited land base has increased considerably. Forest clearing, overgrazing, poorly maintained marginal arable lands and fire have greatly altered the natural vegetation of Nepal, leaving the soil exposed to massive degradation.

The serious detrimental effects of erosion in Nepal are manifested in the following ways:

- i. loss of topsoil from cultivated land and grazing land; as topsoil is erode, soil fertility declines and the land is less able to maintain its productive capacity
- ii mass movement of slopes -- including rock failure, landslides, slumps and debris torrents -- causes large-scale destruction of productive land, irrigation systems, paths roads and villages
- iii high sediment loads in rivers quickly reduce the useful storage capacity of man made reservoirs and cause silting of irrigation canals and damage to turbines and water control structures
- iv sedimentation, in conjunction with peak discharges results in abrupt channel change; these changes may cause complete loss of fertile farm land due to deposition of erode material or slumping of river banks and, in some cases, destruction of human settlements and loss of life (Carson 1985).

According to an inventory of watershed conditions in Nepal, it is estimated that seven percent of the total land area-about 10,000 Km is sufficiently devoid of vegetation to be considered to be in the process of desertification (Nelson D. 1980). In addition, 17 percent of land needs immediate conservation attention.

Flaws

Inadequate coordination among line-agency programs and the failure to incorporate conservation measures into development activities

With the exception of specific integrated watershed programs, there is a lack of any long-term planning on a watershed basis with respect to either development activities or conservation practises, resulting in the application of ad hoc measures spasmodically undertaken.

In considering obstacles and constraints, it is important to differentiate between surface erosion and mass wasting. Surface erosion refers to the loss of topsoil resulting from rainfall or wind, whereas mass wasting is the en masse movement of fractured rock and other unconsolidated materials, including soil, from a slope. Recent research has concluded that mass wasting is the dominant process in the evolution of natural slopes throughout much of the Nepal Himalaya. The instability of these slopes is natural, and man's effect on his erosion process is incidental at best.

Some of the obstacles confronting the soil conservation program are as follows:

- i. although projects such as terrace improvement, drinking water source protection and trail construction provide immediate benefits in some cases, there remains a general problem in gaining public support for, and participation in, conservation and watershed management issues. This is primarily due to the apparent absence of short-term benefits for a rural population that is just managing to survive at or below the subsistence level
- ii. a rapidly increasing human population and a livestock population of roughly 100 head per km², which together are placing excessive demands upon the productive capacity of the land

Forestry

Forest covers some 5.6 million ha, or 38 percent of Nepal's land area,¹⁴ and stretches from the lowlands' tropical, deciduous, riverine forest, below 300m elevation, to the Abis forest, found at 4500 m in the Himalaya.

A consideration of forest land area may appear inconsequential since it is volume of growing stock, not hectares of land, that is consumed for fuelwood and fodder. Nevertheless, in terms of future management, it is a critical factor and one that is in Nepal's favour, particularly in the Hills which contain two-thirds of the forest land.

Biological Diversity

Nepal presents a great diversity of flora and fauna ranging from the dense tropical monsoon forests of The Tarai, with highly productive paddy fields and warm waters, to deciduous and coniferous forests of the subtropical and temperate regions, and finally to the subalpine and alpine pastures and snow covered Himalayan peaks, with their cold streams, glaciers and lakes.

Nepal rich biological diversity reflects the stability of those widely varied physical conditions. Over 5400 species of vascular plants, including 240 species of endemic plants and 700 species of medicinal plants, 130 species of mammals, 800 species of birds and 117 species of fish have thus far been recorded in Nepal. The single genus Garrulous is represented in Nepal by 16 of the total 20 species of the eastern Himalay.

This abundance of biological diversity is present within a relatively small geographic area. The significance of this fact is that, if one of the components, or a major part of it, were lost, it could have a devastating effect upon a broad range of biological species.

For example, if Nepal were to lose its remaining humid tropical forest -- a possibility which is frequently predicted -- lost would be ten species of highly valuable timber, six species of fibre, six species of edible fruit trees, four species of traditional medicinal herbs and some 50 species of little known trees and shrubs. In turn, the habitat for 200 species of birds, 40 species of mammals and 20 species of reptiles and amphibians would be severely altered, if not eradicated.

Obviously, the importance of conservation measures necessary to ensure the maintenance of Nepal's rich biological diversity is paramount.

National Parks, Protected Areas And Wildlife Conservation

Today there are six national parks, five wildlife reserves and one hunting reserve in Nepal. In total, these parks and reserves cover approximately 11,000 km² -- more than seven percent of Nepal's land area.

It seems policy of His Majesty's Government to include pristine areas, representing principal geographic divisions and biotic regions, within the network of parks and protected area. Accordingly, the following network of national parks has been established:

- . Sagarmatha, in the eastern Himalayan region
- . Langtang, in the central Himalayan region
- . Rara, in the western Himalayan region
- . Shey-Phoksundo, in the west Himalayan region
- . Khaptad National Park and Shivapuri Watershed and Wildlife Reserve represent the Hill region
- . Royal Chitwan National Park lies in the southern lowlands and the Churia Hills and contains subtropical vegetation and oriental fauna.

Other area, such as Trijuga, Barun-Makalu and Annapurna, are under consideration.

In addition, the flood plain of the Koshi River in the east, the Tarai Bhabar region of Parsa and Bardia, and the riverine open grassland of Sukla Phanta are also representative ecosystems included in the network of national parks and protected areas.

Sagarmatha National Park, containing the world's highest mountain, and Royal Chitwan Park have both been included in the World Heritage List.

Currently in Nepal, 26 mammals, nine birds and three reptiles have been classified as endangered species. The network of national parks and protected

areas encompasses the habitat of most of these species. Most of the wildlife habitat, however, occurs outside of parks and protected areas, where wildlife resources are virtually unprotected. Similarly, aquatic species, including fish, receive no protection. As a result, a substantial percentage of wildlife is harvested indiscriminately both for commercial and domestic purpose.

Nepal's natural beauty, extraordinary cultural heritage and rich ethnic diversity attracted nearly two million tourists during the 17 year period, 1970 to 1986. In 1970, about 45,000 tourists visited Nepal. By 1986, the number of tourists who came for trekking and mountaineering alone rose from 12,600 to 33,600.

Tourism plays a substantial role in the economy of Nepal, where few employment opportunities exist beyond the agricultural sector and the capacity for earning foreign exchange is limited. In 1975, gross foreign exchange earnings from tourism amounted to 11.5 million dollars. By 1985, this figure had risen to 43.0 million and represented 18.5 percent of the total gross foreign exchange earnings that year.

Mountaineering and trekking activities, by their very nature, are bound to have a direct impact upon the social and economic structures of mountain villages—erosion of traditional values being one. However, the native Nepalese and Tibetan Handicrafts that had languished for lack of patronage prior to the advent of tourism in Nepal have, since that time, experienced a significant revival. Similarly, the renovation of many buildings in the ancient cities of the Kathmandu Valley can be attributed to outside influence (Gurung 1984).

Clearly, many economic benefits accrue at the local level. In general, however, these benefits are not distributed throughout any given community. Porters, who may live some distance from the actual trekking routes, and lodge owners are usually the principal beneficiaries.

In those areas where well-travelled routes exist, there are detrimental effects to the environment that can be attributed directly to mountaineering and trekking activities.

Energy Development

Nepal's theoretical hydroelectric potential is estimated to be 83,000 MW, of which 27,000 MW is considered economically feasible under current conditions. Nepal's installed capacity of 161 MW meets less than one percent of the total energy requirement. Fuelwood supplies 84 percent of the need, and agricultural residues and animal dung, 11 percent. Petroleum and coal—both imported—provide the remaining five percent. Petroleum alone accounts for 3.8 percent of total energy consumption and, during the decade 1975 to 1985, petroleum product imports doubled in volume and increased four-fold in value.

The generation, transmission and distribution costs associated with electrical power are, and will continue to be, very high. Increased urbanization will result in increased use of electricity. Nationally, however the consumption ratio of fuelwood to hydroelectric power will alter very little. At present, about five percent of the population has access to electricity. This represents less than a two percent increase in the past 25 years.

It is estimated that the total annual fuelwood consumption in Nepal is about 11 million M3. This is roughly equivalent to clearing, annually, 50,000 ha of well stocked forest. Since only 10 to 15 percent of Nepal's forest land can be considered well-stocked, the equivalent area cleared is closer to 100,000 ha. The Seventh Plan, (1985-1990), calls for planting 175,000 ha in total over the five year period.

It is planned that, by 1990, installed capacity will be increased by 85 percent to 238 MW. The new projects include Kulekhani 11-32 MW; Marshynagdi-69MW; Andhikhola-five MW; and number of small projects with a total capacity of roughly four MW.

A large number of attractive hydroelectric projects have been identified on the basis of studies undertaken in three major river basins--the Karnali, the Gandaki and the Kosi. Possible future projects include the Sapta Gandaki (225 MW) in the Gandaki Basin, and Arun No.3 (400 MW single stage) in the Kosi Basin. Although both these projects are economically attractive, commissioning will take a long time and will occur only when detailed engineering design is completed and required financing is arranged. Therefore, it is more likely that smaller projects will be undertaken to help meet the expanding demand until one of the projects mentioned above is undertaken.

Two mega projects are also being studied -- the Karnali (Chisapani) and the Pancheshwar, with installed capacities of 3600 MW and 2000 MW, respectively. Both projects would be multi-purpose, comprising power generation -- primarily for export, irrigation and flood control. The magnitude and complexity of these proposed projects, including environmental considerations, capital costs and the international market aspects, are such that considerable study and research are necessary before a decision concerning feasibility can be reached.

Industrial Development

Although the industrial sector accounts for just five percent of Nepal's gross domestic product, its contribution to the nation's economy is growing significantly. In the ten-year period between 1974 and 1984, industrial output more than doubled. During the five year period ending in 1982 the number of employees in the industrial sector increased by 62 percent to more than 81,000. It is estimated that by 1990, this figure will be 95,000.

Implicit in the "wise-use" definition of conservation adopted by the NCS for Nepal is the idea of sustaining productive capacity. When considering non-renewable resources, the definition can be refined to read wise-use of the resource in order to obtain optimum recovery.

Existing laws in Nepal broadly identify the importance of the conservation of hydrocarbons and minerals, and require that "the best" conservation measures be practised. Well-articulated conservation policies and programs concerning non-renewable resources, however, do not yet exist. In part, this reflects the fact that very little mineral production has occurred to date.

Mineral exploration in Nepal has established that there are large deposits of carbonate minerals, namely limestone, dolomite and magnesite, talc and erratic low-grade phosphorites, along the Mahabharat and midland belts of the Hills. Deposits of such metallic minerals as copper, cobalt, iron, Zinc and lead occur in different parts of the country.

The zinc-lead deposit of Ganesh Himal, at 4200 m above sea level, is one of the best-known medium size metallic mineral deposits. Occurrences of semi-precious stones such as garnet, tourmaline and aquamarine are located in the pegmatites of eastern Nepal, and in a few cases, in the central and western parts of Nepal. In the central part of the country, some pegmatites also contain ruby.

Except for the low-quality lignite deposits of the Kathmandu Valley, no commercial coal deposit is known to occur in the country. However, the sedimentary basins underlying the Tarai and the Churia zones are known to hold thick layers of sedimentary rock, and it is probable that these basins have hydrocarbon deposits.

An iron ore deposit, containing proved reserves of 3.3 million tons of are averaging 56 percent iron content, exists in the Phulchoki Hills southeast of the Kathmandu Valley. A study was conducted in the late 1970's to determine the feasibility of establishing an iron smelter using the Phulchoki ore. Due to the lack of coal in commercial volumes, the study considered the use of locally produced charcoal. It would have required 20 to 25 thousand ha of plantation forest to provide the necessary volume of charcoal on a sustained yield basis. The project did not go ahead -- the fuelwood requirement being one of the major drawbacks.

The production of limestone, magnesite, zinc and lead, agricultural lime, slate and boulders provides employment in the order of 3000 full-time jobs and several thousand more seasonal, short-term job opportunities.

POLICY NEEDS

Drinking Water

Source Protection

An adequate supply of safe drinking water is of paramount importance to the health of the Nepalese people and is fundamental to the welfare of the nation.

The protection afforded drinking water sources is generally inadequate, particularly in the context of animals grazing in the catchment areas and related pathological contaminants, the use of chemicals in agriculture and soil erosion.

The importance of rehabilitating, and subsequently maintaining, long-established traditional drinking water sources has been largely overlooked.

Legal provisions respecting the protection and rehabilitation of sources of drinking water exist, but are generally not enforced.

Determination of the boundary of the area necessary to protect the water source.

Installation and maintenance of vegetative fencing along the boundary.

Rehabilitation of the actual water source and the enclosed protected area, including the planting of trees and basic soil conservation work to maintain soil stability.

Regular follow-up surveillance of the water source area to monitor the adequacy of the protection program and the installed water supply and sewage facilities and to take the necessary corrective measures

Legal provision for the protection of drinking water sources, currently contained in various pieces of legislation, should be consolidated under a "Water supply and Sanitation Act" (WSSA).

Forestry

Nepal's forest, if properly managed, can be a major factor in reducing the serious erosion and flooding problems that beset many areas of the country; in providing the basic essentials of fuelwood, fodder and timber upon which the majority of the population is directly dependent; and in source of off farm employment opportunities.

- . increasing population pressure and road accessibility in the future can only exacerbate the current problem of encroachment in the forest areas of the Tarai and Inner Tarai.
- . displaced villagers, for example, the victims of natural calamities such as landslides and floods, have a legitimate need to be resettled in, or adjacent to, forested areas.
- . the major emphasis of the Department of Forest has been one of protection and prohibition in order to maintain, or enhance, natural productivity; these measures have not been sufficient, however, to meet the rising demand for forest products or to control the increasing problem of forest degradation.
- . although the community forestry program is extremely modest in relation to the magnitude of the national problem, its success has shown that local people are willing to assume more responsibility for forest management.
- . public sector and controlled private sector industry and non-government organizations can contribute substantially to the protection and management of the forest, as well as to the national economy, through forest based industries and enterprises
- . forests in the Churia Hills and adjoining Bhabar, because of their particular susceptibility to erosion, will be strictly protected against encroachment, the heavy removal of biomass and injurious effects of grazing and free
- . areas of forest land necessary to maintain the ecological balance, for example in the Churia Hills and Mountains, will be identified and managed in such a way as to minimize human activity
- . inhabitants of the flat land in the Bhabar tract will be encouraged, through various financial incentives, to grow industrial tree plantations and horticultural crops

- . people displaced because of landslides and floods will be allotted land in agro-forestry projects
- . existing and potential encroachers on forest land will be employed in plantation and silvicultural activities, including intercropping in the plantation areas, thereby reducing the loss of forest land through unregulated settlement
- . a survey of forest deficient villages in each District will be undertaken and an assessment made of the amount of forest area that will be required to meet future local demands based on current consumption patterns
- . an assessment will be made to determine the area of forest cover required to re-establish an ecological balance in identified critical areas, and a data base will be established and updated at regular intervals, for purpose of both short and long-term forest resource management and development
- . harvesting of government forests will be conducted according to HMG approved local forest management plans, containing silvicultural measures and, where appropriate, agro-forestry techniques based upon accepted forestry principles
- . in order to improve forest land productivity, more of the responsibility forest land productivity, more of the responsibility for forest management and the production of forest crops will be transferred to the private sector through leasehold agreements and other arrangements with user groups at the ward level, and in other cases, individuals, small and marginal farmers and minor forest product users
- . where such responsibility is transferred to the private sector, the Department of Forest, through the appropriate district offices, should ensure that the terms and conditions of the leasehold agreements and other arrangements are complied with
- . private owners of trees or forest will be entitled, without interference from government, to utilize, transport and sell forest products to the domestic market
- . the creation of more nurseries in the private sector will be encouraged, including for example, school nurseries; the present incentive to land owners of a land tax concession will be supplemented with cash incentives, where appropriate; land ownership limits under the Land Reform Act may be waived with respect to private, unproductive land converted to forestry plantation, and recognition certificates may be awarded to those who have successfully established such nurseries
- . forest development projects should be designed and structured to include activities that will be of direct benefit to local communities in order to motivate villagers to actively participate in forest management and protection
- . in those areas where it is deemed absolutely essential, and no viable alternative exists, the forest should be protected, that is, forest harvesting must be prohibited

National Parks and Protected Areas

- . one of Nepal's major conservation achievements has been the establishment of a network of national parks and wildlife and hunting reserves, which together cover just over seven percent of Nepal's land area, and that two of the National Parks, Chitwan and Sagarmatha have been declared World Heritage Sites
- . there are gaps in the present network of protected areas, for example, in terms of sites necessary for the preservation of biological diversity, sites of unique scientific and research value and sites having significant cultural, archaeological or historic value
- . land and other resources within the parks and protected areas are not managed in the context of a comprehensive management plan nor within established planning guidelines
- . the successful protection of wildlife, resulting in specific population concentrations in some areas, has had serious effects upon local communities in terms of both personal danger and damage to agricultural crops
- . restrictions placed upon the customary harvesting practices of local communities pursuant to the establishment of parks or protected areas have, in some cases, resulted in social and economic hardships
- . the lack of effective two way communication and a comprehensive management combined with regulatory procedures, at times lead to acrimonious relationships between local villagers and those responsible for park administration and management
- . for purpose of future park and protected area selection, the current broad classification of geographic divisions the Tarai, Inner Tarai, Hills and Mountains should be defined taking into account other factors for example flora and fauna
- . gaps in the current network of protected areas will be identified on the basis of the refined classification, giving priority to those areas considered to be most seriously threatened

To qualify for consideration, the lands to be protected must satisfy one or more of the following:

- . contain sites of significant religious, cultural, archaeological or historical value
- . contain habitat essential to the survival of a significant population of terrestrial mammals, migratory birds or fresh water fish
- . contain examples of outstanding site-specific or unique landforms or geomorphic features
- . contain sites necessary for the preservation of genetic diversity

- . contain habitat essential for the preservation and enhancement of rare and/or endangered species
- . contain nationally important landforms or water bodies that are, or may become, subject to environmental deterioration

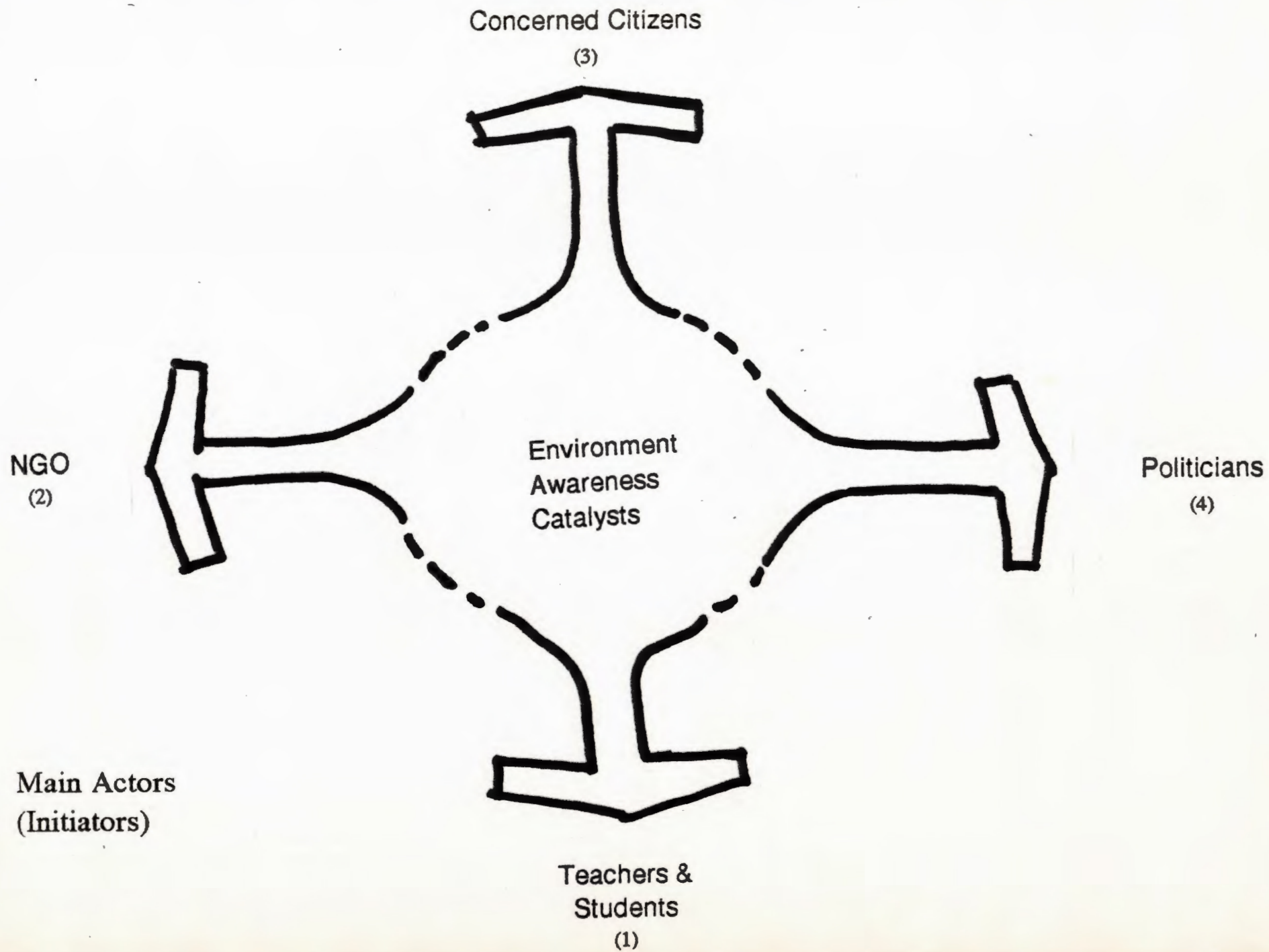
Agriculture

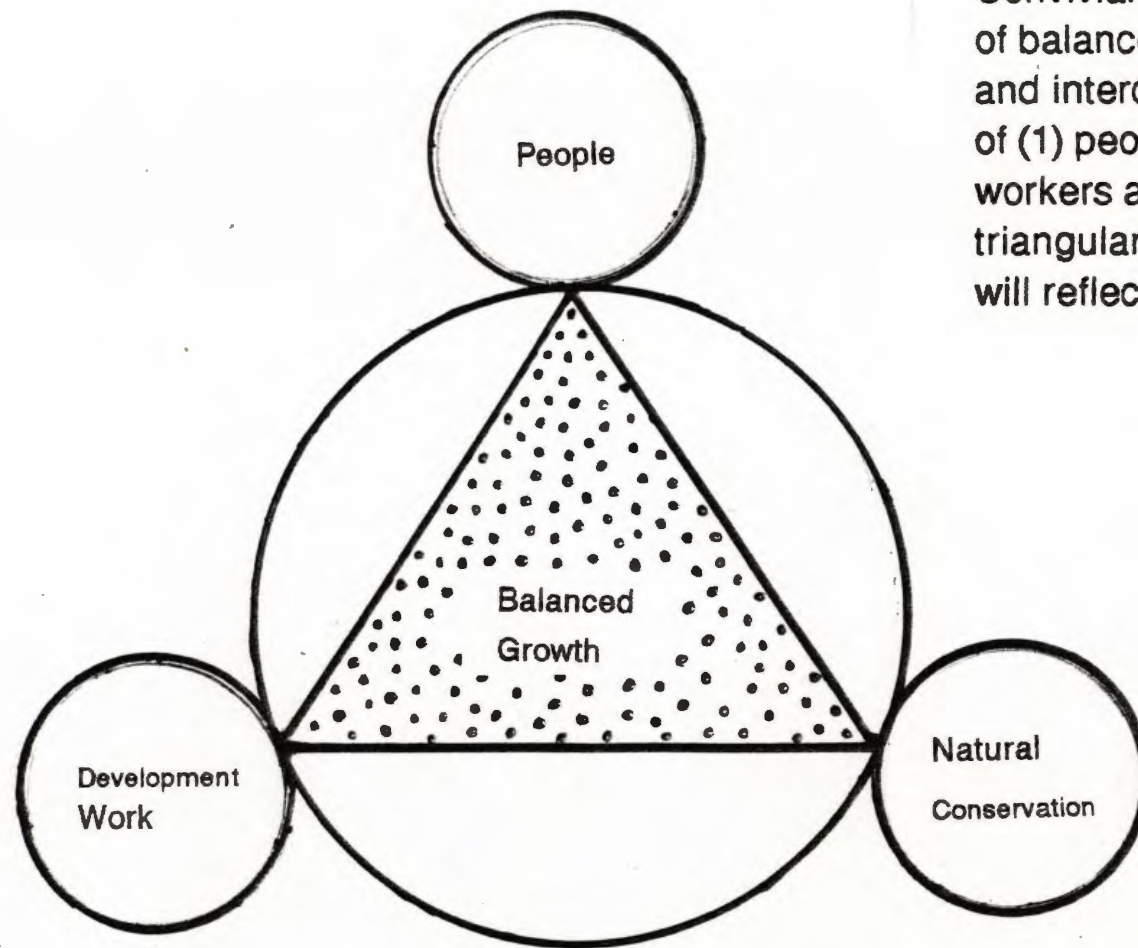
- . the present annual agricultural production of four million mt will have to increase to nearly nine million mt by the year 2000 if the basic minimum food requirement of the Nepalese people is to be met
- . virtually all of the land suitable for cultivation is being used for that purpose; there is also land that is unsuitable for crop production and should not be but is being, cultivated
- . the average area of cultivated land per capita is just 0.17 ha
- . the cultivated land distribution in Nepal is highly skewed; approximately 50 percent of all households have holdings of less than one half ha and in total, account for only 06.6 percent of all of the cultivated area; conversely, 47 percent of the total cultivated land covered by holdings of more than three ha are owned by only nine percent of all households
- . fragmentation of agricultural lands continues to occur, resulting in inefficient farming practices; although total production has increased, inadequate replenishment of nutrients and increasing reliance upon lands not suitable for cultivation have led to an overall decline in agricultural productivity and serious soil erosion problems have resulted
- . dual rights and conflicting interests between landlords and tenants result in inefficient land use and low productivity
- . inadequate storage and transportation facilities result in substantial losses of agricultural production
- . deforestation and overgrazing have led to soil erosion and flooding which, in some cases, have resulted in the loss of agricultural land
- . specific successes with respect to block production, aquaculture and horticulture programs show the individual farmer's capacity to improve and diversify agricultural production if given appropriate incentives and encouragement.
- . HMG should make every effort to redress the highly skewed nature of land distribution and to address the problems of increasing fragmentation of agriculture lands, dual rights and conflicting interests
- . a program should be developed to encourage landowners to enter into contractual arrangements with private sector groups and non-government institutions to cultivate unused land

- . in order to enhance productivity in the Hills and the Mountains, agricultural land management policy will include the protection of watershed areas, soil conservation, including the determination of the maximum slope terraces for which cultivation rights may be granted, promotion of agro-forestry and communal pasture management

Followings Should Be Given Considerations

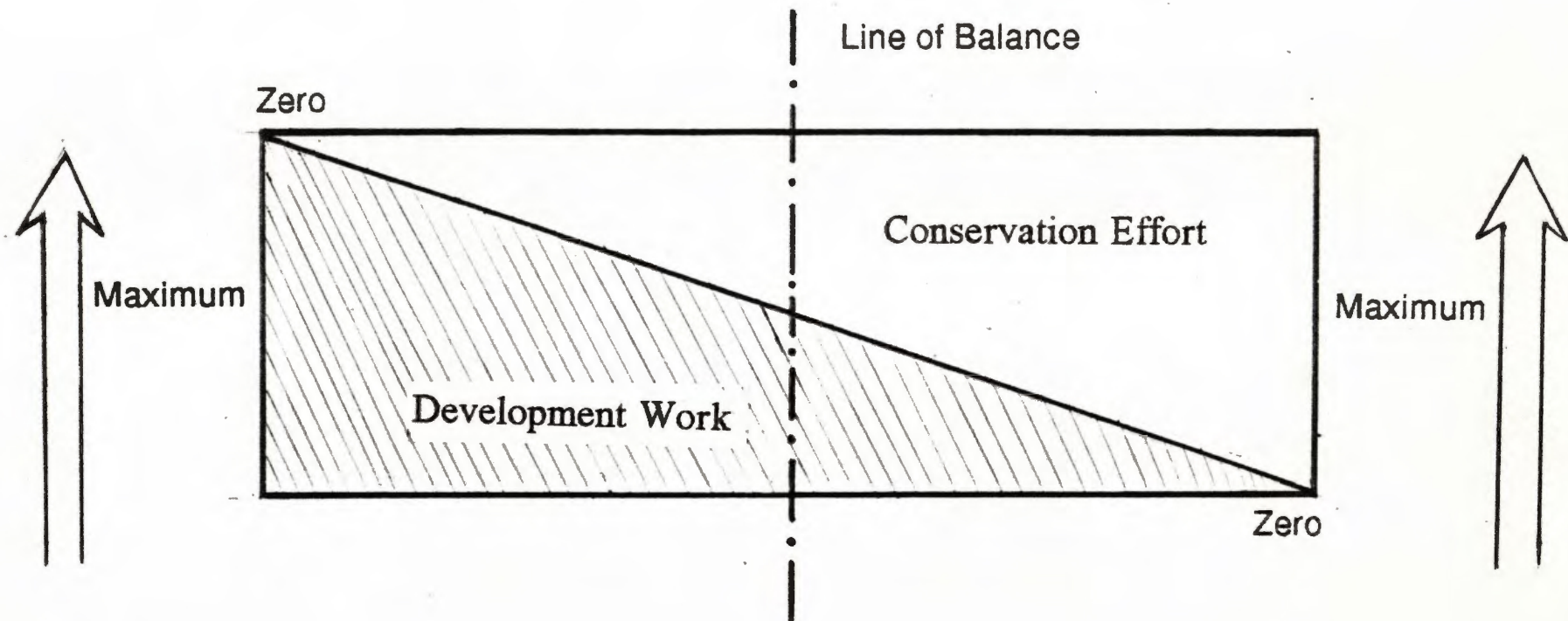
- . mixed cropping, alternative cropping and green manuring practices
- . integrated farming; for example, poultry, piggery and aquaculture
- . horticulture with intercropping in dry-hill areas
- . planting of leguminous crops following harvesting of main crops
- . use of marginal crop lands for horticulture, pasture, fodder and fuelwood tree development, and aromatic and medicinal herbs
- . programs should be undertaken, particularly with respect to small farmers, to:
 - enhance their access to credit for such purposes as improved terracing, gully control, small-scale irrigation and agricultural diversification into cash crops, agro-forestry and horticulture activities
- . improve local storage and transportation facilities and facilitate effective marketing procedures
- . the most critical soil erosion problem areas and their potential for affecting productive agricultural lands should be identified; in such areas, major restoration measures should be undertaken, the Department of Soil Conservation and Watershed Management being the lead agency-with respect to gully and torrent control and catchment conservation; and, in flooded agricultural lands, agro-forestry reclamation measures will be implemented
- . although the use of pesticides is not common throughout Nepal, there are specific areas, such as the Kathmandu Valley, where they are used, and their use will increase as more emphasis is placed upon increasing national food production levels
- . there is insufficient information available to users concerning which pesticides should be used, and what quantities
- . the problem of storage and disposal of pesticides is becoming increasingly urgent
- . the unregulated use of some pesticides poses a significant health hazard to pesticide handlers and food consumers
- . there should be control over the importation of controversial pesticides and chemical fertilizers that are already banned from use in other countries





Convivial Harmony is indicative of balanced growth of interrelated and interdependent relationship of (1) people (2) development workers and (3) nature. It is triangular harmony. Impacts on one will reflect on other two.

Convivial Harmony



Spectrum of Development vs Conservation

(is graphical indication of fragile but intimate relationship between development works and conservation efforts).

The Production Cycle



Appropriate Technology: Terai



Terai Harvest



Fish Pond: Near Lahan



Kathmandu Valley



Foodgrain Production: Terai



Pokhara-Butwal Road

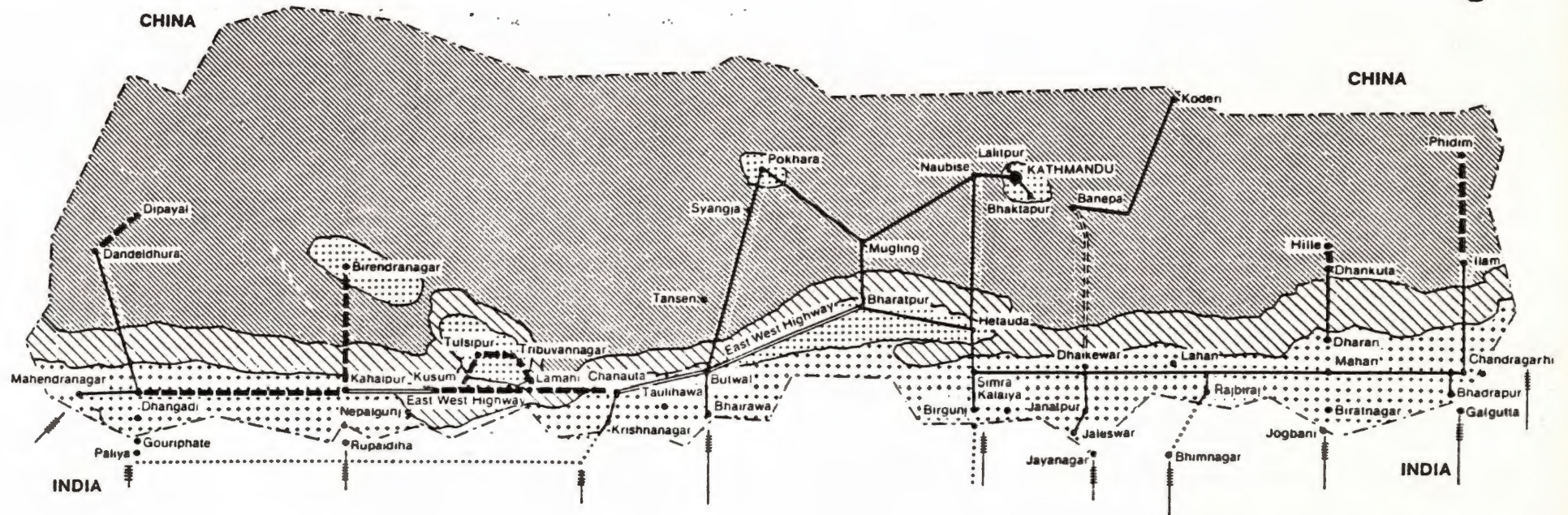


Bhaktapur



Kathmandu

FIGURE II.1



SETTLEMENT SYSTEM & ROAD NETWORK

Legend

- | | |
|--------------------------------|---------------------|
| — East West Highway | ▨ Hills & Mountains |
| — All Weather Road | ▧ Foothills |
| — Fair Weather Road | ▤ Plain |
| — Roads in India (All Weather) | ▥ Valleys |
| — Railway | |
| — International Borders | |

FIGURE 1.2

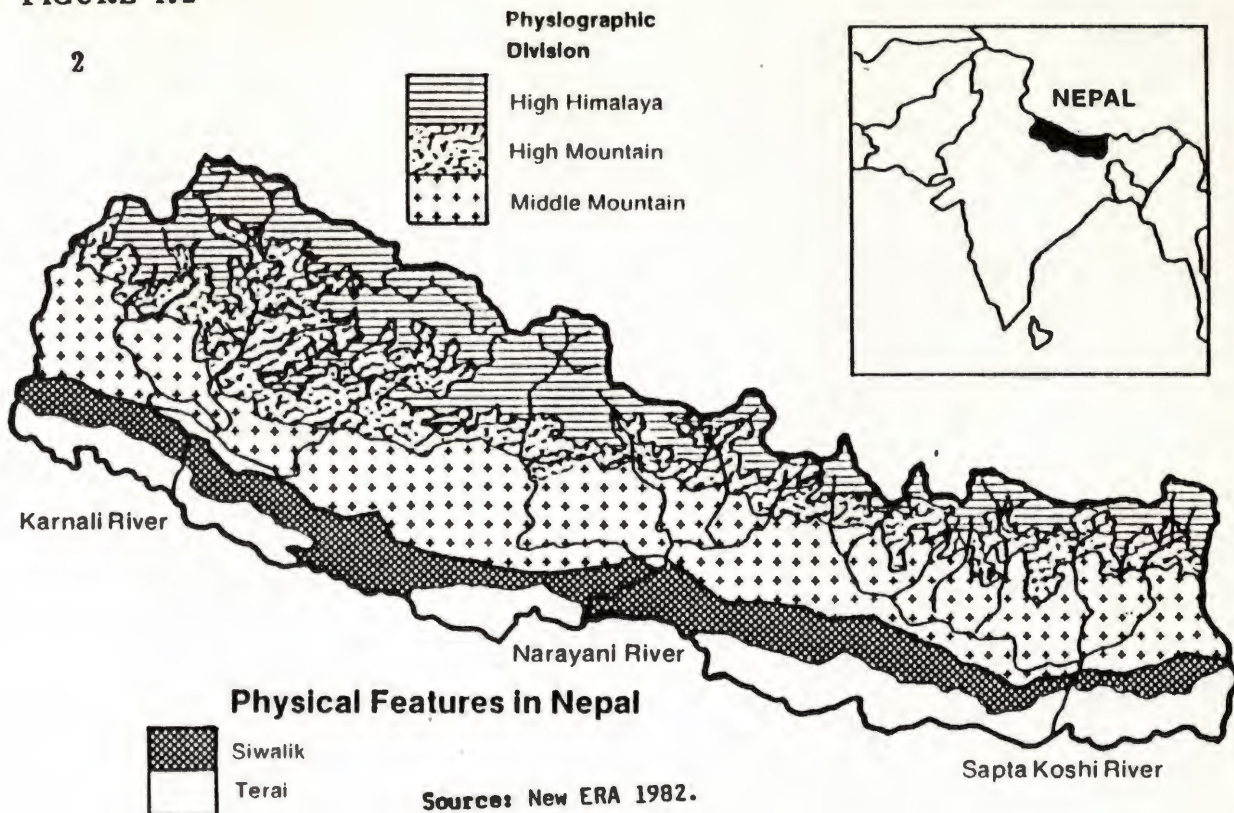


FIGURE 1.3

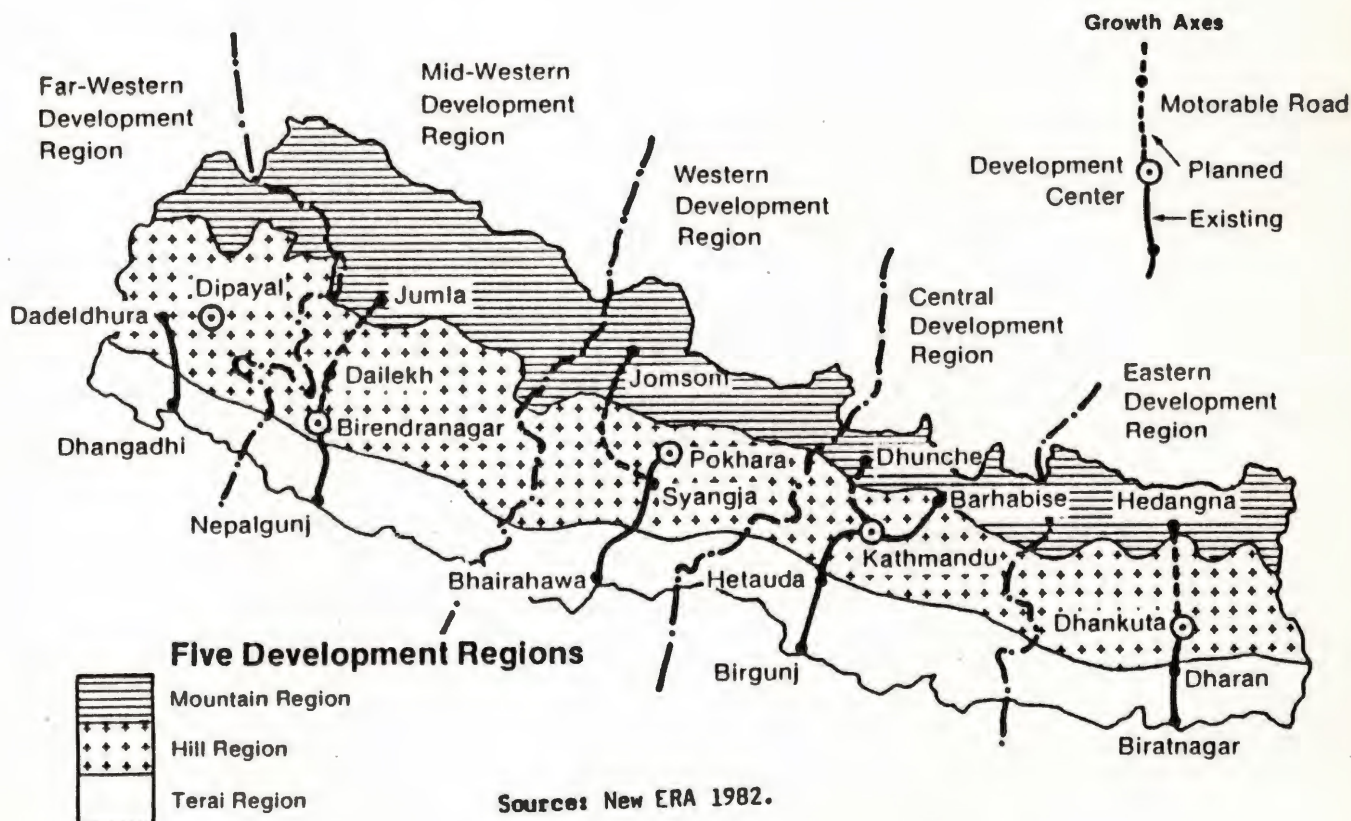
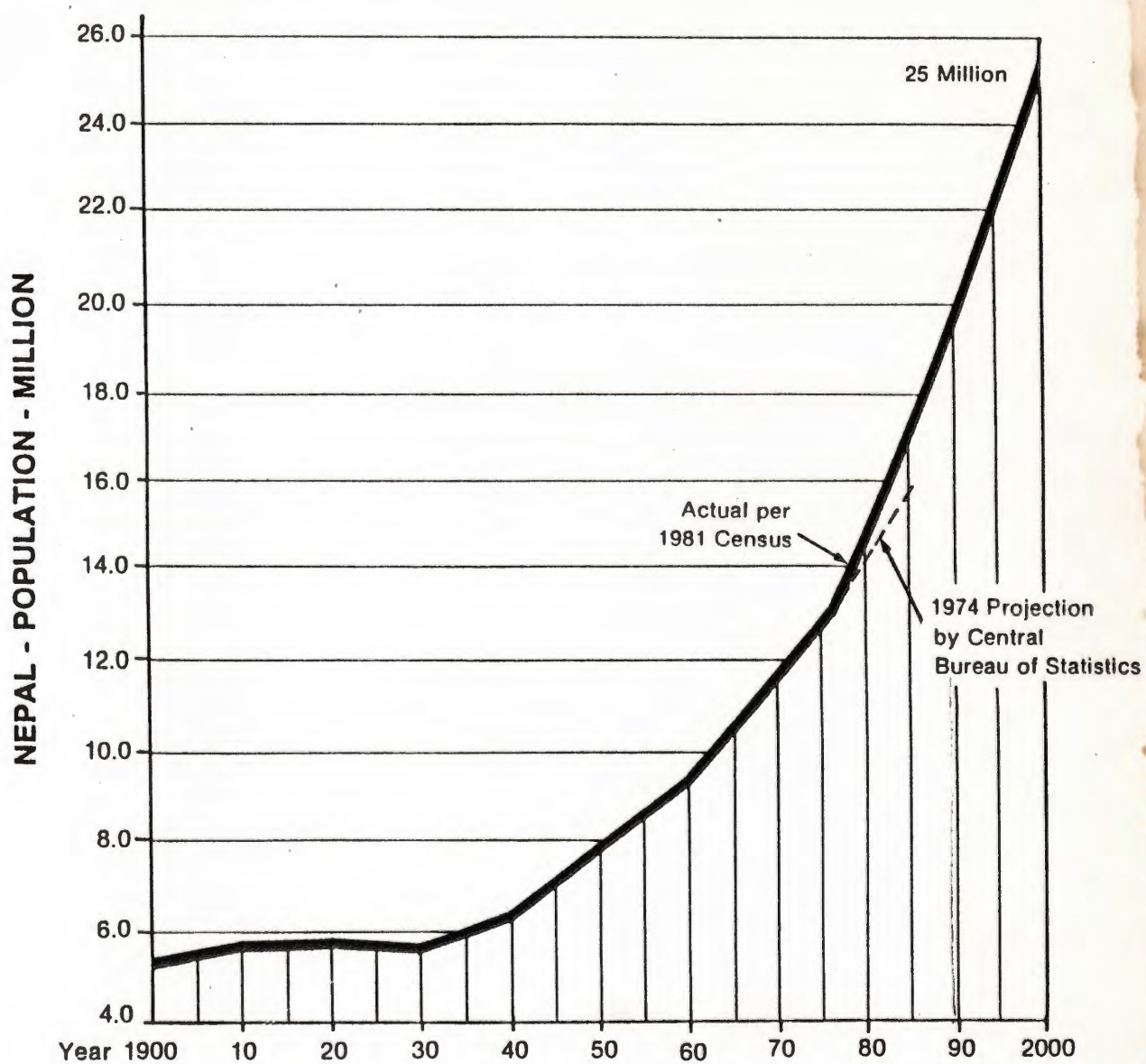
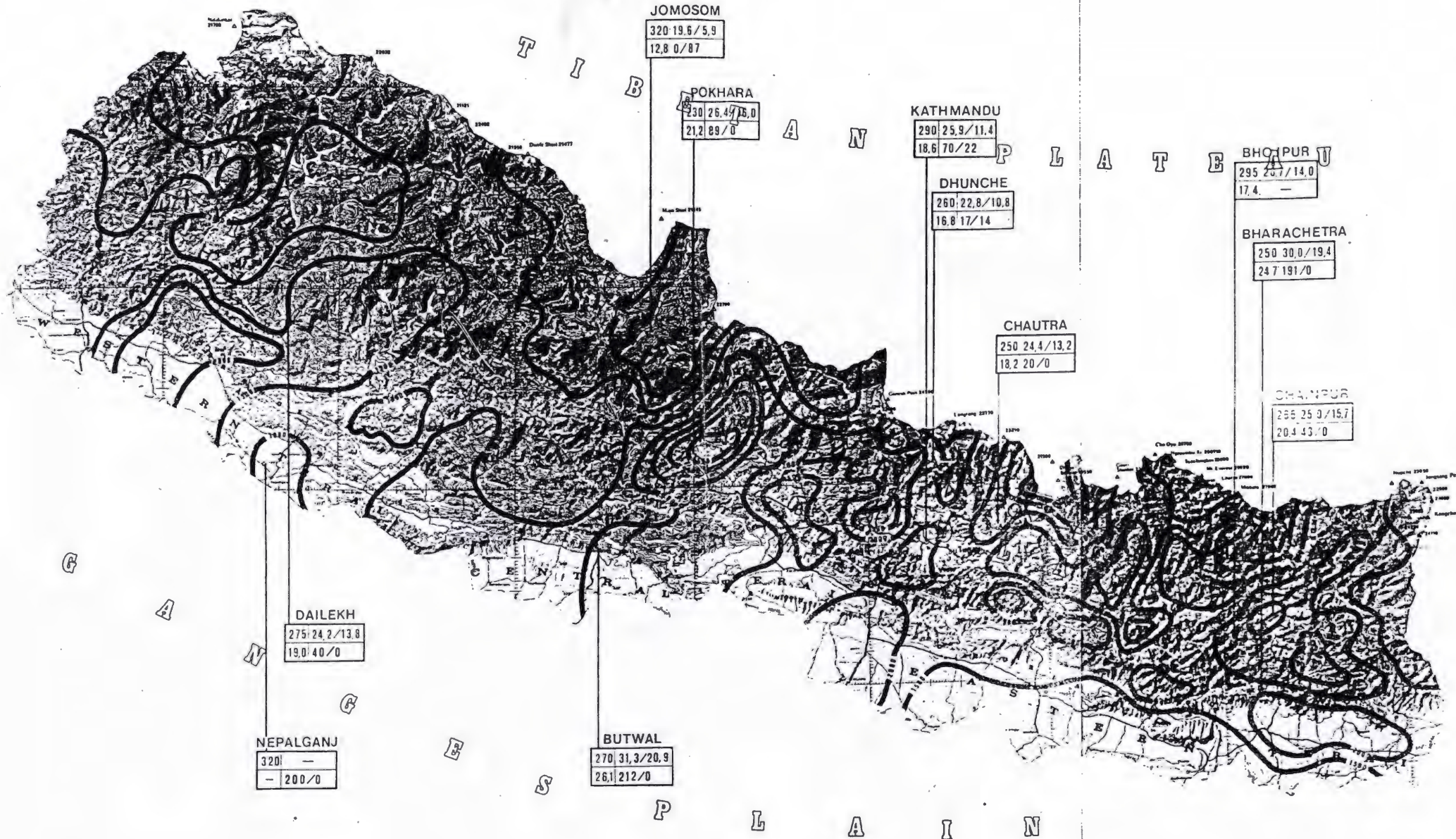


FIGURE 1.5
National Population Growth and Projection



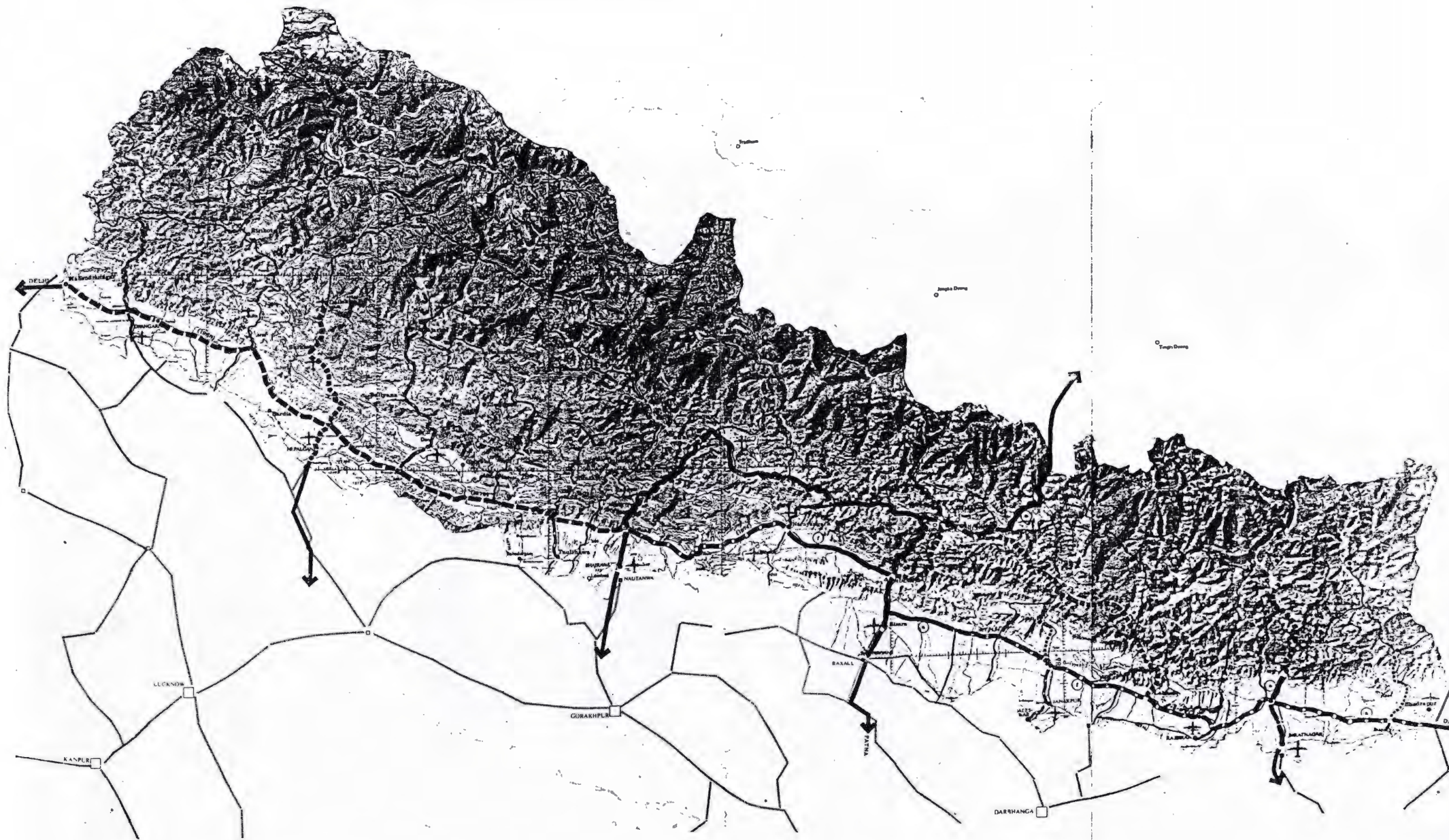
Source: IBRD/WSSB. 4th Water Supply Project PADCO.



CLIMATE RAINFALL & AIR TEMPERATURE (1966 RECORDS)

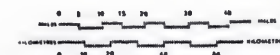
CLIMATIC DATA FOR
SELECTED AREAS, IN 1966:

NO. OF SUNNY DAYS PER YEAR	MEAN ANNUAL MAX/MIN TEMP. °C
MEAN ANNUAL TEMP. °C	NO. OF DAYS WITH TEMP. 30 C and above / 0 C and below

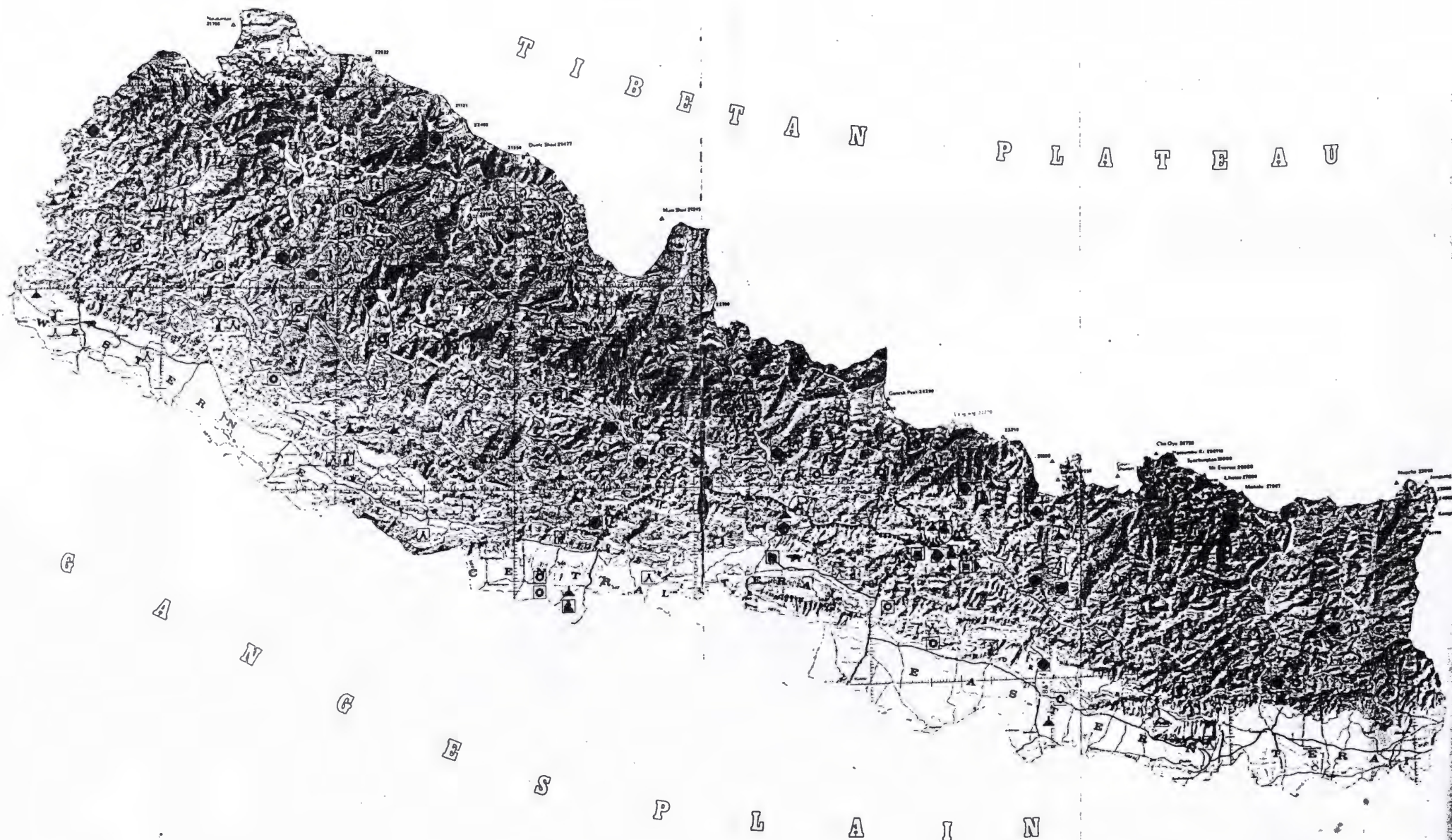


TRANSPORTATION

- | | | | | | |
|--|---------------------|--|---------------------|--|-----------------------|
| | HIGHWAY | | all weather road | | INTERNATIONAL AIRPORT |
| | REGIONAL ROAD | | fair weather rd. | | DOMESTIC AIRPORT |
| | route under constr. | | jeepable rd., track | | S.T.O.L. AIRFIELD |
| | route planned | | RAILWAY, RAILHEAD | | |
| | route proposed | | ROPEWAY | | |



PREPARED BY: GAGE MAP DIVISION 3



TOURIST ATTRACTIONS

- NATIONAL PARK
- PRESERVE AREA
- WILDLIFE
- GAME
- WINTER SPORT

- OBSERVATION SITE
SCENIC AREA
- SCENIC ROUTE
- WATERFALL
- HOT SPRING

- MOUNTAIN PEAK
climbed
- PEAK unclimbed
- HIGH PASS

- NATIONAL SHRINE
- HISTORIC MONUMENT
- ARCHAEOLOGICAL SITE
- FAIR SITE
- MUSEUM