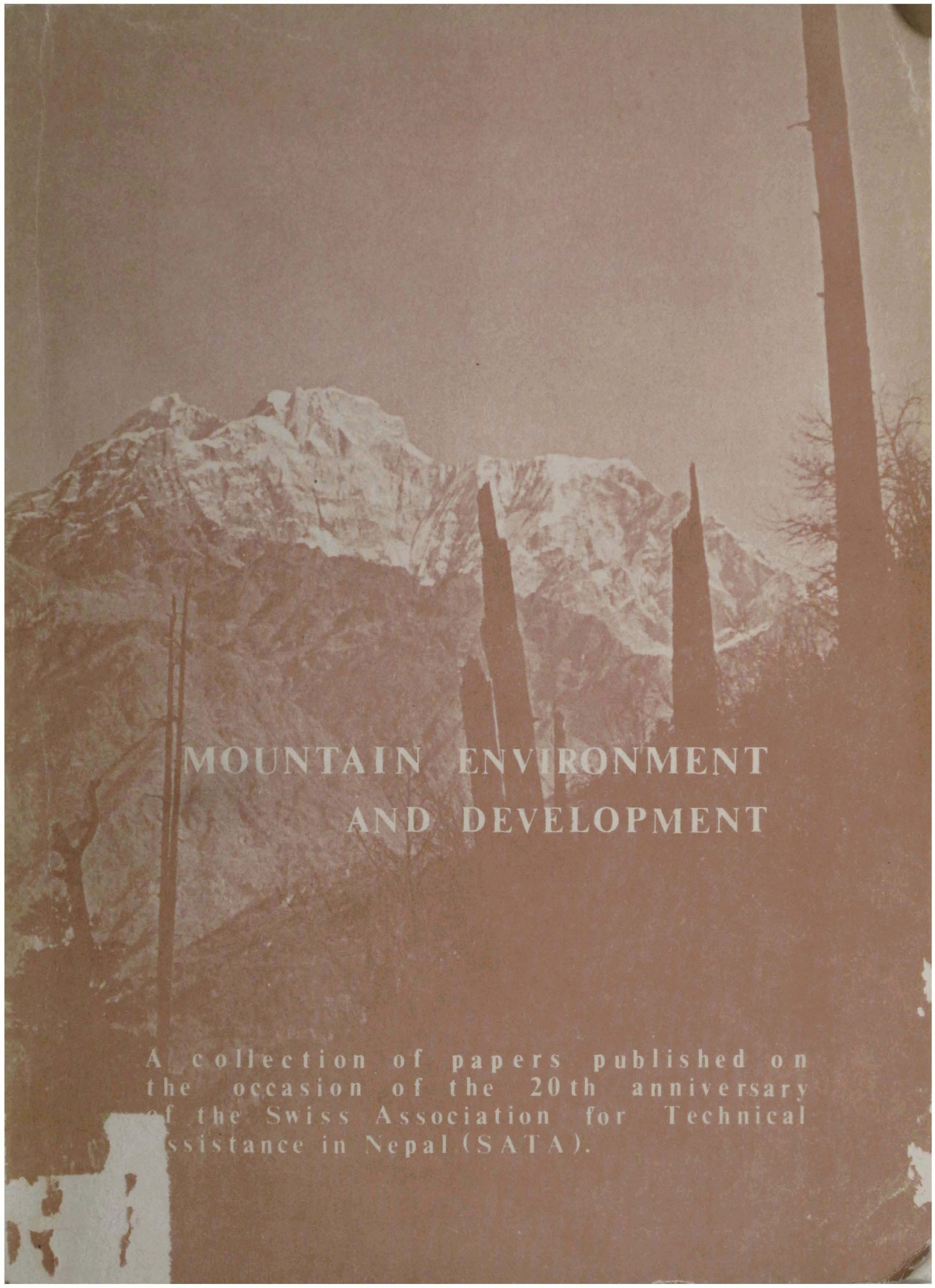

MOUNTAIN ENVIRONMENT AND DEVELOPMENT

A collection of papers published on the occasion of the 20th anniversary of the Swiss Association for Technical Assistance in Nepal (SATA).

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TABLE OF CONTENTS

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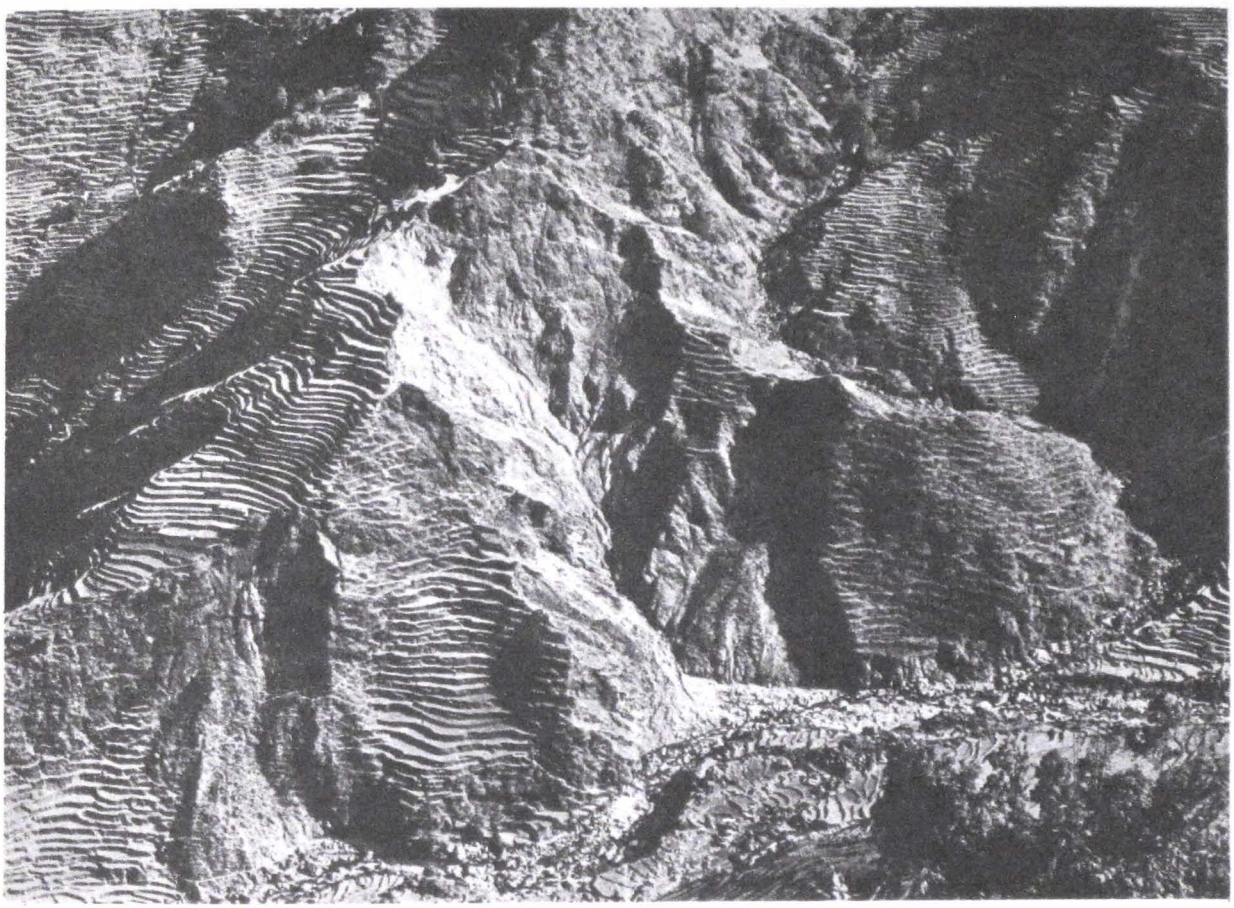
A. Schild
Director of SATA

1 INTRODUCTION



1.1 The Purpose of This Publication

The Swiss Association for Technical Assistance is celebrating its 20th anniversary of activity in Nepal in 1976. There are many ways to commemorate such an event. Reviewing the last 20 years, we find the red line of SATA's involvement in the Nepalese hill and mountain areas. Since the beginning of SATA's activities the hills have always been the main focal point of the project work. For the Swiss, Nepal is, rightly or wrongly, not the Terai nor the metroplitain valley but essentially the hills. It seems therefore justifiable to devote the present book to the hills, the farmers and the way they are trying hard to make a living in a physical environment which suffers from continuous negative dynamics as a result of the erosion of traditional resources.

In the papers included here, various authors deal with an aspect of mountain environment in Nepal. The point of view of the individual contributions is fully respected and does not express any uniform concept. The general assumption is that the ecological balance is deteriorating, that the fast increasing demand for almost all basic resources can less and less be met from the local resources, or in other words: The development of the hills is largely a negative one. An ever increasing population has to live on the same amount of land. The resulting pressure leads to a vicious circle where the hill population has to live with ever decreasing resources.

Mountain ecology has not been treated in the form of academic analyses. Most of the authors are or have been directly involved in development work. Their findings are to be seen in relation to practical development work and policy decisions concerning the promotion of the hills. Needless to say, the papers are influenced by the personal experience of the respective authors in the Nepalese hills.

The purpose of this collection should not be limited to the celebration of an anniversary. Nor is the intention that of formulating a comprehensive strategy for the promotion of the hills or the reversal of the negative ecological trend. The problems dealt with should be brought to the attention of a general public and hopefully create a consciousness of the critical situation which for the quick visitor is so well hidden behind the friendly faces of the Nepalese people and the majestic scenery of the Himalayas. If the reader gets the feeling that action is of high priority and something has to be done about the problems described, then a first objective will definitely have been reached. But we aim at yet another goal: The problems of the deteriorating physical environment in the hills are of such dimension, that many questions in the daily technical cooperation work are directly related to ecology. We therefore are seeking a dialogue and discussion on these aspects in order to equip ourselves with more appropriate tools for our work.

1.2 SATA and its Activities

The very good relations between the Kingdom of Nepal and Switzerland are based on certain affinities and similarities, but it would be a hard job to ascertain and scrutinize these. Based on these affinities the relation has always been an excellent one and characterised by development cooperation, which started as a matter of fact in the late forties.

The Nepali-Swiss Cooperation oriented towards technical assistance dates back to 1948, when His Majesty's Government of Nepal requested the Swiss Government to depute a group of experts to Nepal.

This Forward Team of four experts toured the Himalayan Kingdom 1950/51 and worked out a series of proposals for the development of the country. The ones on agriculture and livestock development were included in the programme of the Food and Agriculture Organization of the United Nations (FAO), and the Swiss Government contributed the salaries for the Swiss experts who already in 1952 initiated the first practical steps for the improvement of the dairy development.

The Swiss Association for Technical Assistance, SATA (today in German "Helvetas"), was founded in Switzerland in 1955 as a politically and religiously neutral non-profit organization for technical assistance. In Switzerland SATA is registered as an association with more than 25'000 individual members. The funds are generated through subscriptions, individual or community contributions and grants of the Government. 1956 SATA started its first assignments in a foreign country in Nepal. Experts were deputed for building up cheese plants in the hills and the Central Dairy in Kathmandu. These experts were assigned in close cooperation with FAO. Other bilateral donors provided the necessary investment funds. Hardly any other activity in the subsequent years has characterised SATA more than the involvement in cheese production. As a matter of fact cheese production was a new trade meeting the interest of the farmers in the upper hills. Thanks to the vigorous promotion of the cheese industry by the Dairy Development Corporation, the Himalayan hard cheese has reached, by now under exclusively Nepalese management, a respectable place in the Nepalese economy.

Already in 1958 the SATA activities were diversified and gained a somehow independent profile. The low production of the Nepalese cattle in terms of milk yield made the FAO start a pasture improvement and cattle breeding programme in Jiri. The responsibility from the international side was taken over one year later in 1958 by SATA, which in cooperation with the Ministry of Agriculture built up the farm in Jiri-Valley. These efforts resulted in the creation of the Jiri Multipurpose Project which is critically analysed under chapter 5.1. Though the project did not bear all the expected fruits, it was an outpost for development activities in the hills where important experiences could be collected for wider activities in the seventies.

The necessary equipments and tools for running the aforementioned projects were produced in a small workshop created for this purpose in Ekanta Kuna, Kathmandu. With the inauguration of the Balaju Industrial District this workshop was transferred under the name of Balaju Yantra Shala to this place and organized as a joint venture between the Nepal Industrial Development Corporation (NIDC) and SATA. BYS developed during the sixties to a reputable mechanical workshop. Besides providing repair and maintenance services, it manufactured such important products as suspension bridges, sluice gates and turbines for the hills,

it produces metal structures, office furniture and water tanks for the urban centers.

Besides the production unit, a Mechanical Training Center built up the necessary know-how for workshops and other industries. An Electro Division and Plumbing and Sanitary Installation Division were added in 1968 and 1972 respectively.

SATA supplemented its programme in 1964 by assigning Suspension Bridge engineers with the assistance of the Swiss Government, and by starting a Community Development Programme together with Mahila Sangathan, the Nepal Women's Organization.

All these programmes were - from the Swiss side - organized, controlled and financed by SATA (Helvetas). The Swiss Government supported these activities with financial contributions. Only in 1963 did the Government start at the request of His Majesty's Government of Nepal participating directly in development cooperation in Nepal with the rehabilitation of Tibetan refugees. Here the nucleus for the creation of a carpet industry was laid which has become a more and more flourishing industry during the seventies. By the middle of what was called the first development decade the Swiss Government decided together with the host government to start a Volunteers Programme, under which a group of 15 to 20 trained junior technicians are regularly assigned on an individual basis to various projects.

In 1970 a decisive step was taken when Helvetas, the parent organization of SATA and the Swiss Government merged their organizations in Nepal. All bilateral programmes sponsored by Switzerland have since this date been under one direction under the name of SATA.

Today, as 20 years ago the main focus of SATA's activities is on the hills or on activities which aim at making an impact on the hill economy. Together with the Department of Roads SATA cooperates in the planning and building of suspension bridges and in the construction of a hill road from Lamosanghu to Jiri, with the aim of improving the rural infrastructure and communication.

The Swiss involvement in . . . . . .

BYS is to continue till the late seventies. Here, with the Electro and Plumbing work SATA made its first contribution in the service and tertiary sector of the Nepalese economy. But SATA's efforts in this project will continue to concentrate on the aspects of an adopted technology and on the promotion of alternative energy resources. With the technical support for the building of the Tara Gaon Hotel Village a first venture was made in a unique tourist project.

The main emphasis lies with the agricultural and rural development. Together with the Dairy Development Corporation cheese-makers are being trained. In the Integrated Hill Development Project high priority is given to cash-crops and fodder development.

The implementation of rural drinking water schemes in cooperation with the Local Development Department and UNICEF means a direct involvement in the Community Development.

But the Integrated Hill Development Project with its short-term (agriculture, Lamosanghu-Jiri Road) and long-term (afforestation, health, education and cottage industry) measures requires a most comprehensive effort for the improvement of the economic status of the hill population in an area of approximately 1200 km^2, taking the ecological bottlenecks and scarce resources in the hills fully into consideration.

1.3 Development Cooperation and Hill Environment

It belongs to the well recognised facts that any input in a certain social, economic or ecological environment in the form of technical assistance entails the up-setting of a certain equilibrium. The question, what kind of side effects such an influence, which can easily be conceived as a disturbance by the concerned people, may have very often does not arise. The negative factors are at least in the near future overruled by the short-term benefits and advantages of a certain action.

Nevertheless ecological factors are of highest relevance and have a direct impact on the ultimate success or failure of a project.

1. Certain sectorial measures tend to consider only short-term benefits, such as quick returns. The long-term effects might be much more crucial but remain hidden to start with.

2. Ecological preconditions have to be well looked into so as to give the technical programme a chance of success (climate, soil quality, morphology, water runoff, minerals etc.).

3. The awareness of certain ecological constraints as they exist in the Nepalese hills, can lead to a concept, where the need to exert an influence on the whole system of social, economical and ecological interdependences becomes the central piece of a package deal of development measures.

For all three categories examples are abundant and a few can be quoted from the experience in Nepal. The cheese plant in Langtang which was built up almost twenty years ago was a good success from the technical point of view. Only today we realize how much the surrounding forest resources have suffered and the forest has been reduced to an extent where flora and fauna which belong to the area of the National Park, are endangered. The introduction of an intensive carpet industry in the Solu valley implied even more dramatic consequences. The dying process of the wool requires a lot of firewood. This led to a wide destruction of the forests near the settlements within less than 15 years. Similar phenomena can be observed in regions with intensive tourist contact (c.f. 3.4): a new activity with very advantageous short-term benefits brings additional constraints to the already over-used ecosystem.

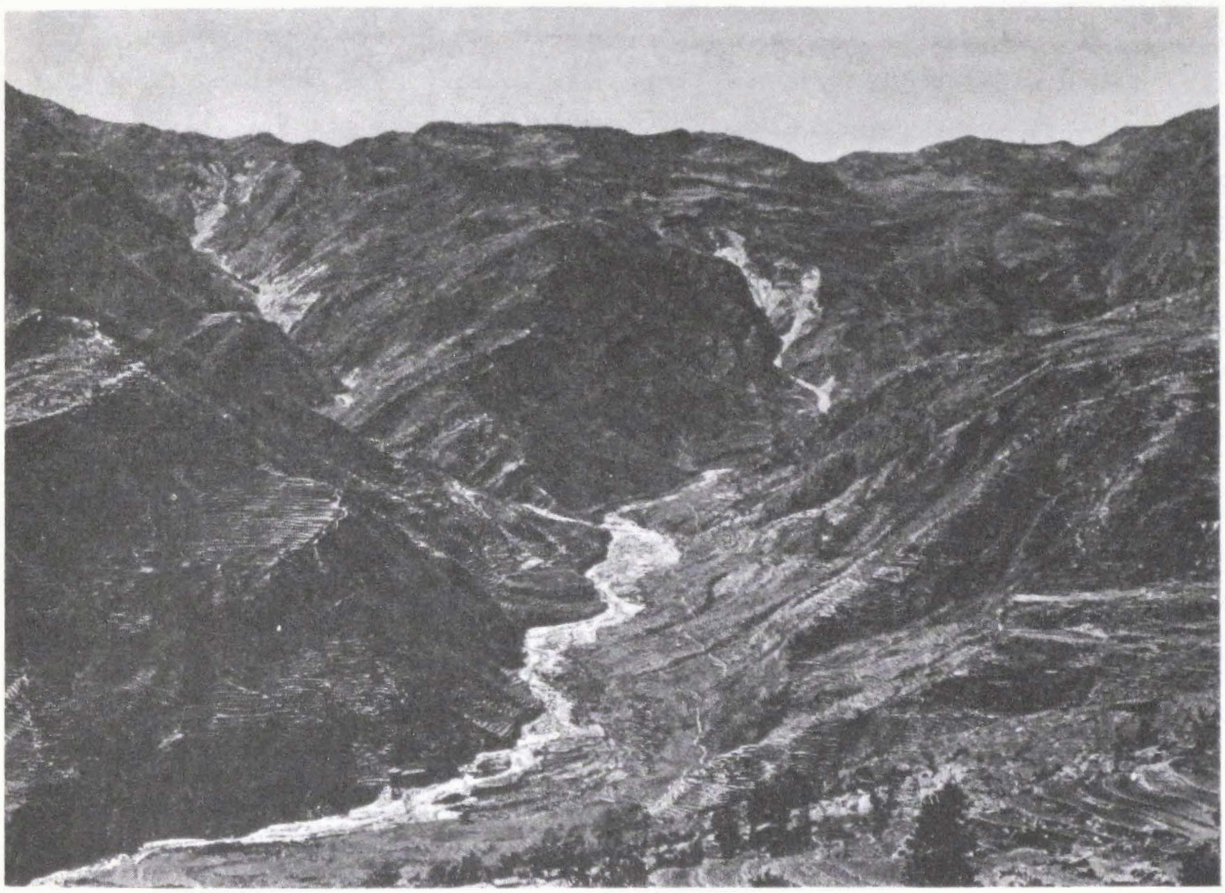
An example of where the available resources have not been properly surveyed and taken into consideration is given by Robert Schmid (c.f. 5.1). In this case even the short-term success has been hampered.

Understanding the seriousness of the environmental stress in the hills should not bring the planners to a one sided conservative, back to the nature attitude (c.f. 4.3). Economic and political forces call for a new dynamic equilibrium, where an interregional exchange of goods is imperative (c.f. 4.2).

How such a new equilibrium can be reached in the hills has yet to be found out. We have come to the point, where the ecological factors have to be taken into consideration. A new approach will be necessary for the planners where the framework is given by the cultural, social and economical conditions (c.f. 4.1). Based on these a strategy will be required for which a number of basic data and values somehow have to be made available. For this purpose a lot of research on basic data seems to be unavoidable. But the dimension of the problems is such that practical solution finding has to take the lead in our approach to hill development (c.f. 5.4). The beginning therefore cannot be but careful. A better exploitation and management of the existing resources (c.f. 3.1, 3.2, 3.3) has probably to precede the input of heavy and imported technology.

A. Schild

2 EROSION OF TRADITIONAL RESOURCES



2.1 FLOODS AND DROUGHTS

THE HIMALAYAS AND THE GANGES PLAIN AS AN ECOLOGICAL SYSTEM

by H.C. Rieger

1. Introduction

Each year, when the mighty Ganga and her tributaries burst their banks, wide areas in Bangla Desh, Bihar, Uttar Pradesh and West Bengal are flooded. In many places people have adjusted their way of life and have learnt to live with the floods, but again and again we read of disasters in which human lives are lost and property is damaged. With similar frequency we hear of droughts in the very same areas when the rains fail and the rivers and wells dry up. This seems to be a natural cycle of events which man is unable to influence, to which he must resign himself for better or for worse.

However, there are voices now being raised, which say that one of the causes of floods and droughts in the gangetic plain is man himself: ecological degradation in the catchment areas in the Himalayas is causing an increase of floods and droughts in the plains, both in terms of intensity and of frequency.

It is not possible to say at present, whether this view is correct, let alone to measure scientifically the cause-effect relationship postulated. But to ignore the dangers for the future implied by progressive deforestation and erosion in the hills would be similar to overloading the proverbial camel merely because the effect of each additional straw is imperceptible.

The literature on mountain eco-systems and particularly on the situation in the Himalayas is now quite copious. But most of it is relatively narrow in focus and concentrates on one or another specific aspect of the larger system we wish to discuss. In this paper we intend to describe the complex ecological system of the Himalayas and the gangetic plain as it emerges from the numerous publi-

cations on individual elements and relationships of the total system. We will deal with the natural factors first. Then we will introduce man and study his influence on the ecological system in the hills. Third, we will describe the effects of ecological disturbances in the hills on the plains, and finally we will look at some additional factors that aggravate the situation.

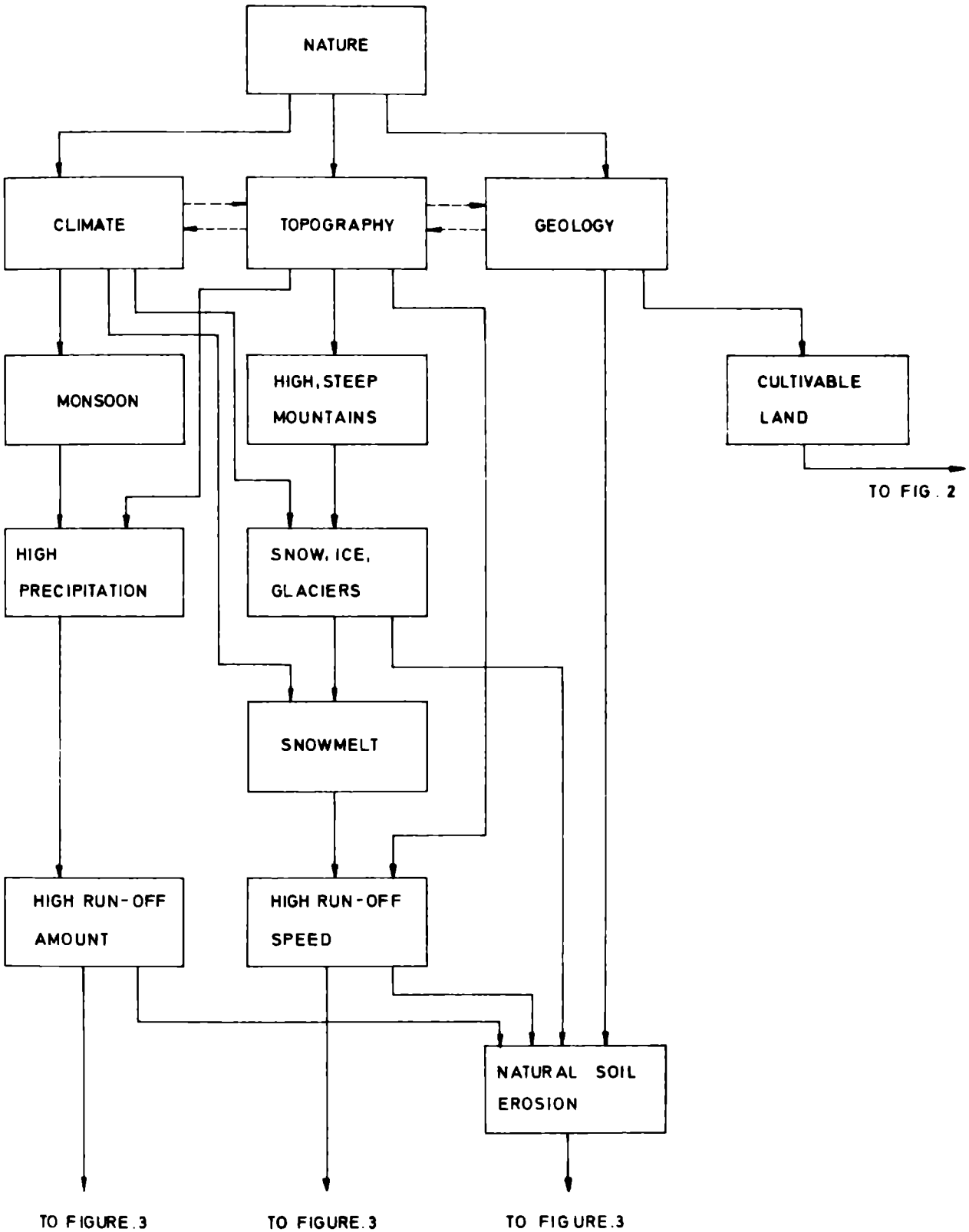
2. Natural Erosion

Water flows downhill. This is also true in the Himalayas, where massive downpours occur during the monsoon season (July to September). The south-west monsoon winds cross the Arabian Sea and the Bay of Bengal, picking up large quantities of moisture on the way, turn north-westwards at the head of the Bay of Bengal and then advance along the Himalayas from east to west. Here the moisture bearing winds strike the youngest, longest and highest mountain range of the world causing precipitation levels unequalled elsewhere. In some cross sections of the mountain range there are differences of elevation of almost 9000 metres over a distance of only 150 kilometres. The steepness of the terrain, the tectonic instability of the area, as well as the relatively young age of the mountain all contribute to the erodiability of the slopes, and a natural weathering process results. In the high mountains of perpetual snow and ice, glaciers scour the mountain slopes and transport rocks and boulders to the lower valleys.

The huge amount of water run-off caused by precipitation and snow melt and the considerable speed of run-off result in a natural erosion process. It has been estimated that if heavy rains double the water flow, "scouring capacity is increased four times, carrying capacity thirty-two times and the size of particle carried sixty-four times". (TEMPANY and GRIST, 1958, p. 88.)

The main causative factors of the natural erosion process are summarized in Figure 1. The given climatic, topographic and geological conditions of the Himalayan mountain range lead to large water run-off quantities and speeds which in turn result in natural erosion. Without such a natural weathering process there would be no fertile river valleys or plains, or, for that matter, a fertile delta area in Bangla Desh.

FIG 1: SUBSYSTEM NATURAL EROSION



In Figure 1 we have added the cultivable land, which does not contribute to natural soil erosion, but which is a natural factor connecting with the anthropogenic system which is discussed in the next section.

3. Man-made Erosion

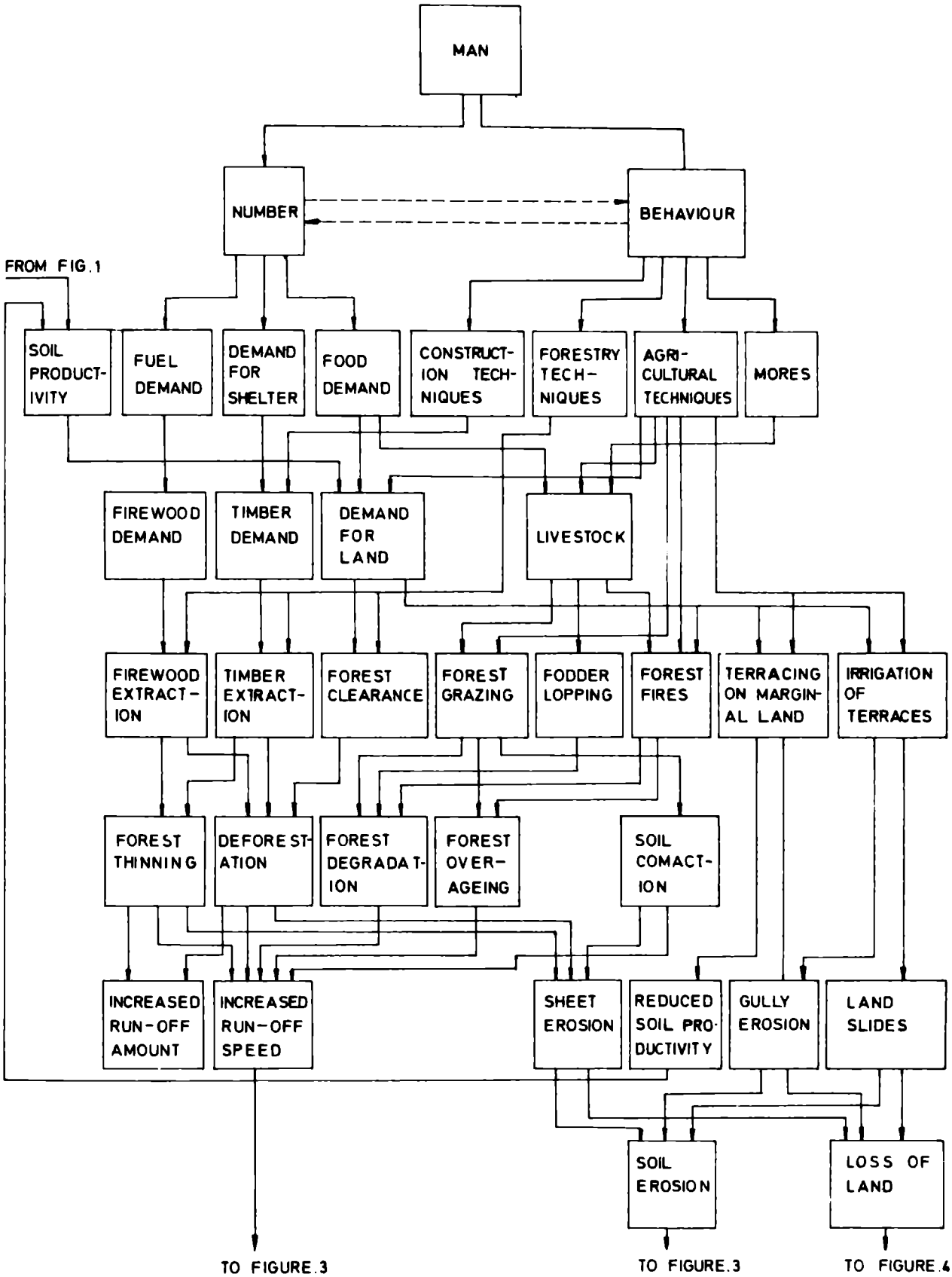
Systems generally become more complex when man interferes in natural processes, and erosion in the Himalayas is no exception. The more important relationships are depicted in Figure 2. To facilitate an understanding of the processes involved, the main components can be summarized as follows: As the human population expands in the hills, forests are depleted or degraded. The water retaining capacity of the natural vegetation is reduced and run-off is increased, both in quantity and speed. This fact, deforestation itself, and the use of inappropriate agricultural techniques on unsuitable land leads to different forms of soil erosion and, ultimately, to the loss of cultivable land.

Man's presence in the Himalayas makes itself felt in two ways: first, by large and increasing numbers, and second, by his behaviour. To survive, man needs food, clothing and shelter as well as fuel for cooking and, according to location and climate, heating. The way in which he fulfills these needs depends on the traditional and culture-bound techniques as well as the norms and mores of the society in which he lives.

3.1 Cultivation

Cultivation requires land. Population growth results in pressures to expand the cultivable area by clearing forest lands. The land requirement of a given population depends, among other things, on the productivity of the soil, and this can be considerably enhanced - or reduced - by the agricultural techniques applied. Increasing population pressure also results in marginal land, i.e. less suitable and mostly steeper slopes, being brought under cultivation, thus leading to a reduction of overall productivity of the land.

FIGURE 2: SUBSYSTEM MAN-MADE EROSION



The quality of terracing is subject to local variation. The classic rice terrace has an outer bundh of about 30 cm height to retain the water, and generally provides a good resistance to erosion. Maize terraces, on the other hand, are more susceptible to erosion, having no bundh and being generally inclined outwards to prevent water retention.

Irrigation of terraces can increase the yield of the available land, but entails certain dangers. As the main rivers usually flow far below the terraces, the steeply flowing side streams are tapped for irrigation at a level high enough to permit a flow along the slope of the side valley to the fields in the main valley. There are usually no facilities for limiting flow, so that floods caused by excessive rainfall may enter the canal and overflow at the point where the steepest slopes are traversed and where the canal is generally smallest, often causing big gully erosion (TAUTSCHER, 1974, p. 8).

3.2 Livestock

Livestock is usually held in excessive numbers in the Himalayas, partly for religious reasons, partly on account of the low yields of cattle, and partly because of the need for animal manure. Livestock makes demands on the forests in two ways. First, the forest is used for grazing all the year round, and the cattle feeds on young plants, and leaves and twigs of small trees. Second, the leaves and twigs are lopped for cattle feed by the population. Where this practice is overdone, whole branches are amputated and the trees are consequently considerably weakened. The thinning of the leaf cover reduces the protection of the forest soil, and induces the growth of grasses and thus poses a fire hazard for the forest. Lopping also leads to a stunting and finally death of the trees and thus to an impoverishment of the range of species, as only the trees which can survive such brutal treatment remain.

The destruction of forests by fire is at least partly affected by the holding of livestock. Many peasants lay fire to the dry cover of grass and pine needles in order to improve the growth of fresh grass and to destroy the slippery pine needles which pose a danger to the livestock grazing on the slopes. In

areas where the burning of forest grass is practiced regularly, a characteristic open forest of old pines pwithout any young trees has resulted. Of course, self incendiary fires also occur, but according to DONNER, 1972, p. 355, purposely laid or carelessly caused forest fires are the rule.

Finally, mention must be made of shifting cultivation which is still being practiced in some parts of the Himalayas. Since yields on the primitively cleared and cultivated land are low, the area burnt is correspondingly large.

3.3 Fire Wood and Timber

In the absence of alternatives the fuel needs of the population in the Himalayas are met by fire wood. Trees are robbed of all their branches except for the top crown. According to ROBBE, 1954, annual fire wood consumption is of the order of 0.6 cubic metres per family or well over one million cubic metres for the whole of Nepal. However, this figure seems to be a gross underestimate, for FAO calculates the production of wood for fuel purposes in Nepal to be no less than 6.6 million cubic metres in 1967 (DONNER, 1972, p. 354). In a study by MAUCH, 1974, it is estimated that over 90% of wood extraction from the forests in the Kalinchowk area is for fuel purposes.

The forests also have to meet the population's need for construction timber. This varies considerably according to climate and local building styles. As far back as 1931 HESKE, 1931, p. 571, criticized the wasteful use of timber in constructing houses in Tehri-Garhwal and concluded that an average family of five persons requires one tree trunk annually for construction purposes. MAUCH, 1974, p. 9, confirms that in the central Himalayas (Eastern Nepal) about 70 cubic metres of valuable wood is logged per house, although less than 20 cubic metres would suffice if properly and efficiently utilized.

Timber and fire wood extraction, forest clearance for cultivation, grazing, lopping for fodder and burning of the undergrowth, in conjunction with inefficient timber utilization are causing a general degradation of the forests by thinning, overageing and finally local destruction. It is evident that

the destruction of the forests is progressing more rapidly every year and that Nepal, for instance, is likely to be all but totally denuded by the end of the century. Without alternative sources of energy this process cannot be stopped (MAUCH, 1974, p. 5). On the other hand, DONNER, 1972, p. 354, considers the provision of alternative fuel resources in the near future an unrealistic proposition.

3.4 The Forest's Effects on Soil and Water

The state of the forest and vegetation cover has decisive effects on the water household of a given area. A good forest will provide relatively high infiltration rates and a correspondingly low run-off of water, because of the relative stable and porous condition of the soil and the protective layer of leaves and other organic substances. Numerous experiments in Europe, America and Japan have confirmed the absorptive capacity of the forest. However, the application of these results to Himalayan conditions is not without problems. Where rainfall is of long duration and intensive, as is frequently the case during the monsoon period, saturation may occur and the run-off retarding effect of the forest may decrease rapidly.

On the other hand it has been proved that denuded soil soon becomes compacted to such an extent that run-off is accelerated and soil erosion results. The high kinetic energy of raindrops falling on the naked ground breaks up the soil and carries it away down the slope. The progressive dying out of the soil through over-heating leads to a destruction of organic matter, reduced water-holding capacity, and increased evaporation of moisture.

To complete the picture of man-made erosion in the Himalayas, a number of additional factors, which are not contained in Figure 2 may be mentioned in passing. The cultivation of wheat in winter, propagated by several development assistance programmes, reduces the grazing area available to the cattle, so that forest grazing is on the increase. Recently, several authors have noted the fact that the increasing distance of the receding forests have made fire wood procurement difficult so that cattle dung is being dried for fuel.

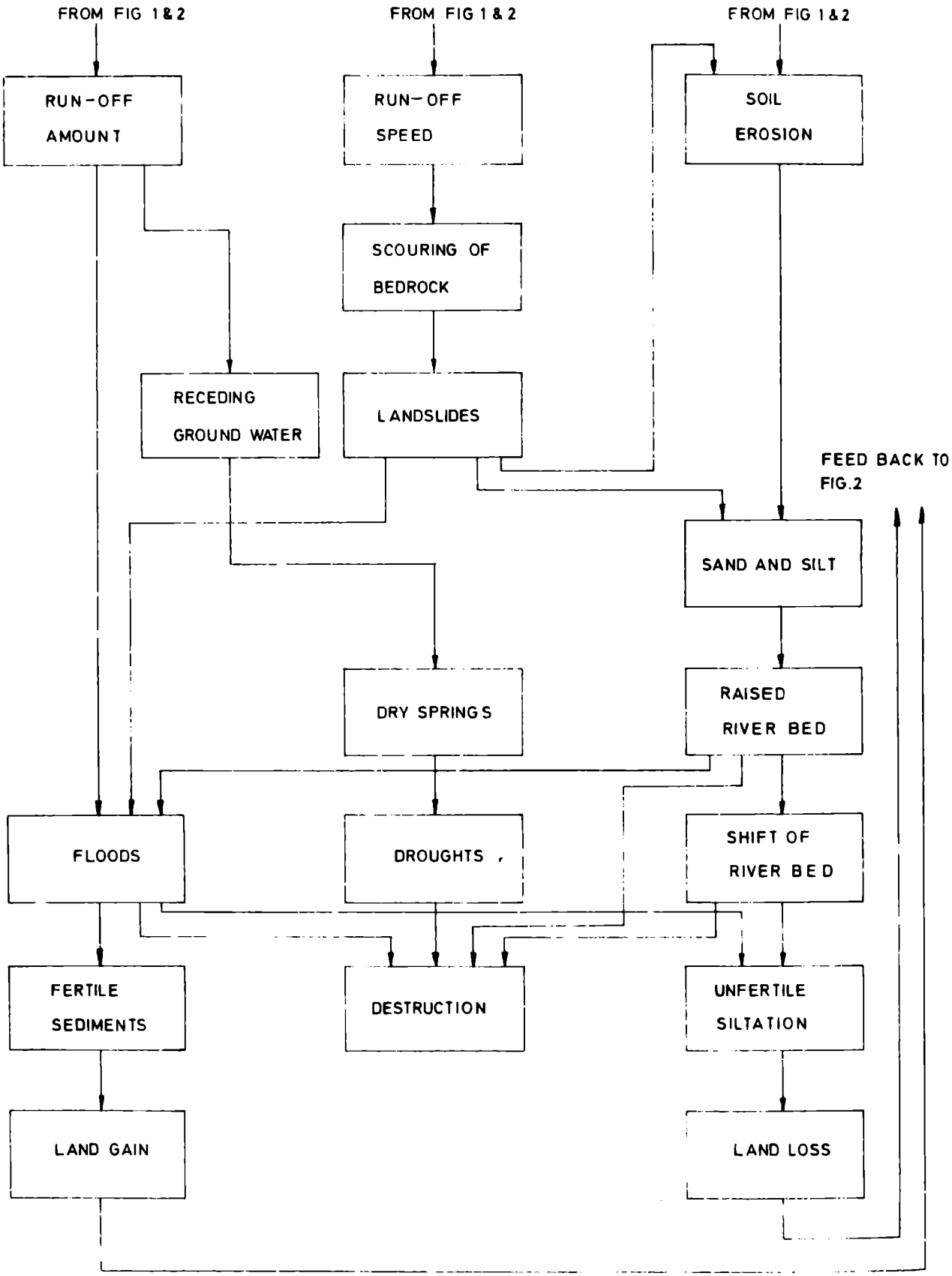
This deprives the soil of valuable manure, so that productivity drops (ECKHOLM, 1975, HOGGER, 1975). Finally, road construction also contributes to erosion. While some roads are aligned along the river valleys and are relatively secure, others are aligned higher up, thus changing the run-off of the slopes. Gully erosion results on a large scale. The roads frequently have to cross geologically unstable slopes and thus cause numerous landslides. Where side-hill cutting is practiced, the soil is simply dumped into the rivers, thus enhancing the sedimentation problems of the rivers for several years (TAUTSCHER, 1974, p. 9).

4. The Effects on the River Valleys and Plains

The main interrelationship between natural and man-made erosion on the one hand and their effects down stream and in the plains on the other are depicted in Figure 3. Increased run-off makes itself felt in two ways: in terms of run-off quantity and in terms of run-off speed. To begin with, increased run-off quantities may temporarily exceed the capacity of down-stream river beds and thus result in floods directly. In addition, reduced infiltration of water into the soil may reduce the groundwater level and thus lead to the drying up of springs. Mountain springs are important for the supply of drinking water and irrigation. According to JAHN, 1975, p. 5, there seems little room for doubt that many springs have reduced their flow or dried up completely in the last decades because of the destruction of the forests. In many villages visited by DONNER the villagers confirmed that water now has to be fetched from farther off than a generation ago.

HESKE, 1931, p. 586, posited a direct connection between the regularity of water flow of rivers originating in forested areas and those from areas in which deforestation was widespread. He prophesied that detailed analyses would prove the relationship to be more pronounced in India with her long dry periods. However, such detailed analyses do not seem to have been made upto now. In any case, they would require long time series of measurements, which are not available at present.

FIGURE 3. SUBSYSTEM OF DOWNSTREAM EFFECTS



The increased speed of water flow intensifies the digging of torrents into their bed material. The continuous erosion of the bedrock reduces the support of the slopes, thus causing landslides. Slope portions right above the gorge, which are kept in place only by friction but have no support at the foot, slide into the gorge, removing the support for higher areas and increasing infiltration into the formations behind the steep rock face (TAUTSCHER, 1974, p. 3). This type of erosion not only expands uphill but can also lead to the collapse of the steep rock face, causing the very dangerous damming up of big rivers.

Sheet erosion, gully erosion and lan-slide erosion, together with the scouring effect of the torrents and streams, produce sand and silt in huge quantities which is transported to the gangetic plain. Thus the Karnali shifts 75 million cubic metres of solid material annually, equivalent to a 1.7 millimetres layer for the whole catchment area (IBRD, Nepal Agricultural Sector Survey, Vol. III, Annex 6, p. 2). The sand and silt are deposited when the rivers reduce their speed, i.e. when they break into the plains, thus constantly raising the river bed. According to Nepali observers the beds of the terai rivers are rising by 15 to 30 centimetres annually (HMG, Draft Proposals of Task Force on Land Use and Erosion Control, 1974). This leads to flooding as well as to quite considerable shifts in the course of the rivers. The Kosi in Bihar, for instance, has shifted its course 115 kilometres westwards within two centuries, leaving 15,000 square kilometres of once fertile land buried under a mass of sand and rubble and displacing 6.5 million persons.

In addition to these effects, excessive sedimentation silts up dams and irrigation canals, thus rendering such construction works useless after a short period of operation. It is interesting to note that this problem is in no way new, as quotations from engineering reports from the turn of the century prove (HESKE, 1931, p. 581).

It should not be overlooked, of course, that flooding in the gangetic plain and in the delta also serves to spread fertile soil in these areas. According to IBRD, Nepal Agricultural Survey, Vol. III, Annex 6, p. 2, 240 million cubic metres of soil are "exported" from Nepal every year. NEWBY (Ganga, 1974, p. 44) locates the end of the Ganga under the sea a hundred kilometres to the

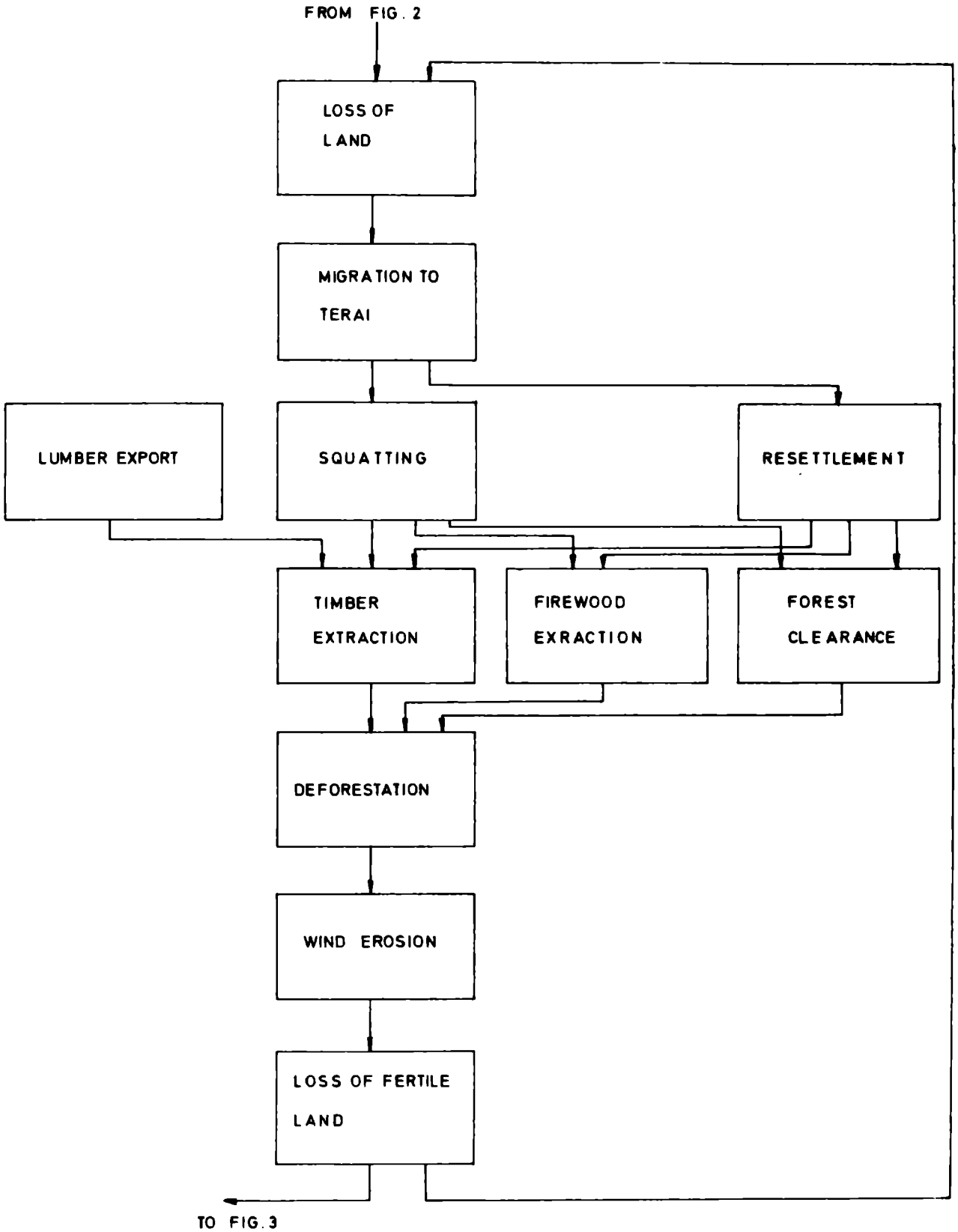
south, where the long tails of sand run down towards the deeps of the Bay of Bengal, or even further: "Four hundred miles out in the Indian Ocean the sea is discoloured by the silt brought down by her."

5. Migration

Population pressure in the hills has led to deforestation and erosion, and the situation is becoming more critical every year. Many have no other choice than to look for alternative means of livelihood. The terai at the foot of the Himalayas now presents such an opportunity since the main reason for the low density of population there has been removed by the eradication of malaria. In fact, the terai belt is gradually filling up. Generally the more enterprising members of a group will take this drastic step first, leaving behind an aged, dispirited population incapable of reversing the negative spiral (ECKHOLM, 1975, p. 764).

Migration is creating new problems. The more important factors and relationships are depicted in Figure 4. There are two types of settlement in the terai. The Government of Nepal, together with international organisations like FAO and IBRD, is implementing organised resettlement schemes in various places. By far the largest group of settlers is constituted by illegal and uncontrolled settling or "squatting". The World Bank estimates that 400,000 settlers migrated to the terai, accounting for 180,000 hectares, of which 130,000 were illegally settled on. FAO quotes an even higher figure and estimates that about 36,000 hectares of good forest land are lost annually through squatting (UNDP/FAO, Forest Development, Nepal, Land Use, 1974, p. 7). On the basis of ERTS- satellite imagery, FAO estimates that no more than 818,600 hectares of forest area remain in the terai (UNDP/FAO, Forest Development, Nepal, Land Use, 1974, p. 7), and ECKHOLM, 1975, p. 765, points out that less than half of this will be suitable for cultivation. If migration into the terai continues at the pace of the last ten years, all the good farmland will be occupied in little more than a decade.

FIGURE 4 : SUBSYSTEM MIGRATION TO TERAI



It is clear that the destruction of the forests in the hills, through the destruction of the previously balanced ecology, is indirectly resulting in the destruction of the forests in the terai. Both squatting and legal settlement are dependent on forest clearance, while a growing population is placing increasing demands on the dwindling forests for firewood and construction timber. In addition, the felling of trees for the Indian lumber market takes its toll. This is not easy to stop, since Nepal depends on the export earnings for the import of essential items to meet the needs of a growing populations.

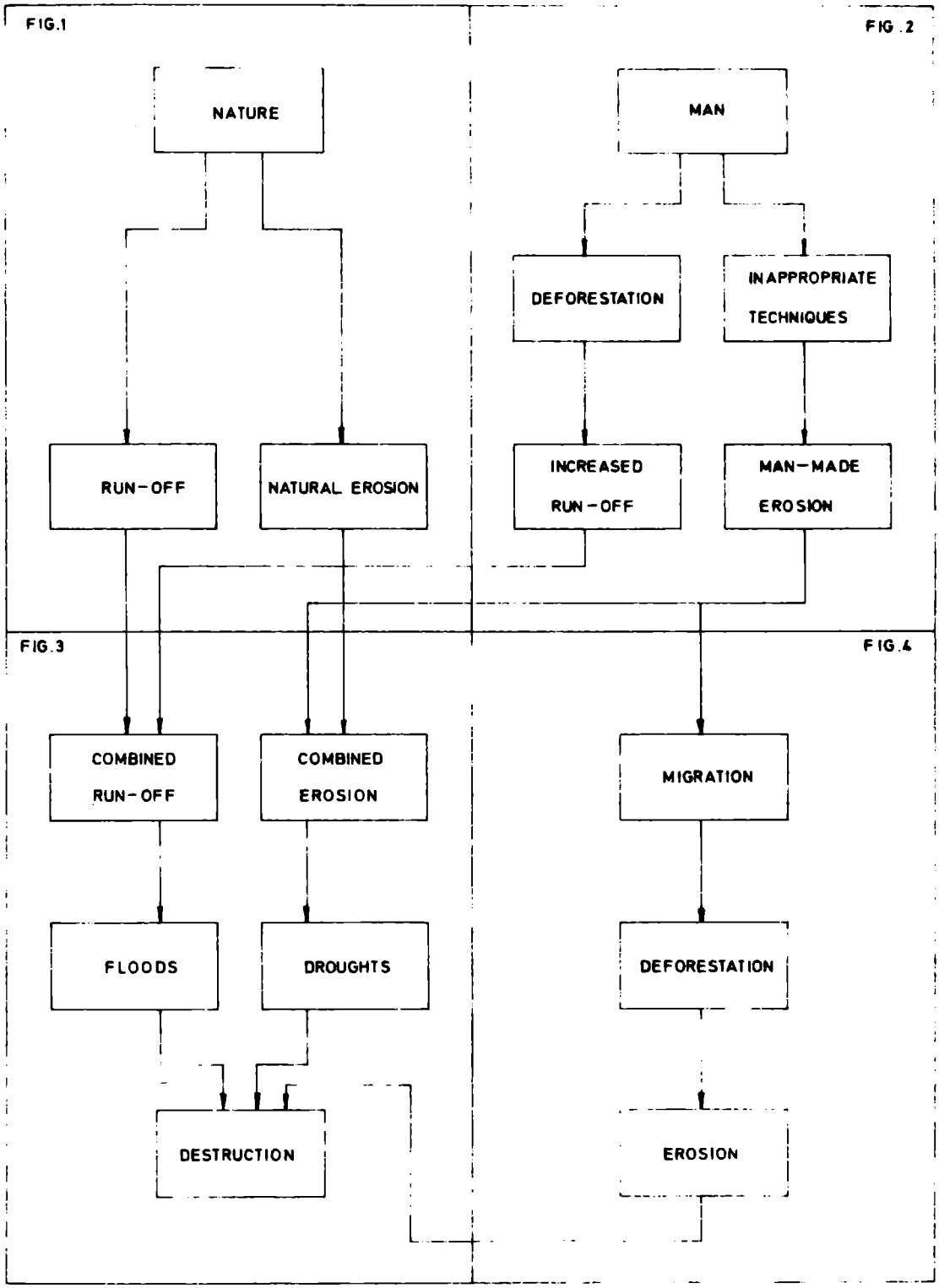
Deforestation in the terai does not have the same destructive effects as in the hills. However, another form of erosion, i.e. wind erosion, is induced where adequate precautions are not taken. The sand storms in U.P. during June, for instance, bear adequate witness to this fact.

6. Summary and Conclusions

In the foregoing sections we have depicted four subsystems of the ecological system of the Himalayas and the gangetic plain. In the first a natural weathering process in the hills and the transportation of fertile sediments to the plains constitute the natural erosion which cannot be curbed even by the complete restoration of the Himalayan forests. In the second subsystem we focussed on the effects of population pressure on the existing forests, the soil and the water house-hold. This was followed by an analysis of the downstream effects in the river valleys and the plains, which are likely to cause increases of floods and droughts both in terms of intensity and frequency. In the fourth subsystem we have depicted the effects on migration of a destruction of the mountain environment and the way in which migration, a stop gap solution in any case, is likely to pose new ecological problems in the terai. The four systems are linked together in Figure 5 which depicts the cause and effect relationships of the total system in schematic form.

Two points warrant special mention. First, several of the processes described are practically irreversible. Afforestation - or better, reforestation - is a lengthy process thwart with difficulties and set-backs. Where the soil has

FIGURE 5: THE ECOLOGICAL SYSTEM OF THE HIMALAYAS AND THE GANGETIC PLAIN



been eroded down to the naked rock, afforestation is impossible. Once the soil is washed away it is no longer usable except at lower levels. Second, particularly in the subsystem of man-made erosion, there are a number of positive feedback loops which have the effect of accelerating the shift towards imbalance. Thus, for example, loss of soil through erosion leads to a more vigorous attack on the remaining forests, which only serves to further erosion and loss of soil.

Returning to our initial question, whether the ecology of the hills has had a measurable negative effect on the incidence of droughts and floods in the gangetic plains we can state our conclusion: the measurability of what has happened upto now seems to be totally irrelevant with regard to what seems likely to happen in the future if the destruction of the Himalayan environment continues to accelerate.

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2.2 THE PHENOMENON OF MIGRATION IN A HIMALAYAN VALLEY IN CENTRAL NEPAL

by G. Toffin

1. Migration and Mountain Ecosystems in Nepal

For about 30 years now, the Himalayan ecosystems have been experiencing a severe crisis. Throughout the hills and mountains a rapid degradation of the natural environment can be observed: deforestation, increasingly poor soil, landslides, overgrazing, disappearance of animal species, etc. Man is becoming more and more of a predator, he tends to exploit his environment over and above its possibilities. This lack of balance makes it questionable as to whether the mountain societies have the capacity to reproduce the basic materials which provide for their existence. It is a direct menance both to the environment and in the long run to the economic growth of the region as a whole.

The demographic factor plays a determining role in the dynamics of this process. On the one hand because the increase in population, which is very high in Nepal as in most other developing countries, is often at the origin of the degradation of the natural environment; and on the other hand because the ecological rupture thus created, causes the population to migrate. Thus in Nepal in the space of 30 years the volume of migration has almost tripled: in 1951, 3.5% of the population left their homes and settled down temporarily or permanently away from home; in 1961, the rate rose to 5.95%; in 1971 it reached 9%. (1) The large majority of these migrants - about 95% - comes from the hills and the mountainous regions of the country. Some go abroad to India, Bhutan or Sikkim; others move about within Nepal from one region to another.

These migrations are not entirely new; in the 19th century, a large number of Nepalese went to work abroad. We can cite for example the Magar, Gurung, Rai, Limbu and others from the Tibeto - Burmese language groups, who were employed in the Gurkha regiments in India. In 1816 the English began to recruit mercenaries in Nepal; since then the number of Gurkhas serving abroad has steadily

increased. The highest figures were reached during the two World Wars: 200,000 in the first, 110,000 in the second. (2) In the second half of the 19th century there were many who migrated to Assam, Darjeeling and Bhutan. Encouraged by a liberal policy for the allotment of land, numerous Nepalese settled down permanently in these regions and after having bought a plot of ground they sent for their families. It is estimated that a third of the population in Bhutan today is of Nepalese origin.

However it is only since 1954 that migration has increased in a spectacular way. It was at this time that a programme was launched in the Terai to erradicate malaria. The suppression of this illness opened up vast territories to the people, which until then had been inhospitable. The hills already overpopulated, poured their surplus population into these fertile lands, newly won from the forest. Today demographic growth is extremely high in the Terai, whereas it is stagnant or increases only slightly in the hills. In central Nepal, from 1961 to 1971 the population increased by 168% in Chitwan in the Terai, and by 19.11% in the district of Nuwakot situated in the hills. (3) The movement of people within the country provokes regional imbalances. The political class is aware of the importance of inter-regional migration and is worried. The problem is becoming a national one.

2. The Field of Enquiry: Ankhu Khola

In order to study the dynamics of migration, we shall base ourselves on a study made in 1974 and 1975 in a valley of central Nepal, situated in the north of Dhading district. This valley called Ankhu Khola or Sat Sey Khola, has a population of about 20,000 people, spread over six gau panchayat. (4) The villages are situated at altitudes of 1400 to 2200 metres, on extremely steep hillsides. The Tamangs account for 70% of the population; the Gurung come second with 25%. Small communities of Bahun, Chhetris, Newar, Damai and Kami are also found in this region, but only represent 5% of the total population. (5)

The inhabitants of Ankhu Khola live from agriculture and livestock breeding. The main crops which are cultivated are millet, maize, potatoes, wheat and oats. Paddy only grows on the lowest terraces and is not cultivated above

1600 metres. Livestock breeding is of great importance in the rural economy: the animals - sheep, goats and cattle - spend the summer months on the grasslands of the Ganesh Himal massif. In winter the sheep go down to the south to the lower valleys. The Tamangs and Gurungs of Ankhu Khola are also tradesmen; in Kathmandu and Trisuli they sell medicinal herbs, clarified butter, basket work, bean seeds. With the income from these they buy salt, material, cigarettes and jewellry in Trisuli bazaar.

It is four days walk from Trisuli to Ankhu Khola. In monsoon time the communications between the villages are difficult, if not impossible; sometimes the bridges are washed away by the rivers, sometimes the paths are destroyed by landslides. During this season the people mainly walk over the ridges in order to move from place to place.

The volume of migration in Ankhu Khola is important. In May 1974, we estimated 7.1% of the population had been absent from their homes and the valley for more than six months. If an absence of 3 months is taken as a criterium, the figures are much higher: 11.2% during certain seasons. (6) Basically 3 main types of migration can be distinguished: the army, the seasonal or temporary migrants and permanent emigration. We shall look at each one successively, and enquire into their origins and development.

3. The Army and the Gurkha Regiments

In our census of Ankhu Khola we found there were 88 Gurkhas soldiers in service, that is 0.45% of the total population of the valley. 61 were serving in the Indian army, 27 in the British. The number of pensioners was lower: we counted 14 in 1975. The Gurungs prefer to enlist in the British army where they form together with the Magar the biggest Gurkha regiments. (7) The Tamangs are mostly found in the Indian army. Of these two ethnic groups there are more Gurungs who leave for the army. In 1975 in the Tamang village of Sertung, 8% of the male population from 18-80 years old had known military life; at Khading, a Gurung village, it was 23% for the same year. The other population groups of Ankhu Khola do not enlist in the Gurkha regiments. In the census there was one exception: a Kami who had served in the Indian army for 5 years

as a blacksmith.

Despite the high salaries and the advantages they have in the army, many Gurkhas - particularly the Tamangs - resign after six or eight years of service. What causes them to do so? The first years spent in the army are pleasant; the soldier discovers a new world. Accustomed to community life he does not suffer from the promiscuity of the barracks. Accustomed to heavy agricultural work and prolonged exertion, the military exercises and marches do not worry him. However after four or five years his interest in military life lessens. He has experienced all the joys of the army, the discipline begins to weigh on him and he starts to miss his village. Then suddenly some event happens in the family which makes him decide to leave the army. This event may be the death of his father or elder brother leaving no-one to direct family affairs, or his wife, tired of being alone, who threatens to leave home to go and live with another man. The lahure (8) may also be led to return home in order to impose his rights and settle various problems of land. Often in his absence his parents or parents-in-law will try to take over his land and his part of the heritage. To avoid losing everything he is obliged to return.

A Gurkha soldier generally has no trouble in readapting to village life. In the beginning he maintains his military habits: he wears only army clothes, talks only of troops and barracks; during the day he listens to the radio he has brought back or he fixes up his house with tools he has bought in India. He serves tea to his visitors, a drink normally unknown in Ankhu Khola. But the transistor batteries and the tea leaves are soon finished. The lahure begins to wear his traditional clothes again, keeping only one shirt or a pair of socks as a souvenir of his former status. The hygienic habits learnt in the army are forgotten. He soon goes back to his fields with his swing-plough and basket on his back. Gradually the village takes over again.

4. Seasonal and Temporary Migration

Every year a large number of people leave Ankhu Khola to go and look for work in the regions of Pokhara, Kathmandu, Assam, Bhutan, Sikkim etc. These migrations usually take a seasonal form: the first wave of migrants leaves in April-May after the spring work is finished and they return in July for the maize

harvest. A second wave leaves in November-December after the millet harvest and returns in June for the harvest of winter cereals. They leave home for short periods - not longer than 3-4 months - at the same time each year. There are also migrations of longer duration - they can last from eight months to five years - which we could term temporary. Whether they are seasonal or temporary, these migrations seldom turn out to be permanent. 85% of the people return home within five years. (9) After this it is doubtful whether they will return to the village.

A high percentage of the population migrates for a season or temporarily. In Sertung, a Tamang village in the upper valley, we calculated that 67% of the male population between the ages of 18 and 55 had already been absent for more than three months, looking for work outside Ankhu Khola valley. The proportion of women is 8%. Most of these migrants are Tamang; the Gurung, Bahun, Chhetris and other groups have very low migtation rates.

The region of Pokhara, Bhairawa and Butwal attracts the most people: in Sertung, 75% of the people who had been absent for more than three months, went to get work in one of these three towns. Assam, Bhutan and Sikkim come second with 54%, Kathmandu valley third with 12% and finally Jammu-Kashmir: 3%.

Each region has its particular attractions for the migrant. Pokhara is the best known town: the migrants go there on foot following the old hill paths. From there they can travel further, taking the bus to Bhairawa or Butwal. Throughout this region the Tamangs take on the work of porters for the foreign Himalayan expeditions or trekking agencies. They also carry the baggage of Magar and Gurung lahure returning on leave to their village. Building sites are another possibility for work; in particular Tamangs worked in great numbers, side by side with other ethnic groups, building the roads Kathmandu-Pokhara and Pokhara-Bhairawa.

Assam, Bhutan and Sikkim are more distant countries. You have to take the bus and train to get there. In all, ten days' journey with a large number of thieves and swindlers along the way. Usually seven or eight immigrant workers leave together with a leader at their head. At the Indo-Nepalese border

contractors, thekdar, offer them work up to Shillong. The big meeting and hiring place is Silgadi on the crossroads to Shillong, Darjeeling, Sikkim etc. From there some go to Bhutan or Sikkim to poach, others - more numerous - set out for Assam where they work as diggers, porters, wood-cutters or in saw pits. Those with the most luck get a job as overseer on a house or building site. Some even manage to find work in a workshop or factory. (10)

The migration to Kathmandu valley is recent. It really only dates from 1972-73 when the first building sites for the Ring Road were opened. The construction of this road attracted a large number of young people of both sexes who saw a possibility of making easy money.

The mountain peasants of Ankhu Khola have never lived in autarchy. For a long time now they have had to go and look for an additional income in the winter months, with which to pay their land taxes and purchases outside the valley. In the 19th and at the beginning of the 20th century, the Tamangs from Ankhu Khola worked as porters in the south of the country: they brought luxury articles and foodstuffs from Bhimphedi to Kathmandu; they also used to drive flocks of goats and sheep which Nepal imported each year from Tibet at dasai from Rasuwa to Kathmandu. This seasonal moving around was however limited. It has considerably increased in the last twenty years. The people will tell you with a smile that formerly the wives used to hinder their husband from leaving. Now departures are so common and numerous that no-one would think of opposing them. Looking for work and pay abroad or in Nepalese urban centres has become a mass phenomenon. These vast movements can be explained to a certain extent by the development of the communication network: nowadays it takes a third of the time previously required to reach the Indian border. But beyond this general cause which affects movements throughout the whole country, there are internal reasons in the villages which account for many departures. It is these that should be examined.

The majority of migrants leave because they are encumbered with debts. They go and look for money in Assam or Pokhara which will enable them to pay them off. Indebtedness is chronic in the Tamang villages of Ankhu Khola; it is a daily preoccupation. They borrow money to make the necessary sacrifices in cases of sickness, to pay marriage compensations, to celebrate the ceremonies

of the cycle of life. The latter in particular are very costly: it is not rare that the family of the deceased will spend 2000 rupees on a ceremony to end the mourning period. In the same way it is traditional at a wedding to give the young wife a pair of gold ear-rings which can cost up to 3000 rupees. This money can be borrowed from a money lender or got by mortgaging a plot of land. The interest becomes too high for the debtor; in order to repay his creditor he has to go and look for money elsewhere.

Sentimental or family conflicts can also result in departures. For example illegimate couples might flee to Assam to escape the quarrels and possible reprisals from the family. For the lover, this flight has an advantage: he is not forced to pay the marriage compensation straight away. The couple returns to the village two or three years later, once the commotion caused by their departure has calmed down. The young man then pays the compensation with the money earned abroad, and everything is in order again. In other cases, young girls between 18 and 22 years of age leave home in twos and threes against their parents' wishes, in order to prove their independence. It is also a means of escaping an un-loved husband or very exacting mother-in-law.

There is a final reason: the musk deer, kasturi (Moschus moschiferus). Being big hunters and accustomed to living in the mountains since childhood, the Tamangs of Ankhu Khola are very adept at trapping this animal. The musk deer really fascinates them. It is true that a male animal contains two to three tola of musk and one tola can be sold for not less than 1500 rupees in Kathmandu. With a few tola of musk, the Tamang is a rich man; he can bring home in two months more money than a soldier from the Gurkha regiment can in three years of service. The kasturi has almost disappeared from the Ganesh Himal massif. To trap it, they have to go further afield to Sikkim or Bhutan for example, where it seems it is very plentiful. All the Tamangs from the high valley of Ankhu Khola who leave for these regions do so with the intention of poaching for it. Only if their hunt is unsuccessful do they seek employment as coolies or diggers. However exciting the prospect of these expeditions in high mountains may be, they almost always end in disillusionment. Everywhere the musk deer is becoming rare, even in Assam. The check points in the mountains as well as at the borders are becoming more and more strict and smuggling is difficult. If they are caught in the act, the poachers have to pay

large fines; some are even thrown into prison. On one hand there is the prospect of riches if they succeed, on the other poverty and an uncertain future if they fail. Those who leave to trap a musk deer are motivated more by fanciful dreams than by "rational" economic behaviour. Whatever the reason, it is an essential psychological factor which pushes people to leave.

5. Permanent Emigration

1.8% of the population of Ankhu Khola have left their valley for more than 10 years. The rates vary with the gau panchayat: in Sertung in the upper valley it is between 0.4 and 0.5%, and 2% in Darkha in the lower valley. The highest figure is in Jharlang where 12% of the population have left the village. This emigration is recent, dating from about 1960; the years with the most departures were 1966, 1969 and 1972. 95% of the emigrants have gone to the Terai, in particular to the districts of Nawalpur and Chitwan. The remainder have settled in Pokhara valley and surroundings.

When a family decides to leave, it sells its livestock and land. It entrusts its house to a distant relative and sets out along the path through the plains with an absolute minimum: some clothes, blankets, jewellry, pans and plates. For the emigrants the Terai resembles the promised land. The publicity heard on the radio or from panchayat members describes, in somewhat flattering terms, the facilities they will have in this region. In fact things are very different. In Sertung, for example, eight families who left in 1974 to go to a purnabas in Nawalpur waited for four months to be allotted some land. Once their savings had been spent and seeing that nothing was on the way, they returned home poorer than when they had left.

What causes these emigrations? The inhabitants of Ankhu Khola leave their village for good because they can no longer eke out an existence there. Reduced to misery, they are willing to leave their homes, their only desire being to survive. The years with the most departures were also the years with the worst harvests. According to the statistics obtained from the gau panchayat, 60% of the emigrants are "paupers" sukumbasi. (11) However the analysis should not stop here. An explanation as to why this wave of departures

only dates back several years and continues to increase still has to be given. Two different developments should be distinguished.

First of all, demographic pressure. At present it is not possible to give exact figures on how much the population in a region like Ankhu Khola has increased in the last hundred years. In the villages there are no family or religious archives; on a national scale there was no census taking before 1951. The demographic history of this valley still remains in the realm of conjecture. At the most we can find some indications. At the beginning of the last century the population of Ankhu Khola was much lower than it is today. The names of the places give us some idea: Chalis for example, a Gurung village with 70 houses today, draws its etymology from Nepali: chalis, which means "forty (houses)". Now, this name was given to the village in 1850 after an administrative reform. In the same way at the same time, Sathigaon (or Sertung), from Nepali: sathi, "sixty" only had 60 houses; today there are more than 120.

More exact is a lal mohar of 1818 which indicates that at that time, Burung consisted of 28 houses; today there are a hundred. The natural growth rate alone does not account for such an increase in population; it is also due to the settling of immigrants in the valley: Gurung, Newar, Bahun, Chhetri. All these groups came and settled in Ankhu Khola from the end of the 18th century onwards, as can be seen from the genealogies. Until the beginning of the 19th century the resources must have increased grosso modo in the same proportion as the population. This was thanks to an increase in the cultivated surface and to the change over from a slash and burn agriculture to an intensive agriculture on land farthest away from the village. Thanks also to the introduction of new plants and new types of rotation of crops. Since 1950 however, everything seems to indicate that the resources can no longer keep up with the growth in population. The vaccination campaigns have brought a considerable reduction in mortality rates, whereas the birth rates have remained constant. (12) The population has increased, everyone in the villages feels it and worries about it; the more so, as for thirty years now, no striking technical progress has been introduced to increase cereal production.

At the same time another phenomenon can be observed: in proportion as the population and its density increased, the farmers started cultivating the ground wherever it was possible, even on the steepest slopes. Plants have been sown higher and higher up, as high as 3000 metres for potatoes, 2400 metres for wheat. All this to the detriment of the forest which has not stopped retreating. Today large glades between 2500 and 3200 metres are exploited for firewood and used as grazing land for the cattle in summer. The retreat of the forest in the face of cultivation and grasslands has exposed the rock to the infiltration of rain water. In addition to the natural erosion in the last twenty years has come an erosion directly linked to the demographic pressure. In its total length a considerable number of landslides can be seen in Ankhu Khola valley today, some of which are two to three kilometers wide. The ecological balance between man and his environment seems to be disrupted. Each year, these slides get bigger. They cause considerable damage, carrying away fields, livestock and sometimes people and houses. In Lindjyo, a village of the upper valley, the slides caused so many deaths that the inhabitants were forced to move out and rebuild their village on the opposite side. The authorities have come several times in helicopter to assess the damage, but they have never given the panchayat the compensations they asked for.

There is a direct connection between the landslides and emigration: in the upper Ankhu Khola, 55% of the families who leave for the Terai have had large parts of their fields and livestock carried away by erosion. In Jharlang, where the percentage of emigration is the highest, the government alloted ground in the Terai to 40 families whose poss-ssions had been carried away in a landslide, one of the biggest and most spectacular of the region. Everything seems to show that the inhabitants of Ankhu Khola have, while taking into account their present agro-pastoral system, reached the optimum in production. All efforts to surpass this only aggravate the deterioration of the environment and in so doing menace the material existence of the society.

6. Migration and Development

Migration has complex origins so that it is sometimes difficult to separate one from the other. We have established a typology of the movements in order to clarify the problem as much as is at all possible. It seemed to us that each

type of migration has its own reasons. Enlisting in the Indian or English army is mainly due to the prestige and power it brings. Seasonal and temporary migration has both economic and psycho-sociological causes. Permanent emigration to the Terai is directly linked to demographic pressure on the one hand, and the break down of the ecological environment on the other. Now we can ask ourselves whether behind this apparent multiplicity of reasons, there might not be a common denominator which would account for migration in a global manner. This denominator, we believe, is to be found in the process of development and modernisation of the Nepalese economy. And this takes place on two levels.

The modernisation of the economy - that is to say industrialisation, commercialisation of its products, mechanisation and development of communication networks etc. - involves first of all a progressive generalisation of the monetary economy to the detriment of the subsistence economies. In Ankhu Khola this impact can be followed: it started with the important place indebtedness and the phenomenon of usuary took in the last century, and continues with inflation which has strongly influenced the price of foodstuffs in the last ten years. The growing monetarisation in commercial exchanges has also played an important role. Thus certain products like salt which were formerly exchanged in Tibet for grain, today have to be paid for in money in Trisuli. The hill peasant needs more and more money to survive, which obliges him to leave home more often and for longer periods.

However there is more to it. Even if Nepal has been changing at an accelerated rate over the past thirty years, the economic and social development is not evident everywhere. It can only be felt in the most accessible and most profitable parts of the country, that is to say in the Terai. The mountains and hills which are difficult to reach and not profitable do not benefit from it. It is evident that the gap between the two regions is increasing. On the one hand the road axes are modern, the economy is being monetarised, the secondary and tertiary sectors are gaining in importance. On the other hand, it is extremely difficult to move around, the economy is based on agriculture and livestock, trade remains traditional. Inevitably investments only bring a profit in the Terai, accentuating the imbalance between the two zones each year. This results in the inhabitants of the retarded sectors, hills and mountains, being forced by the demographic pressure and need for money to

leave their villages and go and settle in the more advanced regions of the country. The integration of a valley like Ankhu Khola into the Nepalese State can only be realised at this price.

Notes

1) Cf. S.J.B. Rana (R.), Thapa (Y.S.), "Population Migration: Nature and Scope", in Population and Development in Nepal, Kathmandu, University Press, 1975, p. 49.

2) Okada (F.E.), The Gurkhas, Program Office; Orientation Paper, No. II, US.AID/Nepal, 1963, p. 2.

3) Cf. Gurung (H.), "The Population Aspect of Development", in Population and Development in Nepal, Kathmandu, University Press, 1975, p. 33.

4) Cf. 1971 Population Census of Nepal, Kathmandu, 1973, Vol. I, p. 5-50.

5) The population of this valley has been described in: G. Toffin, "The Peoples of the Upper Ankhu Khola Valley", Contribution to Nepalese Studies, 1976, Vol. 3, No. 1, pp. 34-46. For more details, refer to this article.

6) The statistical documents were collected between 1974 and 1975 within the framework of RCP 253 (CNRS, Paris) with the help of Krishna Prasad Rimal, whom we should like to thank here. All the villages of Ankhu Khola were included in a study on emigration. In addition two villages were chosen for detailed demographic studies: Sertung situated in the upper valley and Darkha in the lower valley.

7) During the first world war the following castes and ethnic groups were found in the Gurkhas:

Magar	: 35%	Limbu	: 7%
Gurung	: 17%	Tamang	: 6%
Chhetri	: 16%	Thakuri	: 3%
Rai	: 12%	Sunuwar	: 1%

Source : F.E. Okado, The Gurkhas, op. cit., p. 2.

8) The word lahure comes from Lahore, a town in Pakistan where formerly Gurkhas used to enlist as mercenaries.

9) M. Wiener gives figures which are more or less identical for the whole country. According to this author 82,000 Nepalese migrate each year to India. On the other hand 62,000 Nepalese migrants return to Nepal each year, after having lived for one to six years in India. CF. "The Political Demography of Nepal", in Seminar on Population and Development, Kathmandu, CEDA, 1973, p. 100.

10) Some very useful indications on the possibilities of employment which immigrant workers can find in Assam are noted in the Census of India 1961 Vol. III, Assam, Part VII, A Selected Handicraft of Assam, New Delhi, 1966.

11) R.L. Turner translates sukumbasi as: "Remaining without work or food; - S. A man without work or food, a man without apparent means of livelihood." Cf. A Comparative and Etymological Dictionary of the Nepali Language, London, 1931, p. 611.

12) Until present all campaigns undertaken by Family Planning in Ankhu Khola have ended in failure.

3 SOME ASPECTS OF THE HILL ECONOMY

3.1 THE LIVESTOCK, FODDER SITUATION AND THE POTENTIAL OF ADDITIONAL FODDER RESOURCES

by K.K. Panday

What we cannot ignore any longer is the fact, that the size of the ruminant population is simply too high for the prevailing fodder situation. The policy and action of conducting an animal "Family Planning Programme" would not be objectionable and impracticable now. The shortage of fodder is affecting the whole ecology of man and his animals in an alarming order. The future is there, only when our actions take into account the limitations, shortcomings and, of course, the potentials we have.

1. The Role of Farm Animals

At present the highest concentration of man and his animals in Nepal is to be found in the mountain regions. The estimated figures of animal population and its contribution to the economy show a very delicate picture:-

Animal	in 1000 (1969) population		in 1000 mt (1974) meat	milk
Cows	3198		-	185
Oxen	3028	6226	-	-
She-buffalo	2977		NA	229
He-buffalo	505	3482	24.1	-
Sheep	2108		3	-
Goats	2241	4349	3	-

It can be noted that the cows make up over 50% of the cow and she-buffalo population, delivering about 44% of the total milk. A she-buffalo contributes on the average 25% more milk of relatively high fat content than an average cow. The meat contribution of buffalo makes over 45% of total meat produced in Nepal.

The performances of these farm animals can be attributed to a large degree to the fodder they are getting. A higher contribution by the animals in the sectors meat and milk would be of so much value in our meagre ration. It is however true that the performances of our farm animals are not always measured in terms of meat and/or milk.

The agricultural activity is still dominated by the direct production of food for man only; although the population of ruminant farm animals has reached over 14 millions. If we took a look at the causes of rampant land erosion, dwindling of forests and the reduction of soil fertility of farmlands, we become conscious of the gravity of the fodder shortages.

The biggest contribution of our farm animals is their manure production. Of course, the quality and quantity of the manure too are directly related to the quantity and quality of the available fodders. Hence, outwardly, the problem today seems not to make the animals productive for direct human nutrition, but to maintain their body weight during the hardest days of the dry season. During the wet season the quantity of fodder available could be regarded as more or less adequate. The troublesome period, however, is the dry season and this is long enough to reduce the animals' condition. They are fed sub-maintenance rations (SAS Rakhne Matra) for six to eight months a year, traditionally from the following sources:

Forest
- Forages (undergrowths etc.)
- Tree leaves from fodder trees

Farmlands
- By-products of agriculture (stuble of crops, straw of rice and millets etc.)
- Weeds and terrace-border vegetation
- Tree leaves from fodder trees on the farmlands

Grazing - River banks, along streams
- Pastures

2. The Impact of Cattle Feeding on the Environment

- The forests

The forests are exploited at all altitudes up to the cool temperate zones. One of the simple reasons for the forests near the villages being misused is, that a majority of the farmers have no alternative source from which to get their fodder and energy. At Tindhare in Sanopakhar village (Sindhupalchok District) at about 1700 msl, I was shown a hill slope, where two years ago, there existed a thick Banj (Quercus sp.) forest. Now a part of it is a maize field and the rest is covered with Banmara weed (Eupatorium sp.) and other unimportant shrubs. Two hundred metres up and at about 5 kilometres distance, I saw a Banj forest at Thulochaur in Jethul Panchayat, being heavily lopped for fodder purposes. The trees, not many of them were Banj species, were standing like masts, devoid of leaves and lateral branches. A touching picture! The pollarding of trees in the forests is uncontrolled.

Very often the individual farmer does hardly anything to safeguard, take care of, propagate or utilize the few fodder species properly, let alone other species of importance to the forest. Thus a farmer who uses the forest today as his fuel and fodder sources may also be the one destroying it at a rate faster than one would like to believe. The damage left behind by the migrating herds of Chowries in search of fodder, can be devastating to the forest in the cooler areas. Consequently, we notice today, symptoms of development in the mountain regions which are hardly promising. The pressure of man and his animal population on the forests, pastures and on the croplands, has reached its saturation point. Already the cultivated acreage accounts for 16% of the total surface area and any one sided increase of the cultivated lands could bring about irreparable ecological consequences.

The mountain regions are especially vulnerable to over-exploitation. In short, loss of forests, seems to have two main causes:-

Use of important undergrowths and trees as fodder
Felling of trees for energy and construction materials

The second is an economical and financial problem of the country and the solution may lie in the concept and stage of development on the one hand and the cost, availability and possible diversification of energy carriers on the other. The problem with forests as a source of animal fodders can be very local and the solution depends on how quickly we can detract the farmers from the forests. How this is to be accomplished is a technical and administrative matter. The number of farm ruminants today exceeds our capacity to keep them. We can no longer keep on exploiting what little there still exists of our forests. There is hardly a landscape scene in the midlands to be seen without the scars and wounds of man's folly.

- The pastures

As with forests, but even more rapidly, the pastures are disappearing under the pressure of human occupation. Moreover, the misuse of forests seems to have a direct bearing on the condition of the pastures, especially of those bordering the forests. We live in one of the climatically sensitive regions of the world: monsoon region. The habit of burning the pastures is in no way compatible with the cure and nurture needed for our mountain landscapes. This may well be due to the fact that the very simple management of pastures, such as the programme of stocking, ownership and agronomical measures, is widely lacking on the local level. Depending on the botanical dissection and the condition of the vegetation and the way they are being stocked, they are prevailing or being eroded. The pastures up to the higher regions are covered more and more by SIRU grass (Imperata sp.), which is a sign of pasture of pasture deterioration. However, the prevailing pastures, delapidated by over-stocking and fires, rain and by Siru-grass, will be of no great help for a long time, even if they are taken care of and improvement measures are started intensively right now. The technicians should take into account many factors before recommending sheep and goats for pastures in the higher regions with less rain and poor soils. Despite the lack of immediate returns, the work of improving the pastures through administrative and technical means should in no way be slowed or stopped. In view of all the ecological and economical benefits from such actions in the long run it worthwhile continuing.

Other traditional fodders such as the by-products of agriculture should always be used to a maximum, but not at the cost of the quantity of the organic matter which should stay in the fields. A general improvement of terrace border fodder is highly feasible and essential for the sake of the annual crop itself.

3. What Can be Done?

Certain changes and accommodation, however unpleasant to some, may be rather necessary before too late. The ratio between the cows and the buffaloes is rather unproportionate to our economical and cultural needs. This is a very sensitive issue, perhaps it is one of the most important preconditions of our agricultural development. Of course, the cows in our country have other values and functions too. But all this could not be had without feeding our animals enough fodder. The inherent potentialities of the animals are most often visible when they have their normal weight and are healthy. It is not the number which is valuable to the culture. A half starving animal would poorly demonstrate our ethical justices of which we are so proud. We can only feed a certain number of animals, beyond which we only overburden our ecological system, and in the end we destroy the very system in which we and our animals live. An overall improvement of the fodder situation would raise the meat and perhaps milk production and to some degree improve the farm lands indirectly. Above all, the moral satisfaction one would get seeing one's own animals in good health, is immeasurable!

Our cropping pattern, combined with the climatic limitations, does not allow the economical production of fodder as a catch-crop. During the rainfree times, it is the water which is the most limiting factor. It will remain an expensive commodity for agricultural activity in the dry season for a long time to come. In some localities one could achieve a little, by restoring or by preventing the loss of soil waters. The security of farm plants from such isolated cultivations of fodder crops during the dry season is not guaranteed, because the animals roam freely at this time of the year.

The possibilities of fodder production as an inter-crop during the summer months would not come into question at least in the next few years due to the lack of means and conditions required for fodder conservation. We have other priorities

The shortage of the complementary factors like fertilizers/manure is a big enough problem. If we think of irrigating the fields, provided fertilizer/ manure is available to utilize economically, we could also produce cereals or cash crops, which have no difficulties finding ready mouths or markets. The growing of fodder on the irrigated and manured fields would come into conflict with our own cropping pattern on the one hand and the shortage of food in general on the other. The method of producing fodder from cereal lands turned into manicurd meadows, in our country, is economically irrational and ecologically expensive and from the technical point of view not feasible in the coming years. Thus one sees hardly any prospects for the cultivation of alternative crops for fodder.

4. The Potential of Fodder Trees and Tree Fodder

The potential of fodder trees has not been effectively utilized. The significance of fodder trees has a far reaching effect on every aspect of the mountain environment even now. Besides producing fodder they are important:-

as topsoil erosion checks (soil binder and wind breaker),

as soil restorer (leguminous trees: Tanki, Koiralo, Siris, Faledo etc.),

as moisture holder (by giving increased permeability and water storage capacity to the soil as their roots penetrate deeply into the soil),

as shade (helping tomaintain low temperatures of the soil and near-surface air, thus reducing the excessive oxidation of organic matter in the soil).

Fodder trees are only slightly sensitive to water logging, drought or weeds. For the farmers no extra hours or seasonal peak hour commitments seem to be necessary to utilize the trees. For one thing, they are known to our farmers in one way or the other, thus such uncertainties which arise with the introduction of new plants and practices are reduced to a minimum. For another it will still be easier, cheaper and more advantageous, especially to the mountain

environments, to continue producing tree fodders.

It will probably not be easy and possible today, to supply the whole green fodder demand for the winter season, but the prospect is bright. We believe that the best results for fodder production can be more quickly got from tree improvement, than from pasture improvement in the same time span; we need only consider the formidable difficulties of both administrative and technical nature involved in pasture improvement.

What is lacking is the scientific means of improving the tree fodder's quantity and quality. They are distributed in almost all climatic zones with only a few species strictly localised at certain altitudes and climatic conditions. Most of the species are located in the midlands where they are needed most.

Lowland (Bensi - Aul) - warm river valleys and slopes
- Bahadur = Artocarpus lakoocha
- Tanki = Bauhinia longifolia
- Ginderi = Premna integrifolia
- Sal = Shorea robusta

Midland (Lek - Bansi) - warm temperature to subtropical
- Koiralo/Tanki = Bauhinia sp.
- Bhimsenpati = Buddleja asiatica
- Dhalektus = Castanopsis indica
- Khanyu/Kabro/Dudhilo = Ficus sp.
- Kutmiro/Syal puchhre = Litsea sp.

Highland (Lek) - Cool temperate
- Musurekatus = Castanopsis tribuloides
- Painyu = Prunus cerasoides
- Khasru/Banj/Falant
- Bangset/Arkhaulo = Quercus sp.

Above all, the diversity of species is very large. Nepal is richly endowed by nature. This has enabled us to have trees suitable to any region of human

and animal habitations. No fewer than 30 families of fodder species are represented in Nepal: from Anacardiaceae to Ulmaceae. The shoots and leaves from such trees and shrubs around the farmlands as well as from trees in the forests have been a very important traditional source of green forages for winter dry periods, albeit insufficient when fed exclusively in the hard hit dry seasons.

5. The Present Use of Fodder Trees

An investigation of the Immediate Programme area of the Integrated Hill Development Project (IHDP) in Sindhupalchok District revealed that less than 50% of the farmer households had a ratio of one tree per animal, and not all the farmers who keep cattle own fodder trees.

In these areas Kutmiro, Bhimsenpati Nemaro, Painyu, Fusrokangiyo, Khanyu and Chilaune supplied the bulk of the green fodder in winter. The farmers estimate that the production capacity of the local species is between 20 to 200 kg. per year. The gravity with which a tree is lopped determines to a marked degree the regeneration of the tree leaves in the next flush. Another important factor affecting the yield seems to be the hailstone attack. Observations of the fodder trees in the forest near a village and the trees on farmland, reveal that the fodder trees on public lands, so called "everybody's trees", are more ruthlessly lopped than the privately owned ones. Quercus sp. (Banj/Falant/Khasru/Arkhaulo), which grow in cooler regions and are regarded to be generally slow growing seem to be most endangered. The productivity of a tree is determined, to great extent, by the method of its lopping.

The effect of lopping is often determined by the kind and condition of the tools (Bancharo/Khukuri/Khurpa/Hansiya) used. A larger tool (Bancharo/Khukuri) brings down larger twigs/branches, mostly unwanted. Sometimes the trees seem to suffer unnecessarily because an inappropriate tool is used.

Depending on the agronomical, economical, social and geographical factors affecting a farmer, fodder trees are used in a varying degree in the midlands. The leaves of fodder trees are fed to the cattle in the following order of precedence:-

Judgement by farmer	best	good	fair
IHDP area	Bhimsenpati	Dudhilo	Fusrokangiyo
	Kutmiro	Nemaro	Painyu
	Badahar	Khanyu	
	Gogan		
	Bans		
Syangja area	Badahar	Ginderi	Dabdabe
	Kabro	Pakhure	Chiniya
		Chulitro	Berulo

The farmers in Syangja area on the banks of Andhikhola, are said to earn some money by leasing their fodder trees to other farmers. A full grown Pakhure (Ficus sp.) can fetch up to NC Rs. 300/- a season. Except in a very few areas and sporadically by a very few farmers, are fodder trees ever cultivated in the sense that they are planted at a particular time, propagated by hand or manured. However, the number of trees on the fields of such farmers are by no means capable of supplying the green fodder demand through the long dry season. At present the available tree fodder is not sufficient to feed the farm ruminants ad lib. The green tree fodder serves mainly as dessert after the dry and fibre-rich straws from rice or millet which have mostly ballast value.

There are certain limitations in the number and kind of species of trees that can be planted on the crop lands. The disadvantages of the trees on a limited acreage of a poor farmer, may be on terrace borders, are not to be overlooked because of their importance as fodder:

too much shade (ot, tapkana, sep): the food crops do not stand too much extra shade for too long a time. The amount of light during the rainy season may already have been reduced by clouds. Ficus bengalensis and Ficusrreligiosa (Bar and Pipal) can form a very dense and gigantic canopy.

root spread: The nuisance caused by large lateral near-surface roots around the base of the trunks can be enormous.

Many fodder trees in the IHDP area show signs of aging. Loppings are too heavy. Since the gradual closure of forests does not automatically mean there is an alternative source of fodder to be found elsewhere, the farmland fodder trees, which are small in number, are getting the burden. Only an increase in the number of fodder trees in the next years, combined with improved lopping methods could help the trees survive.

The Nutritive Value and Potential of Tree Fodder

From the point of view of nutritive elements, the tree fodder shows a very favourable composition. The author took samples of leaves of over a dozen most popular species of fodder trees in Sindhupalchowk district in June 1975.

The results of the analysis of chemical composition of some of the species are very promising. Some of the results obtained are mentioned here:

Fodder trees	dry matter %	percentage on dry matter basis	
		crude protein	total ash
Badahar	27	15	10
Ginderi	23	21	10
Gedilo	32	18	17
Nemaro	20	17	13
Bhimsenpati	31	19	9
Syalphusro	35	19	12
Tanki	31	29	9

The digestibility of the crude protein exceeded 80% in Tanki and 68% in Nemaro, which is very encouraging. This is comparable with good clover-grass forages. As not all the species of fodder trees are lopped or can be lopped

at the same time during the dry season, it is even better for the farmers. The carrying capacity of a mixture of species is also better than that of one or two best performing species serving even as dessert as at present. Thus fodder trees not only produce fodder economically for animals but also have many other functions of highest ecological importance.

A basic change in the thinking about the methods of fodder production by the technicians on the one hand and finding a better way to exploit the existing trees on the landscapes on the other, is of utmost urgency. The demand for fodder trees is big. The scars and wounds of annual erosions need redressing, the half hungry animals need more fodder and the ill-nourished people require animal proteins and animal fats more and more.

6. Towards a Systematic Promotion of Fodder Trees

There are remarkable beginnings to be seen in the attention being paid to the fodder trees.

Three stations/farms deserve mention:

Khumaltar Farm - Established a small nursery, where small seedlings of Siris, Pakhure, Painyu and Falant were to be seen in summer 1975. There are other species in the collection of the farm for the purpose of observing their growths.

Lumle Agricultural Centre - Established a small nursery. Saplings of nine species between the age of one to three years were to be found in the summer of 1975. Relative values of the Nitrogen and total Ash contents plus an assortment of digestibilities were analysed through the laboratories in England, from the samples supplied by Lumle.

IHDP, Sindhupalchok - Collected seeds from Badahar, Chulitro, Khanyu and of a few others, and carried out some germination tests. A small fodder tree nursery is being established.

These efforts are without doubt very important. The seriousness of the fodder problems, which could be regarded as the pivot of ecological problems in most parts of Hill in Nepal, and the potentials of fodder production through fodder trees, however, warrant planned and consolidated efforts from more technicians on more farms and stations with more dedication and efficiency.

Potential Areas for Planting Fodder Trees

The farmers cannot be advised to use their best crop lands for fodder tree planting, as long as an increase of income from the alternative use of their lands is not demonstrable. Even in such cases it would come into conflict with the limitations mentioned earlier. Hence our efforts must now be directed towards utilizing the marginal and/or, unfortunately man made, waste lands which virtually every locality has. They have to plant as many good trees and different species as possible, also on such land which is less suitable for annual crops (deep soil but stony etc.). Some pasture lands could also come in to question. They would possibly perform better as fodder tree orchards than as overexposed common pastures.

The fodder trees could even help the pastures to survive and revive quickly. Such orchards could serve a triple purpose: forage production, erosion control, and eventually, some fire wood from the lopping treatment of the trees.

Farmers owning relatively good land for annual crops are normally better off. There are always a few farmers (sometimes the majority) present in any hill village, owning agriculturally disadvantageous land. Unfortunately they could also be at the same time a socially discriminated group. These farmers should be encouraged to plant as many trees as technically possible. The surplus fodder that they might eventually produce, should be used for mutually supplying each other's lack: internal exchanges in the village. Such exchanges

could be in the form of cash or kind. The Panchayat personnel could supervise or takeover the operations.

Such more or less interdependent farming could promote the common interests and feelings between the socially heterogenous family structures of a village. The situation of one farmer producing surplus food, while the other is living under famine conditions should not occur.

7. The Necessity of Further Research

To meet the challenge of our chronic fodder shortages, we have a great task ahead. A series of research and observations are required as preliminary steps. The nutritive values of all species of trees used as a source of fodder have to be determined, before we can select a reasonable number of species which would allow an optimum exploitation. The production and carrying capacity of individual species and the techniques for enhancing the productivity have to be found.

In case a forest necessarily turns out to be the only source of fodder for a particular locality, the most applicable technique of exploiting forest fodder trees in the forest itself is to be chosen. Of course, this must be ecologically acceptable.

The above areas of study indicate the necessity of a coordinated, integrated and long range programme, to be started as early as possible. There is no time to be lost, if many of the remaining fodder trees are to be saved.

The necessity of establishing a Center for the Advancement of Fodder Trees and Tree Fodder under the ministration of competent technical staff is of highest urgency. Such a center should immediately establish a direct link with the present sources of information:

- Farmers in Hill Nepal
- Foreign research stations and Libraries

No programme on a regional or national basis aiming at erosion control, increasing the productivity of land and/or preservation and conservation of forests, would be successful without giving the farmers a good source of fodder and a socially and economically reasonable package programme to keep the animal numbers within a tolerable limit.

It is fruitless to wait and expect rational thinking on the part of the majority of the populace living in the conditions we have. A few persons with responsibilities and determination, hard work and dedication could transform the situation and steer the problem towards a solution agreeable to our ecological and cultural needs.

RAJA KO KAM, KAILE JALA GHAM is self destructive thinking.

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3.2 HORTICULTURAL DEVELOPMENT IN THE HILLS - its potentials and necessity.

by S.B. Nepali

1. Introduction

Fruit grew wild and was eaten free of cost in those days when land was plenty and food abundant. In those days marketing of fruit and livestock products was thought unnatural, unsociable and in a sense marketing was limited.

As time passed on, unknowingly the population grew larger and larger, the available food became insufficient and people started working on land which had been pasture land where cattle used to graze; the cattle were taken off this land and fed on by-products from the farm. Cattle or farm animals became too weak to be used as draft-animals, their numbers dropped and so there was less manure for the farmer to use, and he constantly had to enlarge the farming area in order to get enough fertile land. In a way livestock became less useful. Production dropped, food became scanty.

Man continued to toil on the land in the hope of eking out an existence and neglected to uphold the symbiotic balance of nature which is necessary to improve his standard of living.

An ever increasing population, has emptied forest areas in the search for fuel - the only source for cooking energy and light, shelter and food. This is an age-old process. However, the idea of using forests for settlement in a planned way was started in 1952/53, when we were forced to do something for the welfare of the people who had lost everything in floods and landslides in the hills the previous year. The cause of these floods and landslides were never investigated but to help these people they were provided with a place to settle and land to cultivate. At that time malaria was rampant and this

settlement did not get well established. However, the mass campaign against malaria and its success caused many people to take a chance to make their living. The cleared forest area yielded new soil with many years of humus deposit and the good heat, sunshine and monsoon rain gave bumper harvest crops - attracting many people to come down to Terai and settle. This has continued until the present time and I think will continue as long as we find forest. It is, in the absence of other alternatives, the easiest source for a temporary adjustment.

Along with this, people started clearing up the forests in the hills too, expecting more food from the reclaimed land, not knowing exactly what will happen to the land without forest. Cultivated land was expanded, but there was not enough livestock manure available for all the land, and so the good return from the newly reclaimed forest soil which they got in the beginning did not continue for long and the land was left fallow. But the attack on the forest continued because of the need for fuel and food. This is going on both in the hills and Terai.

At the moment only 34.2 percent of the land in this country is under forest. I assume commercial forest is even less. It is estimated that 16.5 percent of the land is under cultivation. This comes to about 2326000 hectare. This cultivated land is distributed in the following manner in the three ecological regions:

Mountain	130000	hectare
Hill	756000	"
Terai	1440000	"

This means the Mountains have 5 percent, the Hills 33 percent and Terai 62 percent of the total cultivated land. If we combine Mountain and Hill the percentage of the cultivated land comes to only 38 percent which is still far below that of the Terai.

According to the latest census (71-72) the total population of this country is 11.56 million; out of which Terai has 4.45 million and Hills and Mountains have 7.11 million.

The Terai has the largest share of cultivable land just to support one third of the total population which resides in this region. The food production of one season provides them with their food and needs. In spite of the massive extension activities not all the potential winter crops or improved varieties are utilised. Possibly this is because either they are not hard pressed or the programme does not suit them. The hills are left with one third of the cultivated land to support two thirds of the total population. Because of the isolation and lack of easy transport, food and other needed materials for the Hill people cannot be made available. Even if these are made available they do not have the purchasing power. In reality they live below subsistence level. This situation has caused the Hill people to migrate to the Terai, to migrate to areas with supplementary jobs, to clear all the forest possible to create and establish an intensive cropping system, to trade with the available commodities like fruit, ghee, honey, herbs, and forest products just to get food enough to live on.

2. Horticulture a Source of Cash

This situation has brought the naturally grown fruit like mandarine, lemon, lime, and bananas of the Hills to the market to exchange for supplementary food and other necessary things like cloth, salt, and kerosene.

I remember while visiting Gorkha (west of Kathmandu) people I came across, said that the fruit from four clumps of bananas, and two mandarine trees is just enough to get salt and oil for a year required for a family of five. In Tehrathum (east of Kathmandu) a porter carrying a Doko (basket) of citrus mandarines told me that this was the cash to buy salt for his family and animals. This shows that horticultural products play a role in supplementing the daily requirements of life. These fruit grow in a more or less wild state near homesteads, with little or no care for their improvement. The number of fruit trees planted in former days was negligible or almost nil.

In the process of the development of Horticulture, the Department of Agriculture, the Horticultural Division (till 1966), later the Department of Horticul-

ture (1966 - 1972), the Department of Agriculture, and the Division of Fruits and National Citrus Development Programme (from 1972 onwards) have done extensive study to establish the fact that in different climatic regions and localities of this country, fruit can be one of the major sources of income. Production from fruit cultivation per unit area of land is quite a lot higher than that of cereal grain production. Mango, bananas and papaya are reported to produce 30-40 metric tons per ha. Apples, pears and mandarines are reported to produce 25-30 metric tons per ha. The national average of fruit production is about 6.5-7 metric tons per ha., whereas the cereal grains under an excellent cropping system and management will produce about 10-12 metric tons per ha. The national average is 3-3.5 per ha.

There are about twenty-six research stations and farms in different development and ecological regions to supply technical information and support new plantations. These stations and farms supply the greater part of the material for plantation.

3. The Introduction of Apple Growing

There are many difficulties involved in researching which region is suitable for which fruit. The following case history of apple cultivation will show this. This fruit has been newly introduced and cultivated in Nepal.

Not having any wild species of apple trees to show which conditions are favourable, we theoretically selected Kakani, a site higher than Kathmandu with a cooler climate but with easy access for marketing. Over a long period of time, in spite of many varieties being planted, many trees grew well but only a few varieties seemed to like the climate and bore fruit. It was realised that this was due to the excessive rain-fall and acidic soil.

In the process of growing apples, the position of site was the main consideration, so we moved to Daman which is higher than Kakani and so Sermathang close to the range of the high Himalayas and Baitadi in the far west where rainfall is late and less. Of these places, Sermathang (Helambu) gave encouraging re-

sults in spite of a not very conducive rain-fall situation. Lately Baitadi has also shown hopeful signs. Daman, in spite of intensive care and observation was found to suffer from hail during the flowering and fruiting season and from excessive rain-fall. Meanwhile we have already sent a few plants to the Inner Himalayan regions like Jumla, Mustang, Manang, and Dolpo to test their suitability. They did best in Jumla, Dolpo and in the lower parts of Mustang and Manang.

It has become clear that we cannot grow just any fruit anywhere we want to. Either a fruit must be chosen and then a suitable locality found, or a place chosen a suitable fruit found which will grow well there.

4. The Difficulty of Growing Fruit in the Hills

At the present moment the Government has decided to concentrate citrus mandarine in the Eastern Zone, mixed fruits in the Central Zone (Kathmandu Metropol), dry fruits in Mustang and apple in Jumla. Fruit crops can play a major role in building up the economy of the hills and mountains. They can be supplied to the Terai where they cannot be grown and in return food grains can be supplied to the hills. But this cannot be generalised. This requires a situation where technology is easily available and the climatic conditions are favourable.

Technology is important because this trade is very new to the farmers. We have a small number of trained technicians. Besides this the climate plays the main role. Different crops behave differently in different climatic conditions. Hence we have to consider factors like rain-fall, its amount and pattern; hail; cloud; sunshine; frost; snow; wind and storm; fluctuation in temperature, does it freeze in winter or how hot is it in summer. Similarly we have to consider the location, which way it faces, the condition of the soil, facility for irrigation and available drainage, not forgetting the long gestation nature of the crop, supply of inputs, transportation facilities, marketing, taking into account the perishable nature of the products. In short, it is quite a challenge to make an orchard payable. It needs a lot of patience and then only specific fruit will grow in specific regions.

In this situation, without knowing the real constraints and challenges involved in growing fruit, and just thinking of the very bright side of owning an orchard, few people have taken up this business seriously, most sit and wait for some return. Besides, most of the people involved in this activity are those who have sufficient land to grow cereal food grains, for others the need for increased production leads to the encroachment of forest and pasture. Possibly this is because LAND is the capital in this country. There are few plantations with just a little land on which to grow their food, where the owners have taken up this business as their would be main income. Why do the Hill people not take this business seriously? There are various reasons e.g. no guaranteed market for the products, storage difficulties, insufficient technical know-how, and most important, there is no guaranteed supply of cereal foods. This programme needs strong support and a massive thrust from a well organised institution to carry out the activity and sustain it.

5. Fruit Production as in Instrument to Fight Erosion .....

With the existing situation of isolation and difficulties in transportation, cereal food grains will be the only farm product in the hills for some years to come, however little the production per unit area may be. This is because the product can be stored and used as and when needed. Yet, the cultivation of cereal food grains and other crops needing soil stirring, makes it extremely difficult to maintain the productivity of the soil.

The land is exposed to a monsoon climate and also dry arid conditions. This helps erosion and loosens top soil, the layer that maintains the good life of the plant and produces the grains.

Erosion in east Nepal is so bad it is almost out of hand and immense efforts are needed to stop it, but in the west it has just started and a planned approach could save a lot.

It has become important to act and stop the top soil, which is very essence of life and production, from being washed away. This requires careful thought

as the surface soil should not be disturbed; the surface should be covered with vegetation and still give a good harvest. This would be possible if fruit trees were planted.

Fruit trees are planted at a specific distance from each other so that the tree has sufficient space for growth and gets enough sunlight. Pits are also dug to a required depth allowing sufficient space for root growth. Once this is achieved, regular irrigation must be ensured for at least the first three years. The soil between the trees should not be stirred up except just under the crown in order to manure, irrigate and conserve water. This situation allows grasses to grow in the interspaces. According to what is most needed it must be decided whether the grasses to be grown will be legume grasses, non-legume grasses or a mixture of both. These grasses could be fed to the cattle, buffaloes, sheep, or goats by stall feeding or by grazing. However in my opinion, except for sheep which are less harmful to the orchard, other animals should be fed in the stall. This creates a cycle from grasses to animal fodder to organic manure to plant food. In this cycle, both plants and animals can live together happily and provide fruit and animal products like milk and milk products, meat and wool, hide and skin. This is how soil is conserved, productivity is increased.

Hence the cycle of increasing productivity has to be created in the place of the vacious circle of forest depletion and soil eorsion. This can be achieved in specific places by planned fruit plantation programmes, complemented by animal keeping.

6. ... And to Create New Employment Opportunities

In addition to this, many more activities can be made complementary like fruit processing - making jam, jelly, concentrates, juice, dehydration products; milk processing - making ghee, cheese; meat processing - salted dry meat, canned meat; wool processing - carpet making and allied products; hide processing - making shoes, bags, coats. These are not the only possibilities. Fodder industries can be built up from the by-products of fruit processing and milk

processing. Similarly fruit production demands packing materials which should be developed in a planned way from forest products like planks and bamboo.

This shows there is a great opportunity to engage people in other businesses who are now solely dependent on agricultural land. At the moment, 94.5 percent of the people are dependent on land. Out of 94.5 percent only 50 percent are gainfully employed. This demands serious thought and better management if the betterment of the Hill people is to be sought.

7. Conclusions

To sum up we can say that the climate in the hills and mountains is favourable for human habitation and people do not like to come down to Terai unless there is a calamity like landslides or ever decreasing production.

Most of the country's population live in the hills. Population growth is serious because due to the poor economic situation there is no guarantee for child health.

There is a great competition for food between man and animal. This has caused poor feeding management. The animals being the only source of draft and manure, poor feeding has affected agricultural production.

Greater competition for food inspired or compelled the people to encroach on the forest where they follow an intensive cropping pattern.

This has caused runoff, floods and soil erosion resulting in low fertility of the soil.

Hence a condition should be created which helps to maintain the fertility of the soil.

This condition could be brought about by planting fruit trees with sod culture or grass cultivation in the interspaces and also by keeping livestock.

This condition helps to provide soil fertility and also helps to increase production.

This condition provides opportunities to employ people in the business instead of them being solely dependent on land and they can still help production.

This condition brings a situation which will create regional integration and economic build up.

However the need for cereal grain food for the Hill people should not be forgotten. Transport and communication, medical care and finally family planning have to be organised.

It requires a lot of work to halt erosion in the hills, to make some provision for the hill people and improve their economic condition.

3.3 INTERDEPENDENCE OF COTTAGE INDUSTRY AND THE ECOLOGICAL SITUATION

by B.M. Acharya

1. Introduction

The people in the mountain regions of Nepal, generally live in isolated and widely scattered localities or communities. The barriers created by the rugged, dissected and difficult mountains and the fast flowing rivers and streams, are so real and challenging that the social and economic interaction, both within and outside the region is very costly and infrequent. The mode of transportation is by and large still on man's back. The development of a modern road transport and communication net-work is still under way and so is still mere fiction for the great majority of mountain dwellers. The way of life and the socio-economic structure of the people has remained unchanged for centuries. Agriculture is the dominant means of earning a living and is at a purely subsistence level. The people have very few sources of cash income. Thus the barter system is still the dominant form of trade and all services are paid for in kind, usually food grains.

High illiteracy and migration rates, differences in the social and ethnic structure of the population and the feudal nature of economic exploitation leading to heavy indebtedness are the common age-old social problems, which are still very strong and have by no means weakened. The differences of altitude from about 260m to over 3500m imply a wide range of agricultural cropping patterns and other economical and social activities even within each locality.

Primarily as a result of the inaccessibility and their remoteness the communities in the mountains have been traditionally independent and self-sufficient in producing and utilizing the local resources to meet their simple needs. As a result some basic activities or professions, other than agriculture, were

also developed in all the different mountain localities. By and large these activities still exist today, even though some are already dead and others are in the process of dying out. Such activities may be termed as "the traditional cottage industries" of the mountain communities. The typical cottage industries are weaving with cotton or wool, iron or gold smithy, leather tanning and shoe making, tailoring, earthern pottery, wood turning, metal craft in bronze, brass or copper, producing lac, carpentry, making of bamboo products, rope or string, ghatta, slate mining, making of lime, tiles or bricks or terra-cotta, handicrafts, Nepali paper, bee keeping etc.

From the principles of economic science and the modern trade practices of industrialised countries, the listed activities would hardly qualify as industries. There are only a few exceptions where the people engaged in these activities are not also dependent on agriculture as their means of livelihood, and thus these activities can only be carried out seasonally or in leisure time, when the people do not have to work in their fields. The activities are traditionally limited to certain ethnic groups of people. The people engaged in such activities generally come from poor social backgrounds or from poor sections of the hill communities. Even though these people still depend on agriculture, such activities offer them supplementary employment and hence an additional (non-agricultural) source of income. The significance of these industries for the mountain communities is very great indeed. As most of the inhabitants of the hills have some skills, which are used in agricultural off-seasons, we can assume that up to 15% of the hill population is at least on a part time basis engaged in the practice of a traditional cottage industry, even though this is only done casually.

By glancing through the types of cottage industries practised by the mountain communities, it becomes obvious that they are directly or indirectly dependent on the forests or pastures, either for raw material or fuel or both. Some of the industries are also partly or totally responsible for the depletion of the forest resources and hence the imbalance of mountain ecology. If we were to look back into the history of the cottage industries, we would find that many of them have disappeared over the years from different parts of the region. The general trend at present is such that many industries are rapidly

closing down. This is basically due to the lack of raw material. The competition offered to certain industries by factory-made products, imported or otherwise, has also contributed to this phenomenon. The consequences are very serious, because this leads to an even greater pressure on the already exhausted land and forest resources.

2. Traditional Industries in the Mountains

The following paragraphs give an account of the various traditional cottage industries in the mountains; - their present trend in relation to past history, and their prospects and limitations, in relation to mountain ecology.

i Iron and copper mining and smelting

Copper ore mining has been dead now for quite a few generations, but the mining of iron ore and the smelting of malleable iron on a large scale has only stopped in the last couple of decades. In remote regions, e.g. Hedegna in Sankhuwa-Sabha district, limited quantities of iron are still made by the local blacksmiths.

Shortage of fuel was the main reason why these industries died out. While they were in operation, they were responsible for erroding large areas of the forests for making wood charcoal, which was the fuel used. When these industries closed down, the large numbers of people engaged in them, were suddenly out of work. As they had no alternative, they tried to make a living by intruding on the forest. Their activities ranged from a shifting type of potato cultivation by clearing high altitude mountain forests to wood shingle cutting, wood turning, making of Nepali paper, and grazing cattle and sheep inside the forest areas etc. These activities have proved to be more damaging to the mountain forests than the effects of making wood charcoal for the iron or copper industries before. The mountain regions, adjoining the "Roll Khani" and "Those" areas in Dolakha and Ramechhap districts respectively, where the people classed as 'Khannels' live, are typical examples of this.

ii Cotton weaving

Until less than 50 years ago, cotton used to be grown locally from which clothes were made in almost every household all over Nepal. In order to grow cotton, forest areas were cleared and destroyed and the cultivation was shifted regularly. Thus in those days, cotton growing was also responsible for the destruction of the forests in many of the lower altitude belts in the mountain regions. As the population increased all the fertile land was necessary for producing agricultural crops and also at the same time it became possible to import cheap cotton yarn from India. So the practice of growing cotton became less and less popular and eventually ceased. However cotton weaving remained for quite some time. Then textile mills were developed in India and the road and rail net-work were constructed to connect the Terai with India. It became much easier to import factory-made clothes with a wide range in design and quality. Many whole-sale and retail clothes merchants from India also arrived in the Terai and the central valley of Nepal. As a result of the onslaught of Indian clothes, the demand for local hand-loom clothes decreased rapidly and within a few years some 90% of weaving disappeared from the mountain regions. The remaining 10% or so of weavers kept weaving with the imported Indian yarn to meet the limited local demands for handloom clothes in the very remote parts of the mountains. During the last 5 years, the shortage as well as the increasingly high prices of Indian yarn has forced the remaining weavers in different parts of the country to stop weaving.

A typical example is Tauthali, a village in the eastern part of Sindhupalchowk District. Between 1974 and 1975 some 600 weavers stopped their activity there. The remaining ones worked to only about 25% of their capacity. In Booch, Katakute and Malu Panchayats of Dolakha District, about 1500 weavers stopped their work from 1971 to 1975.

In the last 2 to 3 decades the Cottage Industry Department of HMG has put its major effort and investment into the fields of training, promoting and financing cotton weaving on improved looms. Unfortunately, however, many more traditional cottage weaving industries have died away, than new ones have been created in the same period of time. All those who have ceased weaving have

naturally become a burden to the mountain environment.

If we compare the numbers of skilled hands in any of the activities, cotton weavers are the most numerous in the hills. However, the future of this industry is dark unless some real efforts are made to save this skill from disappearing for ever. For the mountain regions which have the poorest material resources and where a large percent of the population is under-employed, the development of labour intensive production industries is the right solution to provide a maximum number of people with an alternative to agriculture as means of earning their living. Cotton weaving is one of those industries which can fulfill these criteria.

iii Weaving in wool

There are wool weavers in all the parts of the mountains above 1500m. They are second largest in number of any skilled activity. Weaving is done with local sheep wool and quite a number of excellent products are made. Except in a few places, this once thriving traditional cottage industry, is facing serious setbacks owing to the shortage of raw wool. The traditional pastures of the mountains have not only been used for cultivation, but also overgrazing, and burnings have exhausted the potential fodders. Weeds have developed in most of the remaining pastures. The traditional method of grazing sheep in large flocks, by wandering from place to place, has also decreased significantly because of grazing restrictions both in Nepalese and Tibetan areas. This has influenced the quality of the sheep as well as the quantity of wool, with the consequence that many potential weavers are switching to activities which are seriously undermining the high altitude mountain forests.

iv Blacksmithy

Blacksmithies being an inseparable part of agricultural communities in the hills, the blacksmiths are to a very large extent dependent on their own profession, even though their products or services are mostly paid for in kind. Iron and wood charcoal are the two basic raw materials required by them. As iron is supplied by the clients themselves, there is no real problem with it.

However the traditional practice requires that the blacksmiths provide their own wood-charcoal, which they themselves make in the nearby forests. The general depletion of the forest resources has made it more and more difficult for them to get an adequate quantity of wood-charcoal each year. This problem is reflected in the products fabricated, which are of inferior quality because of the increasing scarcity of energy. As a result most of the blacksmiths are not able to sell their products and earn an extra income.

v Leather-tanning and shoe-making

The traditional technique of tanning raw hides of cows, buffaloes and goats for making leather shoes has been a crude, time consuming and a low graded job, practised by the shoe makers. The raw hide, lime and the bark of certain trees are the chief raw materials required. The technique of tanning and shoe making has now virtually disappeared from the mountains. Several factors have jointly contributed to this state of affairs, of which competition offered by the factory-made imported shoes and the scarcity of the raw material such as the tree bark are the two major ones. The very low social and economic conditions of the shoe makers did very little to help the majority of shoe makers switch to making shoes by improved techniques by using imported factory tanned leather. Thus the shoe makers being also the most degraded group in mountain communities have started making their livelihood by all kinds of means (not all of which are beneficial to the mountain ecology), most of them tending to use the resources already tapped by other sections of the population and consequently placing a further burden on the available land and forest.

vi Earthern pottery

The potters live in localities which are mostly in the lower or middle regions of the hills, which have generally very poor forest or vegetation resources. From the ecological point of view, the fuel required by the potters is the most important raw material taken from the local vegetation sources. As wood is already scarce, pottery is fired with dried reeds, hay, grasses, chir-pine needles etc. which are usually collected from the nearby forests. Thus the impact of the potters on the local forest or vegetation resources is no longer so serious, however the energy difficulties of the potters are clearly visible

in the inferior quality (not properly fired) of their products. Serious implications for pottery as a cottage industry arise in mountain localities only after a road transport is developed there, and imported superior quality products easily compete with the local pottery.

vii Wood turning

For wood turning, mechanical water power is utilised and a wide range of household utensils are made from certain selected trees.

In the past this industry thrived in the mountains totally upon the free exploitation of forest trees. It is not the industry as such which consumes so much wood, but rather the crude and wasteful techniques of the people for obtaining the wood, which is dangerous for the wood resources of the mountains. The scarcity of suitable trees has already forced this industry to close down in most of the lower altitude areas but it is still active in the high altitude mountain forests.

viii Metal craft in bronze, brass and copper

This is by far the best developed and the most significant cottage industry developed in certain parts of the mountains. This industry is not only independent of agriculture but has also proved a source of wealth to many. Taksar, Chainpur, Tansen, are some of the towns in Nepal, where this industry has thrived the best. It is run with a good infrastructure with independent groups of financiers, independent craftsmen and independent merchants. Most of the raw materials such as bronze, brass and copper are collected in the form of scraps and only small quantities of them are imported from abroad. Bronze products are made by casting molten bronze in suitably made moulds, whereas the sheet metal work with brass and copper is done by cold as well as hot processes. A very wide range of products of very high standard are made. The source of energy (or fuel) for this industry so far has been wood charcoal. Sheet metal craft with brass and copper does not require much fuel but for melting the bronze very big quantities of wood charcoal are consumed.

This once thriving cottage industry has had serious set backs in the last ten years or so, primarily for three reasons. Firstly the source of energy for this industry (particularly bronze casting) is wood charcoal heat. Over the years this industry has consumed very large quantities of wood for charcoal making with the result that all the significant nearby forests have been exhausted. Now it takes a return journey of 2 to 3 days walk to get wood charcoal for some places. Secondly, the high price of wood charcoal as well as heavy taxes from several quarters (forest authorities, village panchayats and district panchayats etc.) on both the raw materials and the finished products has made it difficult for this industry to survive.

As a result many financiers have started to invest in other more profitable fields, leaving the industry without any financial support. Thirdly, a serious problem was created by building stainless steel utensil manufacturing industries in the Terai. The effect of such competition on sheet metal craft with copper and brass was more serious than on the bronze products. Stainless steel caused the most damage to this traditional industry, as many craftsmen had to leave their work and migrate during this time. Even though HMG has since revised its policy on stainless steel, it will take a long time to repair the damage done.

This industry can still be revived and made successful by providing it some measure of protection as well as by making an alternative source of energy available - such as hydro electricity and suitable electrical furnaces. Hydro-Electricity could very well alleviate the impact of this industry on the mountain ecology but development research and investigations would be needed.

ix Lac producing

Lac is a dark red resin, which grows on certain types of trees. It can be used raw as varnish and also has a wide range of industrial and other applications. Until about 10 years ago lac producing was very popular in many mountainous areas of Nepal, but now it has virtually disappeared, the reason being that no related industries were established in Nepal itself, in order to protect this activity. Thus lac production in the mountains of Nepal was

totally dependent upon the Indian market which has always been uncertain in its price fluctuations. While lac production was popular in the mountains, the people involved had a direct interest in safeguarding or even planting suitable trees. As lac production ceased, most trees were destroyed mainly for the want of firewood. At present there is a big demand for lac; people would like to produce it again only to find that the suitable trees are no longer there.

x Wood and carpentry

Carpentry is only a casual activity, practised by some mountain folks in order to make simple constructions and furniture from timber. While there are many experienced hands in sawing wood and skilled carpenters in some places, there are many places in the mountains where people have never known the technique of sawing and instead they utilise an axe to obtain the timber. The use of the axe to obtain timber is not only crude, but also most wasteful. This practice has done an incalculable damage to the mountain forests, over centuries. In order to save wood or for that matter to conserve the forests, it is absolutely essential that the people also learn the technique of sawing.

xi Bamboo

Hatuwa is a village in Bhojpur district whose only noteworthy resources are the bamboos especially planted and a large population, many of whom are skilled in making and selling household products from bamboo. Even without any other significant resource, the entire population of Hatuwa make their livelihood from this activity and at the same time exert only minimum pressure on the nearby forest resources. Hatuwa is a leading example, there are other similar places. It can easily be observed that in those parts of the mountains where forest resources are very poor and the people are comparatively conscious of the situation, they have planted the bamboos on a significant scale and have utilised them for every useful purpose. On the other hand those places which until recently had an adequate forest resource nearby did not see the necessity to plant bamboo and thus have only a little on hand. Bamboo can provide a substitute for wood or timber, fodder, fuel and is a very useful and valuable raw material with a wide range of applications for

mountain people. It is essential that the people in mountain regions where bamboo is not already grown, should be encouraged to do so.

For village cottage industries, some of the Nepalese names of household products fabricated from the bamboos are: Mandro, Chitra, Bhakari, Ghoom, Namlo, Dhoko, Dhakar, Dhobe, Thunse, Nanglo, Chalno, Tokari, Dori, Kokro, Serungo, Perango, Mahala, Mudha, Chepa, Tokri etc. These products have generally a good market in every part of the country. In addition, a wide range of handicrafts can be produced from the bamboos, provided that the skill of the mountain folk is developed or otherwise restructured.

xii Rope or string making

All mountain folk make rope or string for household uses from fibres of certain grasses or shrubs in their spare time. The source of these raw materials was until now the forests. The deterioration of the mountain environment and the shortage of land for planting the fibres have caused the people in many parts of the mountains to increasingly resort to importing fibres from outside the region, thus draining away the little remaining cash in the mountain communities.

xiii Slate mining

Slate mining and roofing houses is a comparatively new development in certain parts of the mountains. This resource has not yet been researched on any significant scale and so it is not even known how great it might be. Until now the search for and prospecting of quarries has only been made on local initiative. The necessity of slates, as an alternative roofing material to wood, shingle, thatch or tiles has arisen in the mountains out of the scarcity and high cost of the latter. In places where quarries have been discovered and the houses are now roofed with slates, the positive effects on the mountain ecology can be seen.

xiv Ghattas

The ghattas are the traditional water powered mills, which are constructed essentially from stones and wood. The wooden components of the ghattas require replacement once every few years for which only the largest size trees can be utilized. As there are also numerous ghattas in the mountain regions a substantial amount of wood is needed for them. It has also become increasingly difficult to get suitable trees for ghattas.

The alternative to the traditional ghattas would be to aid the proprietors to build modern mills operated by mechanical water power run through pressure pipes and water turbines.

xv Making Nepali paper

The barks of the tree or shrub edgeworthiana conyzoides (loakta) and a lot of firewood are the two main raw materials required for making Nepali paper by hand in the high altitude mountain forests. Besides the incalculable damage done to the forests while collecting the loakta barks the tremendous quantities of firewood required (approx. 800 kg of firewood for 200 sheets of Nepali paper) for the traditional technique of making paper are also responsible for emptying the mountain forests. Thus the result is that in many parts of the mountains, which were previously the major paper producers, this industry no longer functions.

The attempts to improve the techniques of paper making by the government in the last few years have brought about the establishment of many licensed paper factories which have however done nothing so far to adopt improved and less harmful techniques. On the other hand the paper factories are playing a middle man's role and exploiting those who make paper by the traditional techniques. In doing so, they are supporting an even more intensive exploitation of this resource by financially supporting the previously casual paper makers and by easily fulfilling the necessary formalities for exporting the paper.

From the ecological point of view the continuation of paper making would be justified in the mountains if and only if

- a survey of loakta resources is conducted and a limit to the exploitation of the resource or paper making is set
- paper making is carried out using only the improved techniques such as chemicals and electricity
- development research is carried out for improving paper quality as well as for commercial plantation of loakta as part of an afforestation measure
- all necessary controls are maintained which favour mountain ecology.

xvi Handicraft making

The mountain folks have many traditional skills. They produce handicrafts and works of art in wood, stone, paper, cloth, bamboo etc. So far they have not been produced on a commercial scale. Wood carving, Thanka painting, idol carving etc. are some of the potential mountain handicrafts. Handicraft making is a labour intensive production process, in which the labour cost is the main production cost. The quantity of raw material required is much less than in other production processes. For the mountains, which lack sufficient other raw material resources, handicraft making could prove beneficial to mountain ecology. However the marketing aspect of handicrafts requires efficient organisation and is beyond the know how of simple mountain folks.

3. The future of Cottage Industries

Cottage industry is only a small part of the overall activities of man in the hills. Thus the future prospects and limitations of cottage industries there rest heavily upon what is done in the other fields of activities such as soil, forest and water conservation; agriculture and horticulture development; mining; power development; animal husbandry and pasture management; and also in other social, political and economic fields. The adverse effects of cottage and small scale industries on the mountain ecology and vice versa have been recently realised. Thus a longterm balance between cottage industry activities and safeguarding natural and human resources has to be found. In deciding

which has first priority, cottage industry or the environment, it is obvious that the environment must come first.

The objective of small scale and cottage industries in the mountains should be to give an alternative means of livelihood, through partial or full employment to as many mountain folks as possible, so that they have a non-agricultural source of income, and the pressure on the already exhausted land, forest and pasture resources is minimised. As the mountains have no other significant resources than those that already exist, and the present circumstances in the mountains are very adverse, the above objectives can only be reached if a critical analysis of the problems of the traditional industries and the mountain environment is made and we make a real effort to solve the problems.

Therefore a strategy with both short term and longterm objectives for cottage industries should be devised. The long term objectives should aim at restructuring traditional industries in view of their impact on the hill ecology and managing, controlling and conserving available resources. The short term objectives should aim at providing alternative means and techniques, providing assistance in the fields of raw material, fuel, market, training and transportation. The following are some suggestions for a short term programme of action:

- Cotton weaving should be reactivated through training, promotion, assistance and protection. The importation of an adequate quantity of yarn from abroad and even subsidising the price of yarn should not be ruled out.
- Metal craft in bronze, Nepali paper and lime making should be provided with electric energy as an alternative to wood or wood charcoal.
- Wool weavers should be trained to do cotton weaving.
- The use of the axe for obtaining timber should be replaced by introducing a more economical technology. Burnt brick and terra-cotta making should be stopped.
- Planting bamboo and fibrous shrubs and grasses, bee keeping and slate mining should be vigorously promoted and assisted.

Ghatta owners should be individually or collectively assisted to establish modern water turbine operated mills.

When creating or developing new activities, their structure should be such that it gives the people a clear and direct incentive to safeguard the vegetation resources rather than destroy them. The planting of jethropha curcus for making non-edible oil, and the production of silk, lac, turpentine, tea would fulfill this criterium. With the development of this new type of resource in the mountains, the related industries should be developed so that each activity protects the other.

3.4 THE IMPACT OF TOURISM ON MOUNTAIN ENVIRONMENT

by K.K. Shrestha

1. Growth and Promotion

The famous Himalayas and favourable climate as well as the hospitable people and their culture are the basis for the outstanding rate of the growth of tourism in Nepal. Tourism is actually a recent phenomen in this country. Nepal opened its doors to foreigners only in 1952. A significant steady increase in the inflow of tourists has been seen since 1966 when over 12,000 visited Nepal, and by 1975 as many as 92,440 tourist arrivals were recorded including 17,881 visitors from India. The trend shows that more than 100,000 tourists will visit Nepal in 1976.

The promotion of tourism started in 1956 when the "Tourism Development Committee" was formed and the 'Department of Tourism' of HMG was created soon after. The publication of the "Nepal Tourism Master Plan" in 1972 showed among other things, the potential for development of tourism in this country. At present, accordingly, the second phase of its implementation has started. After the completion of this 10 year plan the tourist industry will be if not the biggest, at least one of the most important industries in Nepal.

The "Tourist Festival Week" organised last year as a part of the celebration of the "South Asia Tourism Year - 1975" was a big success with regard to the promotion of tourism in Nepal. The National Committee in charge of this celebration was successful in getting the cooperation of various HMG Departments and non-official organizations and the public.

Large numbers of tourists were attracted by the exhibition of handicrafts, wild life, postage stamps, coins and a host of other tourist sales-aids, as well as by the presentation of cultural programmes and film shows.

The image of Nepal on the world tourist map has become more pronounced with its various activities. Nepal was elected last year as one of the two Vice-Chairmen of the "South Asia Regional Travel Commission" (SARTC) in the first general assembly of the World Tourism Organization (WTO). Early this month (March), the first SARTC meeting was held in Kathmandu. This meeting has brought deeper understanding and cooperation and coordinated efforts for generating a better tourist market in the countries of the region. Another important outcome of this meeting is the "Declaration of South Asia Tourism Decade" which in fact came into effect last week.

2. Natural Beauty

- Trekker's Paradise:

Nepal is a paradise for trekkers. Almost all the hilly regions of Nepal are attractive to trekkers. While trekking in Nepal, one can get close views of the spectacular snowy peaks and picturesque lakes. One can also meet the interesting people living in remote villages in the rugged mountains. Trekking here has become popular though one often has to encounter loose and steep trails, the height of which vary from place to place.

At present, the most popular trekking routes because of their scenery and accessibility are Kathmandu to Namche-Bazar, Kathmandu to Helambu, Kathmandu to Pokhara and Pokhara to Annapurna base camp as well as Pokhara to Jomsom. Besides these, other places of interest to trekkers are Jiri, Langtang valley, Gosainkunda, Jumla, Palpa, Dolpa, Ghandrung, Ghorapani, Lake Rara, etc. Some areas like Mustang, Humla, Panchthar, Charka, Manang, Olanchung, etc. are, however, still restricted areas though some of these areas were open before 1974.

Almost all seasons, except mid-winter and mid-monsoon are trekking seasons in Nepal. The majority of trekkers are found to visit Namche-Bazar followed by the Annapurna base camp. Trekking along the above mentioned routes lasts from a few days to over a month depending upon the route one chooses.

The publications of various booklets by the Department of Tourism and a few books by some individuals are also playing a significant role in promoting trekking in Nepal. The number of trekking organizations have also played an important part in increasing trekking activities in Nepal. Every year, trekking is becoming more and more popular here. In 1970, less than 4,000 trekkers were recorded and this number in 1975 increased to over 15,000. This tremendous increase in trekking activities in the mountains of Nepal is also due to the deconcentration and diversification of tourists in this country as envisaged in the Master Plan. The steps taken by HMG for developing Pokhara valley as a major tourist area, secondary to Kathmandu will be playing an effective role in increasing the number of trekking trips starting from Pokhara.

- Mountaineering Activities:

The Himalayas of Nepal are of exceptional interest for the mountaineers and are undoubtedly the most impressive scenic spots in the world. The first attempt to climb the 8,848 meters high Mt. Sagarmatha (Mt. Everest) was made as early as 1922. The conquest of Mt. Sagarmatha in 1953 by the British Expedition made a glorious beginning for mountaineering in Nepal. This country has since then been projected to the outside world as the "land of mountains". The Himalayas of this country have been the centre of mountaineering activities for the last two decades. So far 53 persons have reached to the top of Mt. Sagarmatha. Successful climbing to a number of virgin peaks as well as re-climbing most of the challenging mountains have been on the increase recently. The mountaineers throughout the world are forever lured by the beauty of the snowy peaks of Nepal.

Since 1970, more than 20 expeditions have been carried out annually in the mountains of Nepal. Last year 23 expeditions were made to different peaks including the Japanese Women's Expedition which placed the first woman on the top of the world. This year, out of 21 expeditions permitted so far, 15 parties are busy preparing their adventure to different peaks. In fact, HMG of Nepal has received applications to climb different peaks for as far ahead as 1981.

The all-Nepalese Mountaineering Expedition last year scaled Mt. Kwangde and opened a new chapter of the national mountaineering activities. Like last year's joint British and Nepalese Army Expedition to Nuptse, this year too, a similar party is climbing Mt. Sagarmatha.

3. Direct Impact

- Economic Aspect:

In Nepal, the tourist industry enjoys all the necessary incentives that are accorded to other export industries that bring in foreign currency. In 1974 this industry emerged as the biggest source of foreign exchange, since about 40% of the income that year was made through tourism. Similar earnings in 1975 reached $ 9,692,000 which is an increase of 26.2% compared to the preceding year. On the other hand, it is found that as in the previous years, the largest number of persons employed in any industry to date are employed in the tourist industry in Nepal. Thus this industry plays an effective role towards the development of the national economy, as it has major influence in other sectors of the agri-based economy of Nepal.

The amount of foreign currency involved on the other hand for the construction of modern hotels and purchasing canned foods, foreign liquors and luxury items for the attraction of first class tourists has not been estimated so far. Thus the foreign exchange earnings through tourism are not the actual net earnings as one can observe.

- Goose of Tourism:

Nepal has attracted a large number of tourists, trekkers, mountaineers and some natural scientists and nature lovers in the last two decades. Every spring and autumn, dozens of mountaineering teams try to scale one peak or an other. Thousands of trekkers trek through the hills and mountains of this country almost throughout the year. Recently, the number of scientific expeditions to study the flora, fauna, geology, geography, etc. have been sig-

nificantly increasing. If the present trend continues unabated, the degradation of the mountain environment may eventually cause irreversible damage to the mountain ecosystem in Nepal. The result of mass tourism in the mountains of Nepal may result in a negative approach to the development of tourism in this country. Tourism is thus not only the goose that lays golden eggs but it also fouls its own nest.

- Garbage Trail:

The pressure of mass tourism has been severely felt on all the trekking routes. The local resources like firewood, timber, food grains are heavily consumed by large scale expeditions involving hundreds of people. On all the trekking routes, one comes across a trail of empty cans, glass ware, wooden boxes, packing materials and all sorts of litter and trash. In fact, the Lamosanghu (Sun Kosi) to Namche-Bazar route is now called the "garbage trail". There is visual pollution all along these routes. In the Solukhumbu area, especially from Lukla via Namche-Bazar to the Everest base camp where the majority of the trekkers go, the whole trail is badly polluted and the condition is getting worse each year. On the other hand, last year more than 4,000 trekkers reached this area whereas only 20 tourists were recorded in 1964. The number of tourists in this area sometimes even exceeds that of the local population.

Furthermore, it is found that on all the trekking routes when camps are made, the tents are invariably installed in the same area by each group of trekkers. These areas are found to be left uncleaned after the camping is over. Hence, these frequently used camping areas are becoming very unhygienic too. Human and animal (mules) excrements, unburnt pieces of wood, ash, trash and garbage pollute the water of the nearby creeks and rivers used by the trekkers and the local people for drinking and cooking purposes. New problems of soil and water conservation have arisen near the camp sites.

4. Indirect Impact

- Deforestation and Landslides:

Annually, hundreds of tons of firewood are used for cooking and camp fire purposes by mountaineering expeditions and the trekkers in addition to the local consumption. The result is massive deforestation as seen along the trekking routes and in the vicinity of the camping sites. The destruction of the scant vegetation in the alpine regions of Nepal also leads to frequent mudslides, landslides, creeps and rockfalls as well as the silting of the rivers.

Hard pressed by the food requirements of the unorganised trekking groups or individuals, the local people have been following an extensive but unscientific form of hill-agriculture even in places with low fertility soils. And to meet the ever increasing demand for dairy products and mutton, pressure on grazing grounds has also increased. Overgrazing, deforestation, unscientific use of terraces all lead to serious soil erosion and landslides. The result is the degradation of soil fertility, loss of topsoil and disturbances in the ecology of these areas to a great magnitude.

- Change in Landscape:

New permanent structures, stone houses are springing up along the trekking routes which provide shelter and food for the trekkers. Air strips and even modern hotels are being made in places around Khumbu, which change the landscape and the environment of these areas. The once green forests and fertile lands are slowly being replaced by these modern amenities that the tourists demand. Hotels, lodges and tourist resorts are, on the other hand, the largest consumers of food and firewood in these areas.

- Peace and Tranquillity:

Out of a choice of some 240 snowy peaks in Nepal, the mountaineering activities for the present are still concentrated on only 40 peaks. Thus the epic silence of the himalayas in these areas is slowly becoming a thing of the past, parti-

cularly in the spring and autumn every year. Very often, the members of one expedition party meet the members of the other party at the snow heights. Thus the large number of expeditions involving many climbers even disturb the peace and tranquillity of these areas.

- Socio-cultural Impact:

Exposure to mass tourism also has adverse effects on the social behaviour and religious sentiments, the traditions as well as culture of the Himalayan people. As one critic put it, the flood of visitors is also responsible for the decline in the moral values of the local people. The villagers are increasingly fearful of having their valuable and ancient objects stolen from their normally unguarded temples and religious places. Such articles are found to be sold to the tourists who pay fancy prices and buy them as decorative pieces. It pricks the sentiments of the natives when they learn that the tourists use their religious things, that are even available on the market, as decorative gimmicks.

It was once a pleasure for the people living in the hills and mountains to provide free food and shelter to the foreigners as per the famous Nepalese hospitality. Of late the influx of tourists in their villages has been too much for them to make it manageable for lodging even in terms of business. The large number of penniless hippies and poor trekkers who cross their locality has been more of a curse than a boon for them. The local people are so naive and kind hearted that they simply show sympathy to all these foreigners even at the cost of their own convenience.

5. Preservation of Natural Environment

- National Parks and Wildlife:

The action of His Majesty's Government of Nepal in declaring its intention to establish four National Parks and five Wildlife Reserves in this country is laudable. These establishments will not only enhance the inflow of tourists

but also serve as models for environmental protection and ecology preservation. National Parks located in the mountains are Mt. Sagarmatha (Mt. Everest) National Park (established in 1975), Langtang National Park (in the process of being established) and Lake Rara National Park (to be established in the near future). These areas will ensure the conservation and management of the mountain ecology without destroying the natural environment by mass tourism and other human activities in their respective areas.

- Clean Environment:

The problems faced by Nepal in the matter of preserving environmental problems have been receiving due attention from His Majesty's Government. This year HMG has promulgated the "Mountain Expedition Regulation Act, 1976". Among thirty-seven rules in this Act, one of the most important ones is rule 28: "Clean Environment to be Maintained" which instructs the mountaineers to do the following:

1. The mountaineering team shall pitch camps only at places acceptable to the local people or only at places allotted by His Majesty's Government for such purposes from the starting point of its caravan to the base camp of the mountains to be scaled.

2. The team shall, before leaving the camps pitched pursuant to sub-rule (1), burn off or bury under the ground all containers and boxes of materials used there at such places, whereby the clean environment of the river banks, religious places or places of public importance may not be adversely affected.

3. Places of base camp and advance camps pitched above the base camp shall have to be cleaned after the end of the expedition.

4. The team shall not damage or destroy any tree, products of any tree or other forest resources surrounding the area or route of the expedition.

Now that the rules have been put into effect, it is hoped that the condition of the mountains of Nepal will not deteriorate any further. The green mountains, one can hope, will remain green for ages to come, since the felling of the soil-retaining trees would be stopped and the mountaineering parties would be required to carry their fuel requirements.

- Modest Gesture:

In 1973, six young environment conscious students (4 boys and 2 girls) of the Olympia Evergreen State College, Washington, gained wide acclaim for taking the initiative to clean up the environment in the Everest region. For 20 days, they buried about 2 tons of garbage which they collected in the Khumbu area. They also placed a couple of signboards reading "PLEASE DO NOT POLLUTE EVEREST" in English, Japanese and Nepalese at different places in the Everest region. It is further heartening to learn that this year too, 20 foreigners are in the Everest region to work for 25 days to clean the garbage left there by so many expeditions that took place in the preceding years. This "Everest Clean-up Group" is sponsored by Mountain Travel Inc. of U.S.A. and one hopes that their efforts will bear fruits in accelerating further positive steps for cleaning-up tourist infested regions in all of Nepal.

- MAB Programme:

The Man and Biosphere (MAB) Programme of UNESCO has given serious thought to the effects of tourism. In fact MAB report No. 8 has duly considered the "Effects of Tourism and recreation on mountain ecosystem". It also deals with "A case study on man/environment relations in the Himalayas with reference to Nepal" as of special interest within the framework of MAB Project No. 6: "Impact of Human Activities on Mountain ecosystems". In this report, Langtang, Kali Gandaki and Khumbu are the areas identified for multi-disciplinary studies of interactions between man and Himalayan ecosystems. In the MAB report series No. 14, "A model of tourism research" and "Initial steps in planning regional collaborative projects in the Himalayas" have been well discussed. It is of interest to note that the "Regional MAB meeting on integrated ecological research and training needs in the Southern Asia Mountain system, particularly

Hindukush-Himalayas" was held last year in Kathmandu. One of the main outcomes of this meeting of the countries of the region is the proposal to establish the "Institute of Mountain Ecology" in Nepal. After this Institute comes into being, one can hope that existing gaps in knowledge about the fragile mountain ecosystem will be filled in with detailed research work, and an ecologically sound development of the countries of the region can be envisaged, with due consideration given to the adverse effects of tourism and other human activities in the hills and mountains.

6. Outlook

Tourism has come to stay in this country. The efforts made by His Majesty's Government of Nepal and the public sector to make this industry flourish is bringing expected results. The promotion of tourism in Nepalese mountains should therefore be done with some caution. Undesirable and irreparable changes in the mountain environment and adverse effects on the local people may defeat the very purpose of tourism promotion in this country.

The "Nepal Tourism Master Plan" has rightly proposed a model for "Ministry of Tourism and Culture". This includes, among others, "Department of Ecology" with an important section e.g. "Environment Conservation Section" whose specific function will be "environmental conservation in the widest sense of the word including the continuation of the present activities of the Ministry of Forests cum F.A.O., e.g. survey of areas which should be set aside and protected because of their natural values, wildlife resources, forest or typical landscapes and recreational potentials for tourism, preparation, legal enforcement and control of regulation in this field."

In the near future, larger numbers of tourists will be visiting the hills and mountains of Nepal. These regions cover about 73 percent of the land area of the country, where only about one third of the land is cultivated. This area supports more than 53 percent of the total population with a population density of 58 per sq.km. The impact of tourism in these areas of Nepal thus bears lots of significance. Basic research with regard to the effects of tourism here,

has to be carried out immediately with all seriousness. In order to keep the tourist industry thriving for economic returns and international brotherhood but not to let the mountain environment deteriorate, a proper balance between tourism promotion and the fragile mountain ecology has to be worked out without delay. Nepal known as "Shangri-la" to the world should always be maintained as such.

Tourism in the hills and the mountains is basically concerned with the people dwelling there who will have to face more problems than rewards if the infrastructure for absorbing mass tourism is built up at the cost of the local people and the environment surrounding them. The influx of visitors from abroad must not be allowed to cross the saturation level if Nepal is to learn from the mistakes of countries which have been adversely affected by "Tourist Pollution".

3.5 EXPLOITATION AND PROSPECTS OF MEDICINAL PLANTS IN EASTERN NEPAL

by J.F. Dobremez

Nepal has always been a privileged country as far as the collection and export of medicinal plants is concerned. These are used in the Hindu culture as well as in those of the Tibetans and Chinese. The local healers of the different ethnic groups make quite a lot of use of these plants. They are widely used in the preparation of all traditional pharmacopoeia.

The most ancient records on the utilization of medicinal plants are found in the Rigveda, epics which date from the beginning of the Indo-Ganges civilisations (4500 to 1600 BC). The Ayurveda, basis of Hindu medicine and then the Indian pharmacopoeia have based themselves on this and increased the number of plants which can be used. Among the most ancient we must mention: Rauwolfia serpentina, Ephedra gerardiana, Aconitum spicatum, Nardostachys jatamansi, the medical properties of which the eastern pharmacists have rediscovered, some only very recently.

On the other hand the Tibetan and Chinese pharmacopoeia have borrowed many plants from Nepal. Even before the 10th century a notable quantity of them was exported to China.

These exchanges have increased in recent years and now comprise 3% of the total exports of Nepal (US $ 400,000.- in 1974).

The main importing countries, excluding India which is far ahead of the others, are Japan, Hong Kong and Singapore. West European countries (Switzerland, France, Federal Republic of Germany, Holland) and those of North America (United States, Canada) are rapidly increasing their purchases.

The main plants which are exported are Lycopodium clavatum, Swertia chiraita, Rubia cordifolia, Rauwolfia serpentina, Nardostachys jatamansi, Picrorhiza scrofulariaefolia, Rheum emodi, Orchis latifolia and Valeriana wallichii.

For these plants alone the production possibilities come close to a value of US $ 10,000,000.- which would represent a major part of Nepal's exports.

In addition we must say that there are several hundred medicinal plants known in Nepal and all of them can be exploited and exported in more or less large quantities.

The Government is already promoting this exploitation at all levels.

- Fundamental Research: the Department of Medicinal Plants (Ministry of Forests), contains two sections which are working particularly on medicinal plants.

  Botanical Survey and Herbarium - apart from its numerous research activities, the botanists in this section aim to determine and check the identity of the harvested plants.

  The Research Division of the Royal Drug Research Laboratory is conducting research on the chemical constituents of the medicinal plants.

- Cultivation of Medicinal Plants: there are seven farms dependent on the Department of Medicinal Plants which produce the plants and there are numerous trial plots planted throughout the country.

- Commercialisation: the Royal Drug Research Laboratory and Trade Promotion Center participate in this promotion in the form of a test laboratory in nine business centers outside Kathmandu, spread through the south of the country, and by the publication of a guide for the use of Nepalese exporters. They also travelled through European countries in 1975 in order to promote the sales of these plants. The Nepalese Government is therefore conscious of the enormous possibilities which medicinal plants represent for the national economy. These potentialities are due for the most part to the

extreme variety of the Nepalese environment which permits the growth of a great number of tropical, temperate or alpine medicinal plants between altitudes of 100 to 5,500 meters.

Each region of the country should participate in this effort to exploit the natural resources, the profits from which would be felt as much on the regional as on the national scale.

Like all the mountainous areas of the country, the region of Jiri is a traditional collecting center for medicinal plants.

The wild plants in the region of Jiri are distributed according to the climatic and ecological levels. (see Dobremez, Ecological maps of Jiri-Thodung, 1/50000 and Kathmandu-Everest 1/250 000). It is possible to divide them into four groups.

- subtropical species growing between 1000 and 2000 meters
- temperate species : 2000 to 3000 m
- sub-alpine species : 3000 to 4000 m
- alpine species: in the heaths and greensward above the tree line

Subtropical Species

Adathoda vasica (Nepali: asuro, vasakh). This is a bush of the Acanthus family which grows abundantly along river banks, paths (sometimes planted) and in clearings between 1000 and 1600 meters. The distilled flowers are used to combat colds in local medicine.

This plant belongs to the Indian pharmacopoeia and Ayurvedic medicine. All parts of the plant contain alkaloids, steroids and anthocyanes. The species is important, gathering a crop is easy and it is probably easily cultivated in low lying valleys of the region, on ground which has no agricultural value.

Holarrhena antidysenterica (Nep: kurchi, indrajow). Tree of the Acanthus family which can reach a height of 10m; it grows in light subtropical forests. It is often planted near houses because of its beautiful flowers.

The fruit and bark are used in the Indian pharmacopoeia and Ayurvedic medicine to cure dysentry and as a febrifuge. Easy to gather, easy to grow.

Myrica esculenta (Nep: kaphal). Tree of average size, 10-12 m, which grows in river forests and subtropical dry forests (1200-2000 m). The fruit is eaten all over Nepal and even sold on the market.

The bark contains steroids, quinones, lactones, flavonoids and tannic. It is utilized in powder form as an astringent and antiseptic and against fever.

Cinnamonum tamala (Nep: dalchini: bark; tejpat: leaves). This laurel grows to a height of 10 meters. It is a very common tree in dry subtropical forests. The harvest is very important in East Nepal where they add the leaves to tea to give it a perfume. It is utilized in numerous anti-vomit preparations and as an astringent.

Berberis aristata (Nep: chutro). Numerous species of Berberis, prickly bushes, are used in Nepal. The fruit is eaten by the children and sometimes distilled to make alcohol.

The wood, bark and root are used for skin diseases, jaundices and malaria. The species is extremely common in subtropical countries.

Solanum aculeatissumum (Nep: kantakari). The fruit and leaves are widely used in popular and Ayurvedic medicine.

The fruit contains an important proportion of a glucoalcaloid, namely solasodine which could be at the basis of the chemicosynthesis of the corticosurrenal hormones which are greatly needed in medicine. This solanum grows in abundance in waste land and is very easy to cultivate.

Dichroa febrifuga (Nep: ausro). Bush of the Saxifrage family, blue flowers very abundant along streams and torrents between 1000 and 2000 m. It is the most ancient remedy known for malaria.

Temperate Species

The temperate species of the hills and mountains are found between 2000-3000 m. They consist of oak forests with evergreen leaves (Quercus lanata, Q. lamellosa, Q. glauca, Q. semecarpifolia) and of conifers (Pinus excelsa, Tsuga dumosa). It is a region with a heavy rainfall and cultivation is rare, but the herds spend the greater part of the year here.

Rubia cordifolia (Nep: majitho). Liane which grows in the forest. The rhizomes are used to make red dye. The plant is used in Ayurvedic medicine for snake and scorpion bites, and for skin diseases. It contains alkaloids, steroids, quinones, lactones, flavanoids, saponosides, tannic and anthocyanes.

Mahonia nepalensis (Nep: jamara mandro, daruhaldi). Of the same family as the Berberis and used in the same way.

Bergenia ligulata (Nep: pakanved). Liane which grows on rocks. The rhizomes are useful for fever, diarrhoea and pulmonary affections.

Lobelia pyramidalis (Nep: yekle bir). Herbaceous plant 50 cm - 1 m high, found on heaths and greensward. The leaves and flowers act as anti-spasmodic. They contain alkaloids, steroids and anthocyanes.

Paris polyphylla (Nep: satuwa). This plant is common in humid forests. The big rhizome contains certain alkaloids and particularly saponosides and polysaccharides. It is used to get rid of intestinal worms.

Valeriana wallichii (Nep: sughandawhal). Common in humid forests. The rhizome, used in Indian pharmacopoeia and Ayurvedic medicine contains alkaloids and steroids. It is used to treat nervous illnesses. Its sedative value has

been proved and its freeze dried extract can cure convulsions resulting from strychnine.

Zanthoxylum armatum (Nep: timur). Bush found in humid forests. Fruit and bark for cholera, fever, dyspepsia. The fruit is used as a condiment.

Subalpine Species

They grow between 3000 - 4000 meters in pine forests (Abies spectabilis) and birch forests (Betula utilis). Often the upper border of the forests are cleared in order to increase grazing land. These plants are found in particular on the massifs of the Hanumante and Kalingchok and in the Rolwaling.

Abies spectabilis (Nep: gobre salla). The pine needles are a tonic and astringent. They are used in cases of asthma and bronchitis.

Betula utilis (Nep: bhoj patra). The birch bark is used as an antiseptic in infusions. It is used to cover wounds.

Aconitum spicatum (Nep: bikh). This aconite is the most poisonous of the many found in Nepal. It contains no less than 14 different alkaloids, among which are bikhaconitine and pseudoaconitine. The lethal dose 50 for mice is 417 mg/kg.

Fritillaria cirrhosa (Nep: kakoli). Very pretty flower of the greenswade and heaths. The bulb reduced to powder stops hemorrhages and fights asthma and tuberculosis.

Lycopodium clavatum (Nep: nagbeli). A very common lycopod in pine forests. The spores serve to cover medicine in pill form to stop them sticking together. The price is very high (US $ 5000/T).

Swertia chiraita (Nep: chiraita). This gentian is one of the most collected plants on the sub-alpine greenswade of Nepal. It belongs to all the Asian

pharmacopoeia. It contains alkaloids, flavonoids, tannic and steroids. The plant is very bitter, a febrifuge used for stomach complaints, anthelmintic and as a tonic.

Alpine Species

The alpine level develops above 4000 m, beyond the tree line. It is in this area that most of the reputable medicinal plants of Nepal are to be found. Most of them are gathered in the Rolwaling and to the north of Bigu.

Aconitum orochryseum (Nep: bikhma). One of the rare aconites which are non poisonous. The bulb cures stomach aches.

Orchis latifolia (Nep: panch aunle). The bulb of this orchid is greatly used throughout Nepal. It is considered to have aphrodisiac qualities or at least those of a stimulant.

Allium wallichii (Nep: ban lasun). This wild garlic contains steroids, flavonoids and polysaccharides. It is used for altitude sickness and as a stimulant.

Ephedra gerardiana (Nep: somalata). The ephedrine contained in the plant is a cardiac tonic. The plant is utilised in asthma attacks and for respiratory affections.

Rheum emodi (Nep: padamchal). The big rhizome of this panacea plant contains steroids, quinones, flavonoids and tannic. It is considered as an astringent, tonic and purgative.

Picrorhiza scrofulariaefolia (Nep: kutki). Widely gathered and used in Asia. Tranquillising effect. It contains alkaloids and steroids. It is bitter, a tonic and a febrifuge.

Nardostachys jatamansi (Nep: jatamansi). Plant famous in all Asian pharmacopoeia. It is a light stimulant for motility and stops trembling. It is used in cases of epilepsy, convulsions, hysteria and tachycardia. It is often a substitute for Valerian despite its different effect although it belongs to the same family. It contains steroids, flavonoids and saponosides.

All the plants cited above have renouned medicinal properties. Most of the time they are used as such, but in the future their most important use will doubtless be as the basis for the chemico synthesis of active molecules in pharmacology.

However, the present fancy for "natural" medicaments is likely to launch the use of these plants in developed countries. Other non medicinal species will also be used in large quantities.

Insecticides

Adathoda vasica; buds and yellow leaves of Lyonia ovalifolia (Nep: agneri), a very common tree in temperate forests; leaves of cinnamonum camphora (Nep: kapur) which can be planted up to 1700 m; leaves of Maesa chisia (Nep: biloumi), common bush in oak forests.

Dyes

Rubia cordifolia, Berberis aristata, Mahonia nepalensis, Rheum emodi; Rheum webbianum, Nardostachys jatamansi, Rumex nepalensis (serves as mordant), Pterospermum acerifolium (Nep: golaincho) tree of subtropical forests.

Perfumes

Valeriana wallichii, Acorus calamus (Nep: bojho). Very common in swampy areas.

We must mention in addition all the ornamental plants from botanical gardens either in the form of living plants, or grains or dried flowers.

All these elements go to show that for the price of a certain promotion and by taking certain precautions, the wild plants could provide the inhabitants of the Jiri region with substantial supplements to their incomes. Three points: harvesting, cultivating and commercialisation would have to be properly managed.

Management of Plant Gathering

The harvesting of wild plants (medicinal, perfumed etc.) is at present done by the local population. The inhabitants, depending on their place of origin are specialised in gathering one or several particular species which they know, and which they have the possibility to sell.

The promotion of the collection of medicinal plants therefore necessitates informing the inhabitants about the nature of the plants, the places and times of harvest, the treatment (drying, conservation ...), samples.

This cannot be organised without getting precise knowledge on the resources. Actually there is great danger that the gathering areas will be exhausted and the plants will disappear. The time when certain plots can be exploited will have to be limited. The management of all this will have to be based on an exact knowledge of the distribution and ecology of the species.

be cultivated, so that cultures can be started at all levels in the Jiri region.

The requirements for the cultivation of wild plants are not exactly known, except for certain species (Adathoda vasica, Holarrhena antidysenterica, Cinnamonum), thus it is necessary to seriously study the plants which could have a commercial future. By starting cultivation it is easier to conserve the collecting zones.

Species foreign to Nepal could also be cultivated with success. In Europe in 1975 great quantities of the following plants were lacking: Ammi visnaga, Ballota foetida, Equisetum sp., Valeriana officinalis, Agropyrum repens, Colchicum autumnake, Gentiana lutea. It is a case of finding out in detail the ecological and agricultural requirements of these plants.

We should also think of other plants widely used as herbal teas (Mentha arvensis, M. piperita, Lippia citriodora..). It is absolutely necessary when planting and managing these cultivations to work in close collaboration with the Department of Medicinal Plants which is already managing several cultivation stations in Nepal.

Commercialisation

Gathering and cultivating these plants has no point nor effect if the commercialisation is not perfectly organised. It will be necessary to place in the center of the area covered by the projects, a collecting center such as already exists in the Terai, where the problems of gathering, conditioning and checking the quality of the products will be taken care of. What often stops foreign buyers is in effect the lack of consistency in the supply and in the quality of the delivered material.

It should also be made known that the international market of medicinal plants fluctuates a great deal, and the collectors and cultivators should be warned of possible outlets for their activities.

Another point which preoccupies the official organs is that the price of raw material is very low, whereas the price for extracts is very high. The installation of a simple extraction unit (aqueous extraction, alcoholic extraction...) annexed to the collecting center, would facilitate the transport and checks on quality, and would considerably raise the income of Nepal and the region.

An important activity in promotion is to bring about the commercialisation of dried flowers, ornamental plants (living plants or grains) in collaboration with an artisan establishment (pictures of dried flowers, souvenirs of Nepal).

To conclude it must be said that the region of Jiri is rich in potential for wild plants particularly medicinal ones. However, the various stages of their exploitation are worth organising, based on ecological and commercial studies. Here is the essential role which a multi-disciplinary project can fill, while respecting but improving the ecological and human particularities and potentialities of the Jiri region.

4 RELEVANCE OF THE NEGATIVE ECOLOGICAL TRENDS FOR THE DEVELOPMENT OF THE HILLS

4.1 NOTES FOR A DESIGN: ENVIRONMENT AND DEVELOPMENT PLANNING

Ratna S.J.B. Rana

A country's basic development objectives are the prime determinants of the character and direction of the national planning efforts. In many cases such objectives represent a combination of economic, political and social factors. And planners perform useful functions by outlining the different ways in which development can proceed with alternative priorities for various objectives. Viewed in this context, one of the key roles of the economic planner is to elaborate the growth strategy by coordinating the targets and means of development for a definite period. Since the ultimate objective of national development in most developing countries is to raise the levels of living of all people through expanded output and use of consumer goods and services for education and health, it is not surprising that economic planners emphasize an acceleration in the rate of economic growth to provide higher per capita incomes.

But recently economic planners have recognized the implications of environmental problems in pursuing strictly growth-oriented economic policies. These problems can be broadly classified into two categories -- those arising out of poverty, or the inadequacy of development itself, and those that arise out of the very process of development. The problems in the first category are reflected in the poor socio-economic conditions that prevail in the developing countries. However, as the processes of development get under way the problems in the second category also begin to emerge and to gain in significance as pace of development gathers momentum. The environment policies of developing countries must, therefore, naturally be concerned with both categories of problems.

The environmental problems arising from a lack of development are fairly obvious, and no attempt will be made to elaborate this aspect further. The second category of problems, though comparatively less important in the initial periods of development, arise in almost every sphere of developmental work.

The transformation of agriculture, the development of industry, the creation of transport and communication networks, the harnessing of water resources for power and irrigation and the growth of towns are all integral parts of development. All these involve tampering with the existing environmental conditions in varying degrees. In a way this is inevitable in the process of growth and change, but what has to be recognized is that the environmental problems, or the adverse side effects associated with these developments, could in many cases be greatly minimized, if not completely avoided, by sound planning and policy. However, this aspect has been generally overlooked not only because of the preoccupation of the planner as to how to accelerate the rate of economic growth but also because of the very methods economic planners have employed to tackle the problems of underdevelopment. In essence, this is the assumption on which the income concept is based: that the negative external effects are not considered, that consumer's sovereignty is given, and that distortions in the enumerating system are negligible.[1] However, negative external effects are not accidental or negligible but they are substantial and inherent to modern economic processes, especially in the face of the nature and magnitude of environmental problems occurring in highly industrialized nations.

The traditional argument that more environmental protection will necessarily reduce the growth rate of the economy is no longer valid, particularly if development is to be conceived beyond mere growth in real per capita incomes but instead in terms of "quality of life". What is at stake here is to determine a system of standards which shows from what point onwards the burdening of the environment has to be forbidden or reduced to a tolerable or acceptable degree. The experience of the developed countries has shown that these side effects could, if ignored, attain formidable dimensions and cause damage and disruption on a wide scale. We have an opportunity to avoid some of the mistakes of the past if we pursue a development policy which revises the traditional glory of GNP-ism. This calls for a recognition of the fact that "bad" and "good" are produced simultaneously, and negative goods ought to have negative prices. In other words, there is a need to introduce a compensatory approach, modifying the GNP concept because of its structural inflators, deducting the negative

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1. U.E. Simonis, "Environmental Disruption: Implications for Economic Planning", The Developing Economies, Vol. X, No. 1 (March 1972), pp. 86-105.

prices for environmental disruptions.[2]

These disruptions, or the side effects of developmental work, are commonly grouped into the following categories: (1) resource deterioration: the deterioration, for example, of mineral, soil or forest resources; (2) biological pollution: the pollution represented by agents of human disease, and by animal and plant pests; (3) chemical pollution: arising out of air pollutants, industries effluents, pesticides, metal, and detergent components and similar agents; (4) physical disruption: as reflected, for example, by thermal pollution, silting and noise; and (5) social disruption: of which congestion and loss of a sense of community are examples. The first two categories are commonly experienced by most developing countries, as is also silting of reservoirs and dams, while chemical pollution is of importance primarily in the industrialized countries. The relative importance of these various environmental disruptions depends partly on the ways in which development activities relate to the carrying capacity of a country's natural, and even, social system. Such factors as the speed at which environment disruption is taking place, the degree of its severity, the area that it covers, whether the disruptions are reversible or not, and at what costs and over what period of time, are all relevant.

Within the general framework outlined above, each developing country may ascertain the nature of its environmental problems, and formulate alternative modes of action for dealing with them. Generally speaking, the resource situation and their priorities in developing countries being as they are, the developing countries are not in a position to shift their resource allocation in favour of environmental programmes in any significant way. Under these circumstances, the crucial question is -- how can the developing countries pursue a programme of environmental safeguards which would enhance and not adversely affect the present or future development potential, and at the same time not slow down the growth rate aimed at rapid improvements in the living conditions of the people? Apparently, as pointed out before, this calls for a new approach. First of all, it is necessary to view the relationship between environmental safeguards and rapid economic growth not requiring an either-or choice but as one of maintaining a judicious balance between the two. Secondly, it is necessary to think

2. Ibid.

of applying the environmental brakes now while development is still gaining momentum which might be a better and less costly alternative than applying them later when the development pace has run its full course. Thirdly, as it is true that big problems do not come in neat packages fitting the individual academic disciplines, the environmental questions call for a holistic view and an inter-disciplinary approach towards their solution. Finally, since the developing countries are not in a position to pursue an all out environmental policy, it is necessary to approach the environmental side effects encountered in the various sectors in a selective manner. Obviously, those side effects which directly furstrate major objectives in terms of development priorities should be given the most immediate attention for remedial action. And in Nepal no other sector is as important as agriculture, water resource development and transport. Here an attempt will be made to discuss the nature of environmental side effects in these areas particularly in the context of mountaineous terrain, and also how possibly these could be countered in development planning.

As we all know, agricultural development essentially involves the transformation of low productivity systems of agriculture into more modern systems where productivity is relatively high. The environmental hazards in this process of transformation arise mainly from the chemical control of weeds and pests, irrigation works and fertilizer application. Modern agriculture would be impossible without chemical fertilizers and pesticides, high-yielding seeds and irrigation works. These, however, do not appear to pose a threat at their present level of use. Nevertheless, it is important that their side effects should be taken into account in planning since agricultural modernization will quickly have to replace the spread of extensive farming to new lands in the Terai.

Environmental side effects may also be found in traditional systems of agriculture as a result of rapid population growth. This takes the form of soil erosion, leaching of soil nutrients and degradation of cropped area, indiscriminate loss of forest resources and extension of farming into marginal areas owing to population pressure on land. This is of prime concern in the middle hill areas (Pahar) which is the traditional settlement zone of Nepal. Here man has accelerated soil erosion and this depletion in natural resources is being reflected in the present process of increasing migration from Pahar to the

Terai.[3] Continuing migration from the hills into the Terai is an indication of the rapid environmental deterioration in the hill areas. One of the main reasons for this migration is that economic conditions in the hills steadily deteriorated as population pressure on available agricultural resources increased, and there are indications that this phenomenon will continue in the future.[4] The resettlement programme in the Terai is not adequate to relieve the hills from their population pressure; it is only a temporary palliative and a large share of the country's population will remain in the hills regardless of the conditions there. Soon there will be no scope for migration, and the further pressure of population in the hills will exact a heavy environmental deterioration not only in the hills itself, which is as yet unmeasured, but also on the potential productivity of the Terai in the South.

The incidence of flooding of swollen rivers coming down from the hills has been increasing in recent years. It has been observed that some of the river beds in the Terai are rising from 6 inches to 1 foot every year. This not only guarantees a greater incidence of floods from even normal volumes of water during the monsoon but it is also causing the rivers to meander often destroying prime farmland in their courses, and posing a greater threat to our irrigation structures already completed or at present under construction, or planned for future construction.

It has been pointed out that top soil washing down into India and Bangladesh is now Nepal's most precious export, but one for which it receives no compensation. As fertile soil slips away, the productive capacity of the hills further declines even while the demand for food continues to grow. Some of the terraces in the hills are expertly managed and are relatively stable; others

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3. Harka Gurung, "The Land" in Pashupati Shumshere J.B. Rana and K.P. Malla (eds.), Nepal in Perspective (Kathmandu: Center for Economic Development and Administration, 1973), pp. 25-33.

4. Ratna S.J.B. Rana and Y.S. Thapa, "Population Migration: Causes, Consequences and Policy Implications" in D.C. Upadhya and Jose V. Abueva (eds.) Population and Development in Nepal (Kathmandu: Center for Economic Development and Administration, Tribhuvan University, 1975), pp. 79-96.

continue to be cultuvated despite their declining fertility while some reach the point of no return and are abandoned. Thus, acceleration of erosion due to combination of interrelated factors, primarily the population pressure, is one of the primary environmental threats in the hills.

The problem of environmental degeneration, however, will be difficult to cope with if we continue to approach the development of the hill areas by simply improving crop yields through improved varieties, rotations, irrigations, chemical fertilizer, and so forth. If we do not give proper attention to the inter-relationships between farm, forests, grazing land and water, not only will our efforts towards total resource utilization fail, but our hill areas are likely to become rocky wastelands. As long as subsistence economy is in effect, the intensification of cropping with any given level of technology is limited by soil fertility, temperature and moisture. In the hill areas today, fertility mainly depends upon the amount of animal manure and plant residues that are available as well as on the irrigation water and on the power available for tillage. Ultimately, therefore, it depends on the number and quality of animals which, in turn, depends on the amount of grazing and forest lands available. As we all know, these latter two crucial elements are rapidly decreasing and the decrease is accompanied by reduced water supplies, siltation, soil erosion and landslides. According to one study, rapidly decreasing forests and grazing have caused villagers to devote an increasing amount of time, often one half to a full day's journey from the village, in foraging for animals, and in gathering firewood.[5] This implies that the amount of labor inputs in the fields has decreased thus affecting farm productivity. Thus, unless the non-agricultural lands are given adequate attention - and that soon - improvements of hill agriculture on a sustained basis will be a difficult task.

These facts have not gone unnoticed by the policy-makers. Our Fifth Plan has recognized the need for safeguarding our land and water resources and has thus formulated land use policies.[6] It further recognizes the need to take into

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5. Ratna S.J.B. Rana, An Economic Study of the Area Around the Alignment of the Dhanagadi-Dandeldhura Road, Nepal (Kathmandu: Center for Economic Development and Administration, 1971), Ch. 4.

6. National Planning Commission, The Draft Fifth Plan (mimeo, July 1975), Ch.6.

account the side effects of indiscriminate destruction of our natural resources and environment, and notes that the crux of the land use policy lies in creating a suitable balance and harmony between available land resource and the various demands for its uses.[7] It is hoped that the competent agencies involved in this area will be able to translate this official awareness into meaningful programme on the ground in due course.

If Nepal is fairly endowed with any natural resource, it is clearly her waters from the snow-fed perenial rivers. Hence, river basin development projects are going to be instruments of major importance in her economic development. The Fifth Plan has placed not only relatively high priority on the development of this resource, but has also spelt out long term policies for its development.[8] However, many of the environmental problems which are commonly discussed have arisen in connection with the construction of the river basin development projects. This underlines the need for careful study and analysis in the design of large dams or dams sites so that negative side effects can be minimized through proper planning. Some of the environmental problems associated with river basin development include the spawning of water born diseases, the filling of reservoirs with sedimentation, the drying up of downstream fisheries, the spread of salinization and water logging in associated irrigation projects, the inundation of valuable agricultural and forestry land and loss of mineral resources or wildlife areas. The emergence of most of these negative side effects are gradual; some can be readily corrected, but others are practically irreversible. Some of the consequences can be on such large scale that they may even frustrate the primary purpose of the project, for example, siltation behind a dam. Many of these hazards might not be foreseen at the time of project preparation, but others can be anticipated by preliminary analysis. As such, we should perhaps insist that project and programme costs in terms of adverse side effects in water resource development be evaluated as carefully as the anticipated benefits accruing from them. It must, however, be borne in mind that many of the associated environmental costs might simply have to be assumed in the pursuit of benefits offered by the project.

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7. Ibid.

8. National Planning Commission, The Draft Fifth Plan, op. cit., Ch. 7.

The role of transport as an important instrument of economic development hardly needs to be emphasized. Generally, transportation facilities overcome the frictions of space and the obstacles which geography poses to the optimal utilization of resources. Traditionally, economists have assigned a major role to transportation programmes in the drive of nations for economic development. Nepal too has adhered to this practice for some time and it is now necessary to examine the adverse side effects of transport programmes, particularly road construction in terms of changing natural drainage patterns, and hence inducing soil erosion and landslides. Environmental aspects should be reckoned with in the construction of roads in the hills, particularly through the Chure Range where the geological formations are composed of alternating hard and soft rocks. Here not only is the relief rugged but the soils also, in most cases, dry and immature.

In developed countries the environmental side effects arising from transport development are mainly related to the number of automobiles. The primary issue in this regard is the choice between mass transportation and the number of owner-operated vehicles which is now having critical environmental consequences: air pollution with damage to people, vegetation and landscape. Although these problems are practically non-existent in our case, some of these problems might be avoided by developing countries by adopting a policy of providing means of mass transportation. This is, in any case, indicated by their own level of development and the need to reduce visible disparities among income groups.

A recent study has pointed out: "There is no better place to begin an examination of deteriorating mountain environments than Nepal. In probably no other mountain country are the forces of ecological degradation building so rapidly and visibly".[9] Although there are no hard data to fully support these observations, one cannot at the same time ignore them totally. Those who have travelled through the hill areas in Nepal over different periods of time are almost certain to get the impression that the landscapes are somewhat changing. If nothing else, there is far less vegetation cover now than there was before.

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9. Erick P. Eckholm, The Deterioration of Mountain Environments (mimeo, n.d.), p. 2.

Given that this alone is a fair indicator of deteriorating mountain environment, there is a need to apprehend its potential consequences other than treat it as simply deforestation. The reason for this is that when the environment begins to deteriorate on steep mountain slopes, it deteriorates quickly -- far more so than on gentler slopes and plains. In addition, the damages done to the environment are far more irreversible.[10] If this is the potential danger we face, what then is our strategy for limiting the environmental stress on our hills and mountains? In a way the answer to this question is simple and straightforward. If deterioration of the environment has largely been due to the increasing population pressure on limited land resources, then this deterioration can be checked by simply taking the population pressure off the land. In essence this would involve supporting the population by means of economic activities which do not impose upon the local land resource beyond its acceptable level of carrying capacity, or by shifting the incremental population elsewhere, or a combination of both. This, of course, is easier said than done. Operational programmes in this respect require concerted efforts on two fronts: a massive attack on population growth and development of the hill areas with an environment-oriented economic policy. The former is quite clear. Birth control measures are well known but there is also a need to shift some of the existing population out of the areas to give the long-term policies breathing time to be able to work and to produce tangible results. What might be mentioned here is that this kind of policy cannot be imposed. People have been found not to respond to external coercion but to internal motivation, and government policies can be effectively undermined if motivation is lacking. However good a policy may be, there will be no hope of success unless we can motivate the people by moral, economic, legal or social means.

Insofar as the latter is concerned no general guidelines or specific formulas can be prescribed at this uncertain stage of our knowledge, particularly regarding interaction between environmental and developmental policies. Undoubtedly, we must find our own solution in the light of our own experience and requirements within the framework of our political, social and cultural values.

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10. Ibid.

As already pointed out, it is important that environmental policies be integrated with development planning. At the outset this integration requires a broader definition of development goals than a mere increase in gross national product. Growth orientation in development has been described as "partial rationality" which, however, seems to drown other development objectives.[11] The redefinition of development objectives must include greater stress on income distribution and employment, more attention to social services and welfare-oriented public goods. Besides quantitative targets in income growth and employment, similar targets should also be spelled out for social goals. We should also define for ourselves the minimum environmental standards. These, however, cannot be fixed for all time to come and must necessarily be changed as development proceeds. Environmental indicators can then be devised to measure the progress of the society towards the norms we have set for ourselves.

From the above, it is clear that one of the necessary conditions for integrating environment-oriented considerations into economic policy is that the external effects of economic activities, must be internalised or eliminated. This boils down to considering environmental disruption as social costs which have to be integrated into the cost-benefit analysis of private and public institutions. Conceptually, other considerations would be to take a stock-variable approach, and the use of a qualititative social indicator, supplying scales of fulfillment of basic social needs.[12] These, however, do not seem to lend themselves to project appraisal as would the first approach. Even then there is a need to find techniques for quantifying the impact of development projects on environment, both favourable and unfavourable, so that the society can choose projects with a fuller knowledge of their social costs and benefits. However, all too often there is a tendency to ignore the social costs of various projects in the initial appraisal. Hence, the society's awareness of environmental side effects resulting from these projects come too late after the construction has been completed. Thus, it is necessary to take into account the social costs of environmental side effects in project appraisal right from the very

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11. cf. K.W. Kapp, "Environmental Disruption and Social Costs: A Challenge to Economics", Kyklos, Vol. 23 (1970), p. 483.

12. U.E. Simonis, op. cit.

beginning. Some of the factors which may have to be considered in project selections are: (1) the quantity and quality of known natural resources, and the probable date of their exhaustion; (2) the existing level of water and air pollution; (3) and suitability of alternative sites, ascertained in terms of environmental spillover effects; (4) the availability of possible development of alternative technologies, and their relative costs; (5) the opportunities for waste disposal and for the recycling of raw materials; (6) the impact of the project on environmental disruption, speed of degeneration, degree of severity, and possibilities of reversibility, and (7) the overall costs of various alternatives.

At present there is a considerable debate on how specific environmental guidelines should be formulated for project appraisal. In order to formulate environmental policies, we need a lot more information than we presently possess. It would be useful, therefore, to make a survey of present state of our environment, and the major environmental hazards to which we are exposed in the process of our development efforts. In the present state of our knowledge, there is need for extreme care in devising guidelines so that they do not become bottlenecks in the implementation of development projects, or raise such detail issues as are irrelevant in the current state of our development.

4.2 THE ENERGY SITUATION IN THE HILLS: IMPERATIVE FOR DEVELOPMENT STRATEGIES?

by S.P. Mauch

ACKNOWLEDGEMENT

This paper is based on work done in the framework of the Integrated Hill Development Project being carried out by HMG in collaboration with the Swiss Technical Cooperation. The author is grateful to many members of SATA, to the IHDP team and various representatives of HMG for many fruitful discussions, but also for the opportunities to observe and experience the actual situation in the IHDP region and thereby to live, for short periods of time, closer to the people of the hills.

For one third of the world's people, the energy crisis does not mean the dwindling reserves and high prices of petroleum. It means something much more basic - the daily scramble to find the wood needed to cook dinner. Their search for wood was once a simple chore. But now, as forests recede, it requires long hours - in some areas a day's labour. The vast majority in most poor countries still depends on firewood for fuel. As an Indian official put it: "Even if we somehow grow enough food for our people, in the year 2000, how in the world will they cook it?"

Erik P. Eckholm

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1. Introduction

Wood from local forests is the main energy source for the hill farmers. This resource is in short supply. Demand increases because of population growth, whereas availability decreases. Long-term observation as well as analyses indicate that the overall capacity of the natural environment to support the hill population is deteriorating.

In this paper, the role of energy use is discussed in the framework of regional development policies. Alternative energy sources and more effective forest management, - in the framework of a regionalized economy -, are seen as contributions towards the best possible conservation of the forest, land and water resources of the hill regions. These natural resources, together with human skill and manpower, must provide the basis for the material living conditions of future generations of the people in the hills.

The focus in this paper is on the long-term situation. Examples refer to the region of the IHDP project between the Sun Kosi and the Khimti Kola. This region comprises an area of about 840 km^2, with some 160'000 inhabitants (Ref. 1, 2).

2. Forest Resources and Energy Needs in the Region

We consider the forest resources and the demand on them in the region defined as "big influence zone Jiri west" in Reference 1. The area is characterized as follows:

-	Population in 1971		150'000
-	Population in 1974 (with 0, 8 % p.a. net increase since 1970)		154'000
-	Cattle in 1971 (and assumed in 1974)		103'000
-	Area - Khet and Pakho	320 km^2	
	- Pasture	120 km^2	
	- Bush	220 km^2	

- Forest 180 km^2

Total area 840 km^2

The area has a population density of 180 persons per km^2.

2.1 Forest Resource Demand

We shall take into consideration the three main sectors of forest demand: firewood for cooking and heat in winter time, construction wood, and fodder for cattle.

According to the estimates in Reference 3, about 540 kg of dry wood are needed per year and per person for cooking and heat. This corresponds to about 1 kg per day and person for cooking, and in addition 1 kg extra for heating per day and person in winter time. If a waste coefficient in cutting of 20 % and a ratio of 1.2 between the specific weights of fresh and dry wood are assumed, this corresponds for the whole region to about 130'000 tons per year of fresh wood from smaller trees and bushes. This wood is usually cut as near as possible to the villages.

Construction wood demand is lower, but it is cut with extremely low effectiveness (Ref. 3). For 1 m^3 of construction wood and shingles, about 10 - 20 m^3 of timber is cut. The estimate for the region is an yearly demand of 35'000 tons of fresh timber.

Finally it is estimated that, during the dry season, some 50'000 tons of leaves and small branches from forest and bushes are fed to the cattle population of 100'000.

2.2 Forest Stock and Growth

It is estimated (based on Ref. 3) that the 180 km^2 of forest and the 220 km^2 of bush in the region, produce about 40'000 tons of timber larger than 8 inches, 20'000 tons smaller than 8 inches and about 50'000 tons of leaves and

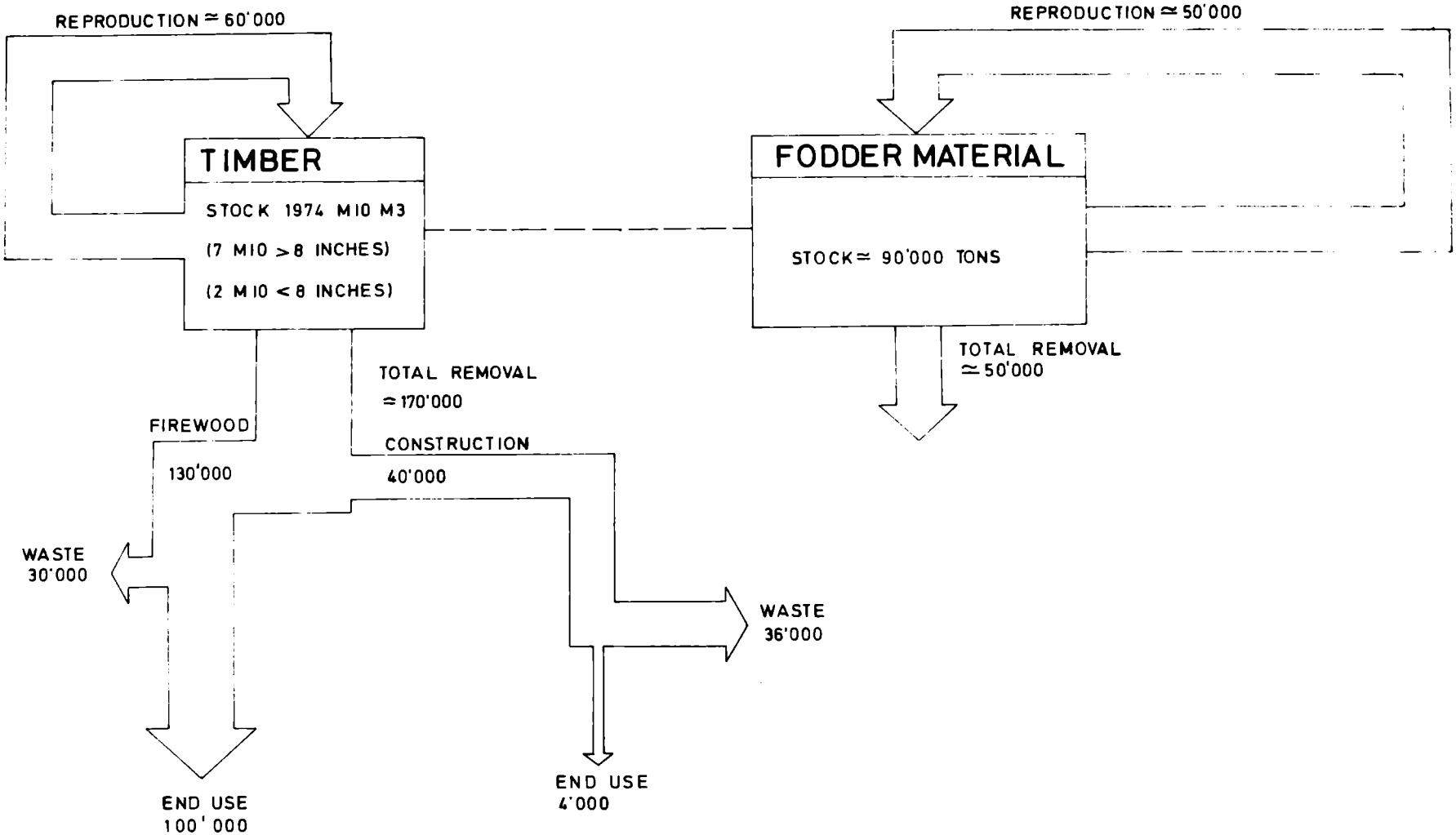


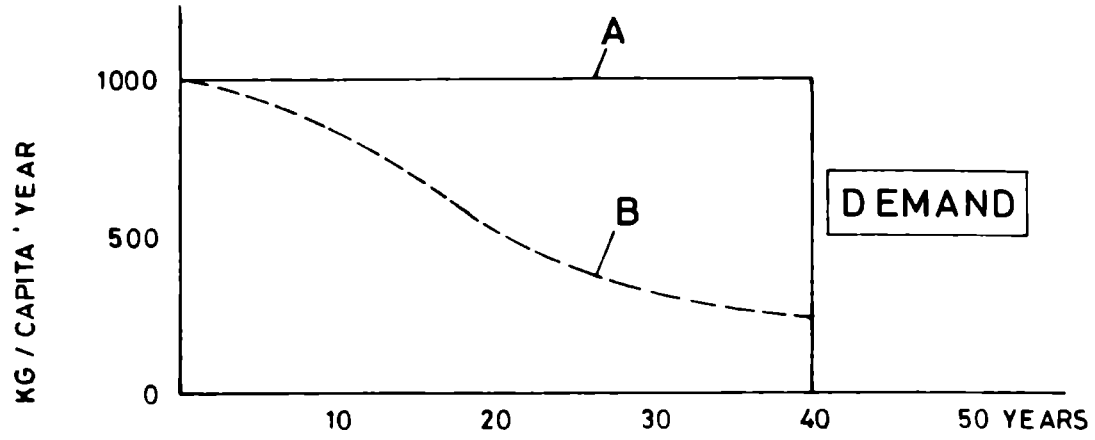
FIGURE 1: REGIONAL MATERIAL FLOW DIAGRAM FOR TIMBER AND FODDER
(FLOW QUANTITIES IN TONS PER YEAR)

small branches per year. Based on the investigations (Ref. 4) for the Kalinchowk area, the total forest stock for the region is estimated at some 9 Mio tons of timber (of which 7 Mio are > 8" and about 2 Mio < 8"), 90'000 tons of leaves and small branches.

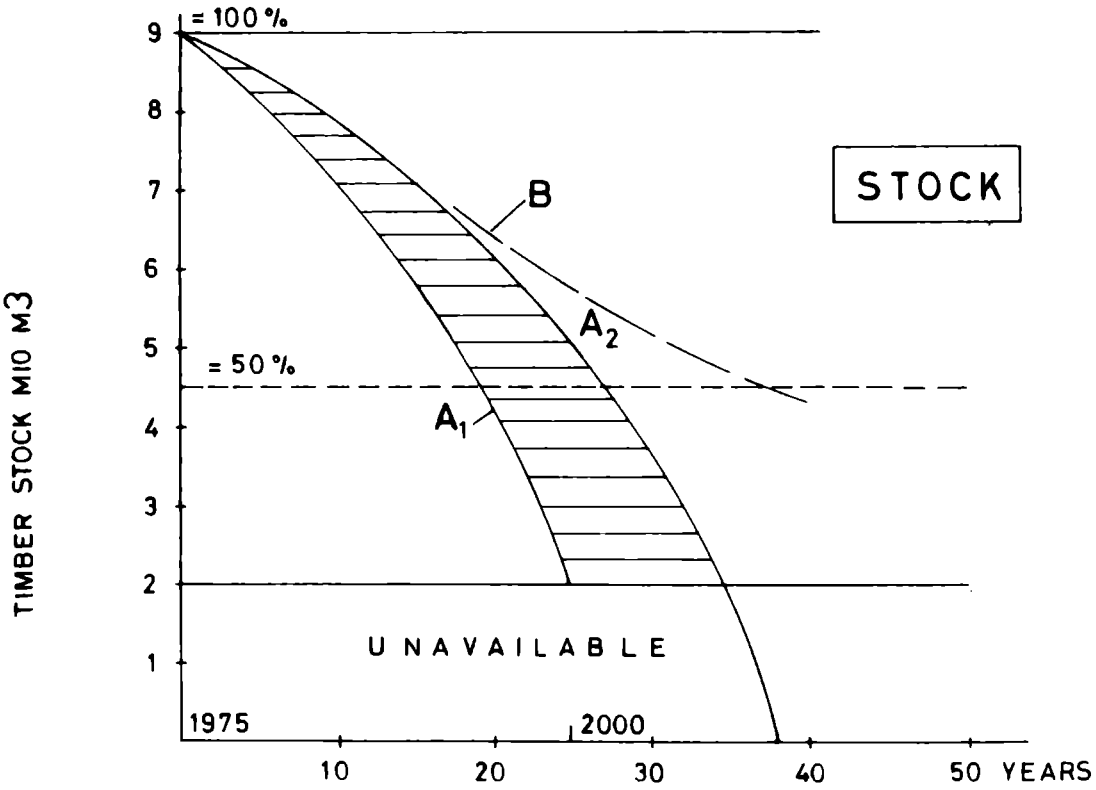
2.3 Forest Demand Exceeds Forest Growth, Stock Must Deteriorate

In Figure 1 the estimated quantities of forest demand, forest growth and forest stock are shown in the form of a material flow diagram. The estimates indicate that from the stock of some 9 Mio tons of timber, about 170'000 tons are withdrawn per year, but only some 60'000 tons are reproduced. This indicates that the forest resources must be declining. This conclusion is supported both by general experience as well as the observation made in Reference 4 for the Kalinchowk area: Older aerial photographs show a forest area which is roughly double the area found today.

When considering the longer-term balance between forest resource demand and forest growth, we must realize that a part of the forest resources are essentially unavailable for use, because they are in remote locations. Let us assume that only 20 % are in this category. Then the demand of 170'000 tons today must be put in relationship to a stock of 0,8 x 9 Mio $\sim$ 7 Mio tons and a growth rate of 0,8 (40'000 + 30'000) = 56'000 tons per year. Figure 2 shows, how the region's forest resources would deteriorate in the future under the conditions as used in the above analysis. A 1 % p.a. net population growth is assumed. For curve A it is assumed that the rate of firewood consumption per capita remains constant at the present levels (Fig. 2a). This leads to a complete depletion of the region's available forest stock within 3 - 4 decades (Fig. 2b). If it is assumed that per capita consumption of firewood decreases as the forest stock is depleted, the process of destruction is somewhat slowed down. The decrease in the consumption rate (curve B, Fig. 2a) is likely to occur in the future: As forests close to human settlements are first depleted, firewood becomes even scarcer. Two scenarios are likely: If no substitute energy is made available, this means that even less energy can be consumed, and that material living conditions will be harder in the future. The more



a) PER CAPITA PRIMARY DEMAND (KG/YEAR)



b) FOREST STOCK AS A FUNCTION OF TIME.

FIGURE 2: DETERIORATION OF FOREST STOCK (FIGURE b) FOR TWO ASSUMPTIONS FOR THE PER CAPITA DEMAND OF WOOD (FIGURE a).
ASSUMPTION: POPULATION INCREASES 1% PER YEAR.
CURVE A_1: 2 MIO M^3 OF STANDING TIMBER ARE NOT ACCESSIBLE FOR USE: CURVE A_2 ALL FORESTS ARE EQUALLY ACCESSIBLE FOR USE.

desirable alternative would be, that alternative energy sources become available to the hill farmer, so he need not rely solely on the forests for his energy needs. Such alternatives could be a mixture of solar energy, biogas, wind, hydropower and kerosene. Manure obviously should not be considered as an alternative energy source, because its value as a fertilizer is much more precious than as a fuel. All potentials to use the available wood from the forests more efficiently, and to increase the per hectare yield of the forests by proper forest management, should be realized in the first place. This potential should be large enough to at least offset the effect of the population increase for about two decades.

3. Regional Ecological Balance and Economic Policy

3.1 Ecological Deficits

The quantitative analysis of forest use and reproduction presented in Section 1 is aggregated and only very approximate. Yet we believe that it adequately reflects the major dynamics of the long-term development. One conclusion of this analysis can be formulated as follows:

"The region has a significant ecological deficit in terms of energy: The energy that the region produces today (through its forests) covers only a fraction of the energy which the population needs even at its low level of material consumption. According to our analysis this deficit amounts to about 65 % of the energy consumed (excluding the energy content of food). The energy deficit is covered by an yearly decrease in the stock of the region's forests. This must lead to a further accentuation of this ecological imbalance."

This concept of ecological balance - or deficit - can be generalized. In this section we extend it to the regional production and demand for food: According to Reference 1, in 1971 the production in the region covered about 70 % of the food needed by the population of 150'000 (measured in terms of calories and based on a daily food ration aquivalent to 2'200 kcal per person). With no closer analysis available at present we assume here that these 70 % of the

2'200 kcal per person and day can be produced without depleting the land's capacity for reproduction. This is an optimistic assumption. It does, for example, not consider the longer-term effects of land erosion. Thus if, for the moment, we accept to simplify by representing the region's ecological capacity to support its population by the two parameters energy and food, our analysis leads to the following approximate regional balance.[1]

	Energy (Fuel) in 10^6 kcal/cap/y	Food (metabolic energy)
Region's demand at present level of population and material needs	2,5	0,8
Region's reproductive capacity, in % of needs	35 %	70 %
Region's ecological deficit, in % of present needs	65 %	30 %

Table 1: Ecological deficit of the region.

At present the energy deficit of 65 % must be covered by using up the region's ecological capacity (capital). A large part of the food deficit is covered by inter-regional trade. From the region's point of view, this food import is mainly financed by the earnings of seasonal migrants to India, as the investigations by Schmid indicate (Ref. 1). However, it must be assumed that a part of the food deficit is also being covered by using up the region's ecological capital as indicated above.

1. We neglect here the potentials of increasing energy, i.e. wood and food production in the future by means of "improved" forest and agricultural management practices. Optimistically one could, for example, assume that they could increase the region's ecological capacity by a factor of 1,5 or 2 over 2 - 3 decades.

3.2 Ecological Deficits and Regional Economic Policy

3.21 Conclusions from the Regional Ecological Balance Estimate

Obviously, if the situation as just described is essentially realistic, and if it were to persist and would even accelerate, this would necessarily lead to the destruction of the region's capacity to support its population within a few decades.

What alternatives are available?

In the long run, whatever fraction of the ecological deficit cannot be eliminated by increasing the region's ecological capacity - including effects of population growth and higher per capita demand - must be covered by interregional trade.

If this statement is accepted, it has very clear and imperative implications in relation to the basic concept of economic policy of the hilly regions similar in character to the IHDP region. Let us briefly discuss these implications:

3.22 Protecting and Developing the Full Ecological Potential of the Region

Primarily, the region's ecological deficit should be kept at a minimum. This involves not only improving forest management practices, agricultural practices, but also developing alternative domestic energy resources (solar, biogas etc.) and food resources (e.g. potatoes), as well as demographically related policies such as health, education and family planning.

There is no question but that all these potentials for reducing the ecological deficit within the region should be materialized. However, the dangers of unbalanced strategies must be fully realized. For example a sectoral policy which aims at increasing food production alone, could very likely be counter-productive in the long run (Ref. 5).

An assessement of all the available information, - such as presented in this paper - leads us to the conclusion, that this "domestic" policy alone can never master the gigantic forces of the present development: population growth, erosion, forest depletion etc. The domestic policy must be accompanied by a policy of interregionalizing the hill economy.

3.23 Interregionalized Economy

What do we mean by interregionalizing the hill economy and what objectives could one pursue with it?

The starting point is the fact that the region's ecological deficit cannot in the long run be fully covered locally. Therefore, the destruction of the region's reproductive capacity can only be prevented, if the remaining deficit can be covered through interregional trade:

The region must import the uncovered energy - and food-deficit. It must finance these imports by the export of local products. These export products must command a high market price and their production must use up as little as possible of the local ecological resources such as forests or agricultural land.

It is interesting to note, that this economic-ecological concept is no theoretical construction. Switzerland, for example, as a highly industrialized country, has used this strategy for many generations, and derives much of its high material standard of living from it. Switzerland produces only some 50 % of the food, and only some 17 % of the energy it consumes. This rich and industrialized nation has a more significant and accentuated ecological deficit as a nation than the hilly regions of Nepal do, as Table 2 shows. Even so, the Swiss agricultural land is much lower than in the hills of Nepal. Why is this possible? Because the Swiss produce and export industrial products and services which command a high market price. With this income, they are able to finance the import of more than 2'000 kg of oil products per capita and year,

and some 50 % of their food.[2]

	Hilly Region Nepal	Switzerland
1. Local food production deficit:		
% of consumed calories	30 %	50 %
= kcal per capita per day	700	1'500
2. Local energy deficit:		
% of consumption kcal per capita per year	65 %	83 %
energy consumed per capita and per year	2,5 Gcal	30 Gcal
3. Money value of energy and food deficit per capita per year:	400 NC 100 SFr.	1'500 SFr.
% of GNP per capita	30-40 %	13 %

Table 2: Nepal and Switzerland are both food and energy deficit countries.
(Difference: Nepal now must cover it from its own ecological stock, Switzerland imports it by trading.)

This comparison between Switzerland and Nepal must be qualified in some respects: First of all, we do not discuss here the social desirability of the extent to which the Swiss economy (and that of the many other industrialized nations) has developed this strategy. Nor should this comparison be seen as a justification of the world wide politico-economic mechanisms which determine the so called terms of trade. These terms of trade essentially reflect how much ecological resources can be bought with the export of its industrial products and services. Nor do we mean that a regionalized economy of the hills

2. Because of the "industrialized" quality of this food, in terms of needed input calories, the 50 % imports are equivalent to about 200 - 300 % of all the food consumed in Nepal, on a per capita basis.

should develop to the same degree the specialization of functions, of technology and labour, or to the same geographic dimensions as this has become the case for the economy of Switzerland and of other industrialized nations.

What we mean is this: The economy of the hills is forced to the concept of interregional exchange, because the ecological potential of the hills is insufficient to support its population even at low levels of material consumption. What types of export products the region should produce and to what other regions or countries it should try to export them must be developed from the parameters of the local - human and material - regional potential. The only general criterion that can be given is:

The exported products should command the highest possible net regional income in relation to the local ecological resources their local production requires.

We must recognize, of course, that the pursuit of such an economic development makes it necessary for the region to have a minimal and functional infrastructure for transportation and communication. The trunk road that is now under construction, connecting the IHDP region with the Kodari highway, must be considered as part of this functional infrastructure which is needed, if one considers such a regionalized economy as indispensible. At the same time one must, of course, recognize the various dangers of counterproductive side effects, which, for example, the existence of this road can have. The strategy does have its risks. We must carefully identify them and try to devise supporting measures in such domains as cottage industry, education, village development etc. This necessitates an integrated regional development concept. First learning steps in this direction are being undertaken by the project team and HMG, together with the local population in the IHDP region.

3.3 The Economics of Covering the Ecological Deficit

Let us give some thought to the economic implications of the ecological deficit

as shown in Tables 1 and 2, and of the size of the task to cover this deficit by the export of "economically-ecologically efficient" products:

3.31 Market Value of Ecological Deficit

Energy

The region has a deficit of about 110'000 tons of fresh wood. If we assume that 1 kg of fresh wood has an energy equivalent of 0,24 kg of kerosene, then the wood deficit amounts to an equivalent of 26'000 tons of kerosene. If further we assume a low price of 2 NC per kg of kerosene, then the market value of this energy deficit is about 52 Mio NC per year.

Food

The food deficit, in terms of calories, amounts to 0,3 x 2'300 kcal x 365 x 154'000 37'000 Mio kcal per year. If we express this food deficit as an equivalent quantity of rice (3'700 kcal per kg of rice), the food deficit amounts to 10 Mio kg of rice. If we assume a market price for rice of 3 NC per kg, the market value of the food deficit is about 30 Mio NC per year.

The economic significance of this ecological deficit can be put in perspective with the following reflections: If we (mis-)use the GNP concept as a measure for the economic productive capacity of the region, we see that the 82 Mio NC deficit amounts to some 43 % of the region's GNP (based on a per capita GNP of 1'200 NC per year). The comparison in Table 2 shows, that for Switzerland the economic value of the food and energy deficit is only about 13 % of the GNP, even though, in physical terms, the per capita energy deficit is 15 times higher in Switzerland than in Nepal.

Another useful perspective emerges, if we relate the region's deficit of 82 Mio NC to the potential slack in the labour force. What are the manpower reserves which could be mobilized to produce exports toward covering the deficit? If we assume that an average manpower reserve over the seasons of 20 % of the

labour force could be mobilized (Ref. 3), with an average earning power of 7 NC per manday, this additional production would be worth about 25 Mio NC, or only 30 % of the deficit value. This means that, based on the present economic productivity level, the total labour force would be incapable of covering the region's ecologic deficit via export products. Export branches, such as small scale industry, would need to receive market prices which correspond to daily wages well above the current levels. As a result, earnings in agriculture also would have to increase without a corresponding increase in local and import prices. In other words, the region must become economically stronger if environmental degradation is to slow down.

3.32 Methods and Criteria for Removing the Ecological Deficit

Figure 3 shows a typology of methods to cover the ecological deficit: Let us assume that all local methods combined could offset the effects of population increase and the further decrease of ecological capacities. Then, interregional economic trade would have to cover the present deficit of 43 % of GNP or some 82 Mio NC per year.

No quantitative analysis is yet available, whether and how this deficit could in fact be covered. We therefore consider a few singular example estimates: In Reference 6 a list of potential export products for the region has been considered (from horticulture, agriculture, small scale industry, seasonal migration etc.) in terms of an export revenue coefficient :

$$\ell = \frac{\text{(export price - cost of imported inputs)}}{\text{local natural resources used}} = \frac{P}{NR}$$

Products have a high export feasibility, if they show a high value of this export revenue coefficient. It is generally more difficult to develop a quantitative estimate for the natural resource use coefficient NR than for the economic return P of a product. As one example, consider the wooden boxes which have been produced in the Jiri region for some time:

Assume such boxes can be sold in Kathmandu for 15 to 20 NC, say 17 NC on the average, and assume 2 NC for transport and sale fees which do not remain in

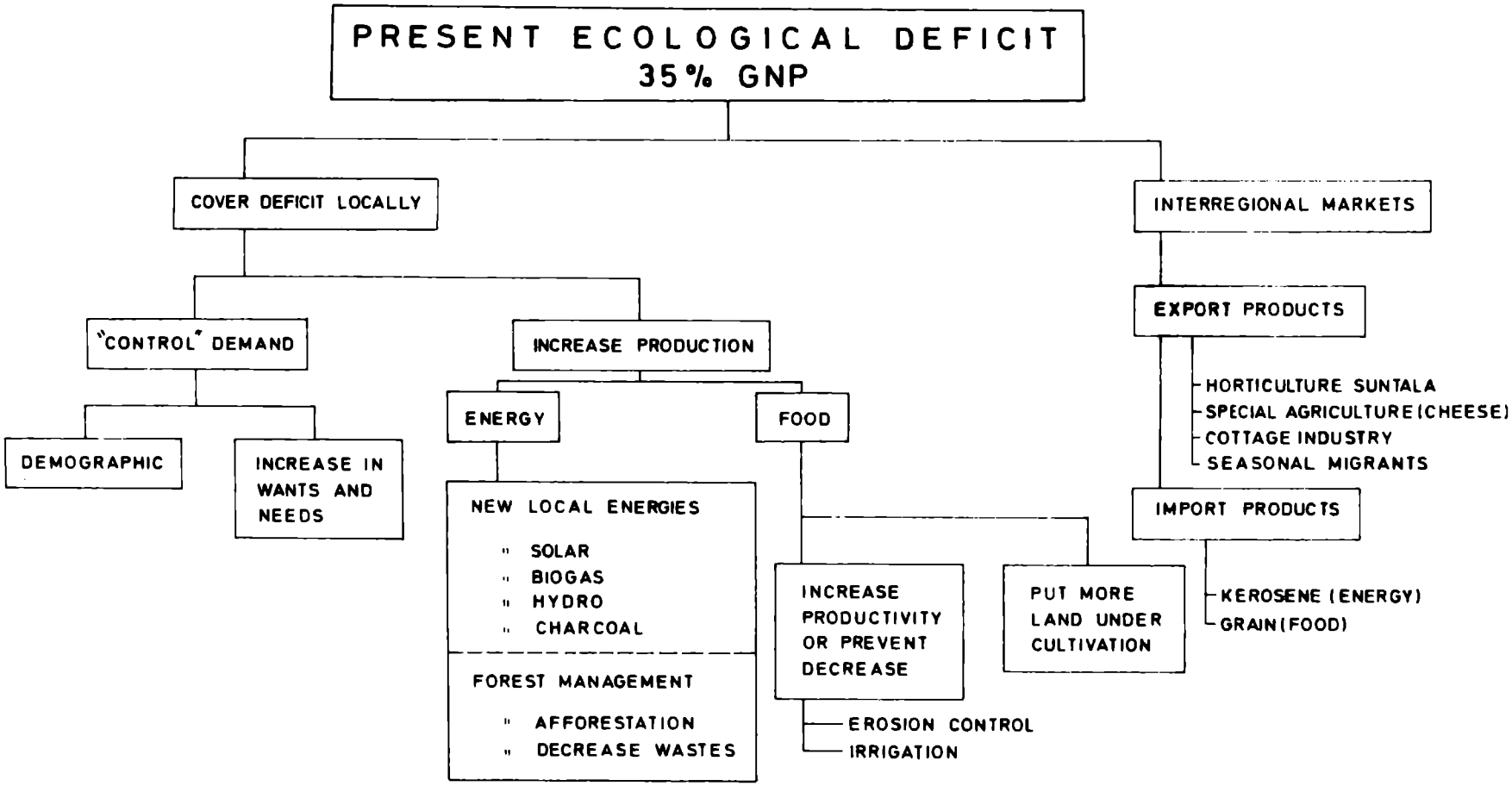


FIGURE 3: TYPOLOGY OF METHODS TOWARD THE RE-ESTABLISHMEN OF AN ECOLOGICAL BALANCE.

the region. Thus the net revenue would be 17 - 2 = 15 NC per box. If the production of 1 box requires 4 dm^3 of crude timber, this yields an export revenue coefficient ℓ of:

$$\ell = \frac{15 \text{ NC}}{0{,}004 \text{ m}^3 \text{ timber}} = 3'800 \text{ NC/m}^3 \text{ of timber}$$

To put this number in a somewhat more perceptible perspective, we ask the question: "What fraction of the total yearly timber reproductive capacity would be needed, if the total economic value of the ecological deficit - equivalent to 82 Mio NC per year - were to be covered through the sale of such wooden boxex?" To get a revenue of 82 Mio NC, some 5,5 Mio boxes would have to be sold. Their production would require 5,5 Mio x 4 x 10^3 m^3 of timber = 22'000 m^3 timber, equivalent to about 20 % of the present reproductive capacity of the region. Therefore, the revenue coefficient for wooden boxes could be represented (under the assumptions made for price and timber use) as:

$$\ell = \frac{15 \text{ NC}}{0{,}004 \text{ m}^3 \text{ timber}} \sim \frac{82 \text{ Mio NC}}{22'000 \text{ m}^3 \text{ timber}} = \frac{100 \text{ \% of ecological deficit}}{20 \text{ \% of timber reproductive capacity of region today}}$$

So far, this is a hypothetical consideration. No one would want to imply that more than 5 Mio wooden boxes could be produced in the IHDP region per year. However, the calculation shows clearly, what order of magnitude the problem of the ecological deficit, and of regionalizing the economy with the aim of restoring the ecological balance is. We can roughly check what fraction of the ecological deficit could more realistically be covered by exporting such products to Kathmandu. Assume that Kathmandu tourists spend 20 NC per day on the average on wood carved products, and that 20 % of this market could be delivered by the region of 150'000 people which we are considering. We further assume 200 tourists per day during 250 days, each tourist staying in Kathmandu for an average of four days. This would imply a total Kathmandu market for carved products (for tourists) of 200 x 4 x 250 x 20 NC = 4 Mio NC per year. If the region could deliver 20 % of this market, the export value would be 0,8 Mio NC and would therefore cover only about 1 % of the total ecological deficit.

An independent estimate from Reference 8 (page 60) leads to the following relationships: A full time wood craftsman can produce 210 NC worth of products for 1 bhari or 1,5 cft of wood. This corresponds to a value for the export revenue coefficient = 9'000 NC/m^3 of wood. Based on this, the regional deficit of 82 Mio NC would correspond to only about 10 % of the reproductive capacity of the regions forests.

Certainly, these calculations reflect an oversimplistic view and the "models" applied are aimed at gaining some insight and perspective of the problem, rather than at absolute accuracy. Among other things, this analysis does not reflect the problem of what fraction of the export revenue money will then in fact be spent to import food and energy.

Other potential export products can be scrutinized in a similar manner, and the analyses can, and should, be improved to a level of acceptable reliability. Other potential export products have been listed in Reference 6: Nepali paper production, solar energy, brick production, granite plates, cheese, etc. A comparative analysis of these products in terms of the defined export revenue coefficient as defined above should give some clues as to how efficient the various products would be in covering the ecological deficit.

4. Can Alternative Energies Contribute Toward an Ecological Balance?

4.1 Energy Policy and Development Policy

In this section we shall consider the energy deficit of the region. This deficit is equivalent to about 110'000 tons of fresh wood. In terms of energy this means about 260 x 10^9 kcal, or the equivalent of 26'000 tons of oil or kerosene. At a market price of 2 NC per kg of kerosene this deficit has a monetary value of 52 Mio NC per year.

The question which must generally be asked vis a vis this situation is the following: "To what extent should - or must - the population of the region continue to rely on forest resources to meet their major energy needs, and to what extent is it necessary, possible and feasible to introduce new alterna-

tive energy technologies? How effective are various technologies in covering the energy deficit?"

We must consider this question, among others, in the light of the analyses of Sections 2 and 3. In addition we must take into account the fact that new types of energy needs - in quantity and structure - might develop in the future: The development of interregional markets, for example, will lead to new demands for mechanical and possibly electrical energy, if small scale industry is to make a significant contribution to the region's export under this policy.

Today, practically all the energy is needed in the form of heat for cooking and heating. Little mechanical energy and little low temperature heat is used. In the future, small scale industry could use more mechanical and electrical energy, and solar energy could provide low temperature heat for warm water supply. Biogas is suitable for cooking and could directly substitute a part of the demand on the forest. The use of electricity from local hydropower for general household purposes in the hills would involve many problems associated with distribution and social impacts of new, essentially sophisticated technologies which are dependent on import products such as electric stoves.

It would be impossible at this time to propose a well thought out and detailed energy strategy. A general framework and a few single elements can, however, be sketched. This could contribute toward the development of an overall policy in terms of regulations, technological development and financial policy.

4.2 How Effective and How Feasible are Various Energy Technologies?

We shall briefly consider a few energy alternatives and illustrate - with aggregate estimates - how broadly these technologies would have to be accepted and used if they were to cover a certain fraction of the energy deficit, and how effective they could be in economic-ecologic terms. We must remember that whatever part of the energy deficit cannot be met by alternative sources will have to continue to come from the over-stressed forest potential.

Hydromechanical and Hydroelectrical Power

This type of energy is relevant primarily for cottage industry in the region (Ref. 8,9). Let us suppose that over the next 10 years some 30 hydroelectrical and/or hydromechanical installations could be realized in the region, with an average capacity of 8 kw and an yearly production of 25'000 kwh each (use for small scale industry, irrigation, ropeway transport etc.). These plants could produce 30 x 25'000 kwh = 0,75 Mio kwh per year in the form of electricity. This is the direct energy content equivalent of only 140 tons of wood. As Reference 9 indicates, however, substantially more wood can be saved per kwh of hydroelectricity, if such plants are used in small scale industry as a substitute for fire wood. This is because relatively low efficiencies are possible when wood is used in such applications. According to Reference 9 with project costs of 400'000 - 600'000 NC one could substitute 250 kg of wood. If we use an annuity of 10 % we see that at the cost of 60'000 - 80'000 NC per year, 250 kg/day x 300 days = 75'000 kg of wood can be substituted. This means that with this application one could substitute local forest energy at the rate of

$$\ell' = \frac{40'000 - 60'000 \text{ NC}}{75{,}000 \text{ kg wood (dry)}} \simeq \underline{0{,}7 \text{ NC per kg of wood}}$$

In Reference 11 we find a proposal for hydroelectric power installations in Nepal in the few hundred kw range, with cost estimates of 0,07 NC/kwh for the electricity from the station (without distribution network). Again using the equivalent of 4'000 kcal/kg dry wood, this corresponds to an economic-ecologic coefficient of $\ell' \simeq 0{,}35$ NC/kg wood at prices in 1963, or roughly 1 NC/kg wood at current prices (1975).

We shall see how these coefficients of economic-ecologic effectiveness for hydroelectric plants compare with other energy technologies. We also must remember that hydroelectrical units must be considered as a relatively complex and sophisticated type of technology for the rural regions considered here. Training, maintenance and spare part problems are more significant than for simpler technologies such as biogas. In addition, most of the investment capital would go outside the region, since it has no capacity to produce parts of this hydroelectrical technology.

Biogas

Small biogas plants are available today; in many places in India they are applied and operated (Ref. 10). The technology is simple, installations can almost exclusively be fabricated locally. For the following estimate we use data from Reference 10:

"The gas produced from the dung of 4 to 5 cows is sufficient to meet the lighting and cooking requirements of a family of 5."

(Assumptions: 0,05 m^3 gas per kg of dung; 10 kg of dung per day per cattle; 0,6 m^3 of gas required per day per person for lighting and cooking; 1 m^3 of gas equivalent to about 0,6 liter petrol or 6,000 kcal; 10 human's excreta equivalent to 1 bullock's manure.)

(Amount of gas produced is highly dependent on ambient temperatures: at 13° C only 50 % of gas attainable at 25° C.)

Initial capital outlay is in the order of 2'000 NC.

If, in the next 10 years, 300 biogas plants with an average capacity of 100 kg of dung per day (10 cattle) can be realized, each plant would yield 5 m^3 of methane gas per day. The 300 plants would cover the cooking and lighting needs of 600 households at an average of 5 people. Since cooking requires about 1 kg of dry wood per person and day, the 300 plants would substitute 3'000 kg of wood per day, or 1'100 tons of dry wood per year. If, for these larger plants, we assume an average investment of 3'200 RS (instead of 2'000 for a plant half as large), and again use an annuity of 10 %, the resulting coefficient of economic-ecologic effectiveness is:

$$\ell = \frac{300 \text{ plants} \times 3'200 \text{ NC} \times 10\ \%}{1'100 \times 10^3 \text{ kg wood}} = \underline{0{,}09 \text{ NC/kg wood}}$$

If we compare this value with ℓ = 0,7 - 1 NC/kg for hydroelectric installations, we can draw the following (preliminary) conclusions: Energy from biogas plants can substitute forest energy at economic costs which are roughly 10 times lower

than electrical energy from hydroelectric plants, because the specific investment (NC invested per kg wood substituted per year) needed is much lower. In addition, the biogas-technology is less sophisticated, and probably more suitable for wide application in the rural areas considered. The specific yearly labour input (working days per kg wood substituted), on the other hand, is probably significantly higher for the biogas energy than for the hydroelectric energy. This fact is economically insignificant as long we can assume the marginal cost of labour to be very small or even zero. This is true at least for certain seasons of the year.

Charcoal

Charcoal can be used to substitute wood for cooking, heating and small scale industrial (or industrial) purposes. We must distinguish between small scale production (a few tons per year) and large scale industrial production (thousands of tons per year). Also we must distinguish between purely economic and economic-ecologic feasibility of charcoal production. Reference 12 investigates the economic feasibility of large scale plants and finds that "there appears to be every reason to suppose that charcoal production is a feasible enterprise in Nepal, especially the Terai, and is capable of making a considerable contribution to the general economic and industrial growth". Reference 12 estimates, that charcoal could be produced at a Kathmandu price of "0,35 NC per kg, a price which is four times lower than the present price for local poor grade charcoal in Kathmandu".

Here, we are more interested in local, small scale production in the hills and in ecological efficiency. From this point of view there are two incentives for producing charcoal, rather than burning wood directly: First, to transport a certain amount of energy in the form of charcoal rather than dry fire wood, we must only carry about 40 % of the weight and 60 % of the volume. This opens up the possibility of utilizing the wood from more distant forests. This implies a relief of those forests which are most under pressure. More of the region's overall forest reproductive capacity can be mobilized. Secondly, net energy, - i.e. wood - can be saved, provided that the energy loss of about

30 %[1] involved in the intermediate step of charcoal production can be overcompensated due to the fact, that a charcoal fire for cooking yields a higher energy use coefficient than a fire with wood. This implies that the same meal can be prepared with less input energy, if charcoal is burnt instead of wood. Although this seems to be the case, there is no empiric data available. From above it follows that the use of charcoal for cooking is ecologically efficient if a charcoal fire yields an energy conversion factor of at least 30 % higher than fire wood.

5. The Simplified Analysis in Broader Perspective

We recognize that the above analysis represents a simplified model of the dynamics of the regional man - and environment-system. First we have explicitly excluded all socio-cultural aspects from the analysis. For practical policy and project implementation this part of the system must obviously be integrated. Otherwise one opens the not uncommon trap of "planning would be nice if only there were no people". A prime example showing how easy it is to invent a policy, but how difficult to implement it, is afforestation.

In our analysis, however, we have also excluded many components of the complex chain of ecological effects and causes: We have explicitly considered the pressure on the forests, and in very general terms, the food pressure on agricultural land. But we have not included, for example, the casual chains between deteriorating forests, pastures, the hydrological system, shifting cultivation, road construction, settlements, migration, land erosion, decreased water retention, decreasing water supply during the dry season, increasing flood problems, again increased erosion etc. etc. Eckholm paraphrases the situation as follows: "The accelerating destruction of forests throughout Africa, Asia and Latin America, caused in part by fuel gathering, lies at the heart of what will likely be the most profound ecological challenge of the late 20th century - the undermining of the land's productivity through soil erosion, increasingly severe flooding, creeping deserts and declining soil fertility." Qualitatively, we

1. This coefficient can be estimated from the data provided in Ref. 12. It implies that the charcoal product contains 70 % of the wood energy put into the process.

must assume that the interaction of all these factors combined have the effect of further accelerating the process as it is described by our simplified analysis. In terms of energy and of overall man- and environment-dynamics, the simplified analysis seems to reflect the dominant factors.

NOTATIONS

m^3	= cubic metre
dm^3	= cubic decimetre
km^2	= square kilometer
Mio.	= million
kcal	= kilocalorie
Geal	= Gigacalorie = 10^6 kcal
cft	= cubic foot
bhari	= 1,5 cft
kw	= kilowatt
kwh	= kilowatt hours
GNP	= Gross National Product
NC	= Nepali Currency
SFr.	= Swiss Francs

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4.3 ECOLOGY AROUND A DEVELOPMENT PROJECT

by Pashupati S. J.B. Rana

1. Ecology and Development in General

While the new interest in preservation of ecological systems is a most welcome and essential trend, there are times when the cool, scientific objectivity required to pursue this aim seems overcome by a profound sentimentality bordering on hysteria. It is all too simple, in the effort to broaden and popularise the idea of ecological maintenance, to turn it into a crusade flaunting the banner-slogan "back to nature". Such retrograde simplifications cannot be tolerated not only by those among the leaders and cadres of the third world dedicated to the idea of development, but also by the broad masses of the underdeveloped world, whose poverty can be alleviated only by developing the resources of the environment. In effect all development which introduces new factors or alters existent factors must also, to some extent introduce disequilibratory variables into an existent system or balance. Pure preservation or the avoidance of all disequilibria is clearly not compatible with development oriented ideology. The question is rather one of offsetting the shorter-term benefits of development efforts against the longer-term costs that they may impose on the environment. However, this task is not easy - for the shorter-term benefits are much easier to foresee and calculate, than the consequential long-term damage. Nothing exemplifies this more clearly than malaria eradication. Who in the 1950s when this plan was brought forward as a boon to the population of the Terai could have foreseen that it entailed the terrible destruction of Nepal's vast forest wealth? Yet within less than 2 decades we have seen the costs of removing the natural guardian of the forests: malaria. Even today seeing all this it is surely a very difficult moral question. Knowing these awful consequences who would still dare to condemn the population of the malarial areas to continued malaria in order to protect the forest? This question also indicates how moral force does not always favour the preservationists. Thus the question is a very complex one.

Politically in deciding between the vague long-term and the tangible short-term, few popular statesmen in the developing world can forget that old dictum of Lord Keyne's that in the long-term we are all dead. It is all very well for the anti-pollution pundits to predict the consequences three generations away; it is after all the present generation the politician must satisfy in order to survive. And even later generations are unlikely to thank a leader who purchased preservation at the price of a low pace of development.

The solution to this dilemma lies in looking at the question not in a static framework but in a dynamic one. The answer is not to maintain or what is worse to return to the old ecological balance of the environment. That is not merely undesirable but also not possible. For in most cases even without the new variables of progress the old ecological balance has already gone into irretrievable degeneration. In the mountains of Nepal for instance the mere fact of 200 years of the Pax Gorkha has unleashed such strong forces of population pressure, that erosion, migration, deforestation etc. are already under way. In fact a return to the old ways and the pastoral dream, would entail a return to continuous strife, anarchy, pestilence and pernicious feudalism, which is the sort of thing that the "back to nature" enthusiasts fail to notice thanks to the rose-tinted glasses through which they see the past. The only valid objective that ecologists can have therefore is to aim at a new dynamic ecological balance between man and nature, compatible with development and capable of continuous adjustment with the ever increasing pace of development. So we should aim in broad principle not at pure preservation, but at adapting the environment so that essential elements of the ecosystems can be conserved in a manner consistent with the increasing betterment of the standard of life of man living in or nearby that environment. It should not be above the ingenuity of the human mind, which has already survived at least one Malthusian scare and showed such remarkable inventiveness in the past, to rise to this new challenge of coordinating the development of man with the continuity of nature.

2. The Integrated Hill - Development and Ecology Approach

Several factors argue in favour of the integrated approach. The whole expe-

rience of road-building in Nepal has shown that if a road is taken up as an isolated project, it has an extremely limited function in the area it is meant to serve.

Especially in hill areas the limited productivity of the area causes the road to be very poorly used - even to the extent of failing miserably to justify the maintenance costs let alone produce sufficient traffic to justify the capital cost. Ways and means to tone up the whole economy so that (a) the production potential of the service area rises sufficiently for it to generate adequate traffic of marketable surpluses out of the region, (b) Consequently to generate sufficient purchasing power so that the area can attract enough inward-bound traffic - has now become a prime consideration in road development. Otherwise a road becomes a kind of surgical incision into the development problems of the area - it reveals the diseases of the region which are in stark contrast to its neat but narrow tar-seal surface, but alone cannot perform an operation to cure them.

The case study of the SATA-Nepal road to Jiri is of great interest in this sense, since in concept it attacks precisely this lacuna. Those who conceived this project proposal are to be congratulated on their appreciation of this problem. I was most impressed to hear when the project proposal was in its early stages, that not only were extensive efforts to raise the agricultural and forest productivity of the area to be made - but also that this was to be integrated with the use of the rise in incomes generated in the course of road building. This seemed indeed a fine bit of planning. For normally a rise in incomes in an area tends to be dissipated in transient rises in standards of consumption which in turn causes great disappointment once the building process is complete - for the rise in expectation cannot be sustained once the road is built. This tantalising situation of seeing unattainable urban goods, already enjoyed and still available - but which can no longer be bought as there are no longer the incomes to buy them, can cause serious political problems and dissatisfactions in the long run. The concept of obviating such consequences - by providing right at the start investment opportunities which should attractively synchronise with the new incomes created, i.e. in a sense

to accompany income generation with a "training" on saving propensities - so that the generated income flows partially into investments which can permanently raise the standards of living of the area was indeed extremely attractive. Here at last was a concept of the truly balanced and harmonised development of an area for self-sustaining growth. Such a growth of balanced development was bound to add the conservation parameter to its conceptualisation. Integrated development and ecological preservation are after all highly akin to one other for both views take a broad view of development and give strong credence to the principle of balance.

However, the ecology aspect of the project must be interpreted in terms of a dynamic balance. This idea of a dynamic balance may be too vague in the abstract - I shall try and interpret it in practical terms by giving an example of potential applicability. The integrated hill project has forest preservation and regeneration as one of its aims. However, this tends to clash with both the desperate need for fuel (firewood) and building material (wood) in the area on the one hand, and with another project objective, the development of animal husbandry (the need for grazing land), on the other. This dilemma can be solved if in afforestation strong emphasis is placed on fodder trees. All farmers that keep animals have a vested interest in preserving fodder trees. Therefore, development and preservation go hand in hand instead of conflicting with each other if the right trees are chosen for the purpose of afforestation - and a new self-perpetuating dynamic balance between ecology and developing the standard of living through animal husbandry can thus be achieved. This is, of course, but one instance; all planning which takes the ecological system into account has to be of this kind.

3. The Ecology of the Project

Each project is a new socio-economic variable introduced into the social environment of the region. By its economic actions, its administrative style and its social behaviour it affects and alters the social environment of the region, and the project itself is in turn affected by the atmosphere it generates

and the reactions it induces from this environment. Its success in working harmoniously with the environment and its failures which alienate the people of the area or set off conflicts will be important factors in determining either the swift and effective execution or the slow progress and minimal impact of the project. This interaction with the social environment of the area can be referred to as the project ecology or the administrative ecology of the project. It is in terms of this somewhat loose and analogical concept that I would like to discuss the practical application of the "integrated hill development and ecology approach".

The SATA-Nepal Project has come into an area in which large foreign projects are nothing new. The Kodari Road and the Sun Kosi Hydel Project have already influenced the attitudes and expectations of the surrounding people. It is inevitable that the people of this region will compare the styles of operation of the SATA-Nepal collaboration with that of the two previous China-Nepal projects.

In Chinese projects the system of small, piece-work contracts, the exceptional attention paid to and empathy for the needs and proclivities of the local people, the willingness on the part of the Chinese technicians to do the most menial, arduous and dangerous work themselves, and the assiduous and studied respect for the local leadership structure - made the projects work with unusual smoothness and harmony in the social environment. This was perhaps principally due to the fact that the vast majority of the income and employment benefits went to the people in the region surrounding the project. It is natural that with this backdrop, variations from the norm of expectation set up by nearly a decade of foreign aid experience should cause resentment and discords. However invidious comparisons may be, there is little doubt that any new foreign aid project coming into this area must live with the reality that the measuring-rod against which they will be compared will be this decade of past experience.

Of course, there are major differences in the situation. The inhibitive cost of occidental technicians means that the vast supervisory technical manpower that China could afford for controlling and checking the small-contract system is simply out of question for the Swiss. In the absence of detailed and effec-

tive supervision and control, a small contract system leaves itself open to tremendous abuse and corruption. Yet tendering for large contracts means that due to the absence of big contractors in the area, the income and economic benefits go to people outside the region. This means not only alienating the the very people of the region whom the "integrated" approach aims at helping, but also violating the very "approach" or concept of the project. For if the income generated at the construction stage is tapped mostly by people outside the "service areas" of the road, then very little new private income and savings will be available in the area for channelling into the other investments that are to raise the productivity of the region and consequently traffic on the road. In effect this cuts off the crucial link that integrates construction with area productivity and road use.

What we have here is a dilemma between direct short-term and indirect long-term benefits. For instance, it was decided on efficiency grounds to award the majority of building contracts in the "Thulo Pakhar" complex to a person not living in the influence area of the road. Even if the buildings were built a little quicker and somewhat better, the costs in terms of loss of empathy with the Pakhar area will be a great set back to the introduction of new inputs and techniques for raising farm productivity.

Secondly, since the contractor and much of his labour force were outsiders, money has leaked out of the project's influence area and consequently far less surplus is available to be invested in the other projects such as fruit farming. In fact, this factor may contribute to the reason, why fruit sapling distribution has been so poorly received in the area today. Thus efficiency considerations in the short-term may have entailed long-term "indirect" costs both in terms of loss of empathy with the local people, and in terms of the loss of potential investments which could have been fed back to other items of the "integrated programme". In future therefore in decisions regarding the project, it may be highly advisable to make a careful evaluation of the "longer-term" social benefits and costs.

As this small example indicates, it is absolutely vital to retain the small contract system in road-construction if the "indirect" benefits of the con-

struction process are to be maximised and if there is to be a "feed-back" of the incomes generated at the construction stage to the production raising aspects of the integrated programme. Clearly the critical problem here is to devise a supervision and control system for small contracts which can avoid the major pitfalls of corruption and poor quality-control inherent in the small-contract system. Here again I suggest that once it is realised that a small-contract system is supervision-intensive, the design of a good control system is surely not an insuperable challenge. For instance if overseers tend to be venal, a system of cross-checking their work by an engineer on a random-sample basis may get rid of much of the abuses. At any rate big contracts are no more immune to corruption and venality than small contracts - they are merely comparatively easier to supervise. But big contracts are also regressive in distribution, and tend to draw away savings and income from the area. Whereas small contracts by their very nature favour the small-man and create a surplus for investment in the influence area of the project. So the challenge of formulating an effective system of working with small-contracts must be undertaken by the SATA-Nepal project despite its difficulties. After all there are no short cuts to development and only if you try to solve the difficult problems can you have successful development strategy. The "integrated development and ecology" approach of the project, while it is excellent and most welcome in concept, has not been applied with the rigour and fidelity that this concept requires in actual execution and practice.

Short-term efficiency considerations have led the implementators at the early stages of project work to find short cuts which by-pass the concept. This is particularly worrying because it is beginning to alienate the local people and may give rise to a discordant atmosphere in the social environment that will minimise the impact of the project. It is for this reason that I have drawn attention to what I loosely call the "administrative ecology of the project". However, no irretrievable damage has been caused so far. If a genuine effort is made to regulate implementation and bring it back in line with the concept put forward in the original plan of the integrated programmes, any emergent discords in the project can easily be corrected. For the programme in essence and concept is one highly suitable to the development problem of the area. The whole point of an "integrated programme" is to tie-in the "indirect" benefits

of each individual project with the direct benefits of other projects and vice-versa, so that in defiance of arithmetics you can get the whole (total benefits) to be considerably greater than the sum of the parts. This is an extremely difficult task to plan and even more difficult to implement, since the degree of coordination and synchronisation required is immense. Yet the whole appeal of the "integrated hill development programme" was that it planned to take up the gauntlet of the difficult programme. While realising that the programme has set itself a very difficult task and that the present teething-troubles are natural at the start of such an arduous programme, one cannot but wish that future implementation will follow the complex design of integrated development with complete fidelity as originally planned.

4. Summing-up

The case study of the planning and inception of this project is of great interest in that it tries to take the development and ecology of an area as a combined whole and integrate all aspects in a balanced framework. The fact that it has been taken up in an area where other major projects have been carried out in great harmony with the social environment means that the new project has to measure-up to very tough standards in implementation style. The novelty of the project is its integrated concept. At its inception, some compromises were made in favour of technical efficiency which affect the concept of integration.

Both the style of operation and the impact on the original plan that this compromise entails have had unfavourable repercussions on the social environment. It is argued therefore that a return to the original concept of integration and balance in implementation style, will yield greater long-term returns. However, in the concept of ecological maintenance, balance needs to be interpreted as a dynamic balance if development and ecological maintenance are to be pursued as a coherent policy.

4.4 THE VOICE OF THE FARMER

The people have no memories of a time when this region was not inhabited. Those who don't know about it assume that it must have been settled sometime in past history. Actually the Tamangs are the people who settled first on these hills. It is about the twelfth generation living in Dandapakhar at present.

1. Introduction

"The voice of the farmer" has been gathered from open and free talks with aged farmers from Pakhar area in Sindhupalchok District. The involved population (Tamangs, Chhetri, Brahmins, Damais, Kamis and Sarkis) can be considered as typical for the upper hills in that region, covering a wide range of the socio-economic structure. Remarks directly related to the recently started project in that area have not been included as the ones directly involved in the project may have given too many sponsorship answers. The talks were held and edited by N.B. Chhetri, Liaison Officer, IHDP; B.N. Dahal, Assistant Agriculture Officer; P. Egger, Agronomist; G.B. Tamang, Junior Technician.

Pakhar area was chosen, as those who have made a resume of the talks here are quite familiar with the conditions and farmers of that area, and can to a certain extent judge how differing answers have to be understood; what can be taken as proper personal views; what has to be considered as a reflection of the questioning and the herewith connected aspirations of the farmer only. In the beginning we only had occasional talks in which we showed great interest in the situation of the farmer, his relation to the environment and the changes he had observed there since his youth.

Very frank questions were asked and we observed that the farmers were willing to talk freely about their farming experiences and difficulties quite early on. They realise that changes are taking place, that the environment is changing

quickly, that the forest and fodder resources are being destroyed, and they lament these facts. However they do not give the matter any thought: that is just the way things are.

Later on, piece by piece, the good land of the Tamangs down in the valleys was taken over by the Brahmins and Chhetris who migrated here only some 5-6 generations back from Udaipur and Kathmandu. At that time it was not difficult at all to get land over here. The immigrants only had to offer a jar full of curd or rice beer and a silver coin as a sign of due respect and humble request to the Talukdar, the headman of the village, and then he would give them some fields. The first settlers were soon followed by some of their relatives. Then the Brahmins and Chhetris were followed by the Damais (tailors), Kamis (blacksmith) and Sarkis (shoe makers).

The following statements reflect the opinion of the farmers: As a result of dividing up the land between brothers - and in the Tamang community between sisters too - it became scarce. The new land put under cultivation was more and more of marginal productivity. Nowadays hardly any arable land even on the opposite northern slope has remained. Within a very short time all that land has come under cultivation. More and more people have to live on less and less land.

2. Migration

When the land resources got scarcer some young men started to go to work in Assam and Darjeeling. The first ones to leave here went 42 years ago. Still more people had to migrate not only to earn some cash but also to make a new living somewhere else. It was a big relief when the late King Mahendra generously opened the Chitwan valley for settlers from the hills. Now it is getting more and more difficult to find land in the Terai and the climate does not suit us hill people either. Those migrants who still had some land they were not forced to dispose off, still have it cultivated by their relatives. Due to the worsening conditions in Terai, 5 or 6 families who are at present farming down there, are expected to return up here soon.

3. Forest

Among the changes in the environment the disappearance of the forest is the most striking one. Above Dandapakhar some ten years back there was still a dense forest. When somebody died we first of all had to send some people to clear the way through the jungle up to the ridge where we used to have the funerals.

Nowadays there are hardly any trees left up there. Nobody had enough power to protect that forest. When a small somehow protected part was still left, somebody put fire to it and then it was all cut down. We now have to get firewood from far away, from above Shildhunga or from the opposite slope of Pakhar Khola valley. This is always a full day's work for a backload of firewood. Very few of us in the village have our own trees, which we can use for fuel purposes. The few remaining trees too can often not be utilized by their owners, as the leaves are stolen in the night by others.

Fire was used to open up new land. Where the newly claimed soil was not fertile enough, we collected dried sods, weeds, and cut bushes and burnt them. In those places where there is enough ash we can get a very good potato crop.

Nowadays some bad people light fires in order to get firewood more easily. Cow herds and children also light fires. Like this all the jungle goes. If it continues like this there will be no way out for us.

So far we have not thought of planting young trees ourselves; there was always enough jungle. Only now has it become troublesome to collect firewood. If we get small trees we may plant them somewhere on our land. The forest now belongs to the government. We will only look after it if we can also get something out of it for our own use.

4. Fodder and Livestock

used by those who have their farms closer to those pastures. We haven't any more big flocks. We have to keep the cattle on the farmland as much as possible in order to make the most of their dung as manure. Instead of cows we have more and more buffaloes. They eat all the straw which is not used for thatching, we get good manure, can eat their meat without difficulty and get even more milk.

However, we do not have enough fodder for our cattle. Fodder in the jungle has disappeared very rapidly and we have to depend more and more on paddy and wheat straw which was hardly ever fed to animals in former times. Those who have some fodder trees and enough straw have increased the number of their cattle.

Everybody is keen to have more but the ones who rely to a large extent on forest and pasture have now less cattle than they used to, not only per farm but also in their hamlet. In the dry season some of us now have to take the cattle to the cowshed on the other side of the valley where some forest still remains. We use the manure partly on newer fields over there but we get less and less grain yield from that side. And the length of time we can keep the cattle over here gets shorter.

The area which is pasture land gives little fodder. 25 years ago locusts which do not normally come here brought the seed of banmara. This weed is covering most of the area which used to be forest before. As its name "forest killer" says, it does not permit anything else go grow. A few want to do something to have fodder trees but we cannot plant them without taking a lot of the cultivated land. There are only a few with enough land to do so. The fodder has gone, tomorrow there will be even less "what to do? All has gone."

5. Farming

Some 30 years ago we still produced enough grain to allow us to exchange surplus for necessary daily goods, which we could not get from our farming. Of the grains we harvested, one third was exchanged. Some of it we took to Kutti in Tibet. For 1 pathi of rice we got 2-3 pathi of salt. Part of this salt we took down to Kathmandu and in return got yarn from which the women wove Khanri,

the cotton cloth, we had at the time. Since then prices have increased terribly. Instead of 8 paisa for one mana of rice we now pay Rs. 1.50, for 1 mana ghee we now pay Rs. 8.- instead of 12 paisa, for a milking buffalo Rs. 900.- instead of Rs. 32.-

Some new crops like cauliflower and potatoes have been introduced. Due to very intensive cultivation and manuring with goat manure we can now harvest 26-34 pathi of potatoes from 1 pathi potato seed instead of 15 pathis which was the harvest 10 years ago when we started with potato production.

In paddy we can also get much more. On a khet (irrigated land) where we used to get 25-30 pathi, we worked very hard and then got 50 pathi. Last year when we planted Taichung rice we even got 5 muri (equal to 100 pathi). While the good farmers who have enough cattle and do very intensive cultivation can still increase their yields, this is not the general trend.

In a khet where we sowed 4 mana of seed we used to get one muri of paddy; now we need an area with 8 mana of seed to get 1 muri. Our wheat used to have big ears and long halms and we filled 6 baskets (Doko) a day; nowadays it is sometimes only one to two. In many houses there is no longer enough food. For some the harvest grains are sufficient for only 3-4 months a year.

Why is there a decrease in yield? - It has just happened, we don't know why?. We just get less even if we put in the same efforts. The rain washes away the most fertile top soil every year. So we have to plough into the new unfertile soil every year. We have not thought of counter benching terraces up to now. If a lot of water however remains in the crop, it will be very harmful for maize and millet. We get all our drinking water from springs. The quantity of water we get from them is always the same. Only one spring has less water. Population and the number of houses are steadily increasing. However, we have less and less fuel and fodder, we cannot claim any more new land. How can we know what tomorrow will be like. Our children now go to school and soon the road will come up here. When this area gets developed it will be better for them and if we can get some other jobs, life will also be easier for us.

6. Comments

The main means of getting information on a farmer's life and economy is to observe how he lives and works and to hold different kinds of interviews. However getting the proper personal view of the farmer, and making him talk on those aspects of ecology which really touch him, proved to be even more difficult than expected. Farmers do talk very freely about things which concern them.

In the above statements, we have therefore made limited use wherever possible of genuine statements, using information given in answer to specific questions only when the talk on the general subject and the changes within the past did not give a proper view (e.g. the decrease of the spring water). Decrease of fuel and fodder are among the most severe concerns of all farmers. The expression one hears again and again is : the jungle has gone. The fodder trees have also gone. Striking and alarming is the relation the overwhelming majority of the farmers have towards the forest and the naturally grown pasture and fodder trees. The old exploitative attitude to the forest as an unlimited resource for common use has hardly changed. There are loud complaints that the jungle close to the village has been cut down in such a way that firewood has to be carried from a forest situated one working day away from the houses. That very forest is however treated very similarly to the one that has already disappeared.

The prevailing attitude to afforestation is that it is the Government's business to provide a solution, and they hesitate to invest anything in it themselves, for fear that someone else will harvest the fruits of their labour.

Those who have started to tackle the problem at the roots are a few outstanding individuals.

Statements concerning the future, and the way the difficulties experienced could be tackled were hardly made (see introduction). Though some farmers have a clear understanding of environmental changes, causative questions are mostly puzzling and embarrass them. The question, why it has happened like this and not some other way is not considered.

Expectations from development activities are sometimes very high. The eagerness to get some benefits from here and there are however higher than the intention and the strength to do something on their own or with others.

5 EXPERIENCES AND PROSPECTS

5.1 THE JIRI MULTIPURPOSE DEVELOPMENT PROJECT (JMDP)
a hard experience in mountain ecology and a very important learning-process in Nepalese/Swiss technical co-operation

by R. Schmid

1. Introduction

Nepalese/Swiss co-operation in the agricultural development task of the economy started with the preliminary study of the Swiss Forward Team in 1950/51. After visits and investigations in different parts of Nepal, they soon concentrated their efforts on the mountainous area of the country. The so called Hills are a permanent agricultural deficit area with a dense population and a high demand for either agricultural land or improvements in the productivity of the soils. The proposals of the Swiss Forward Team included different agricultural techniques well known in Swiss alpine farming, such as cattle-breeding and pasturing. Of course, the climatic differences were taken into consideration, but similarities between the ecosystems of the Alps and the Nepal Hills were not as great as one had anticipated. Mr. Schulthess got his own ecological experience while starting and gradually expanding milk collection and marketing in the Kathmandu Valley. More experience of environmental constraints and limitations was gathered during the 12 years of technical co-operation in the JMDP. As the planners of the JMDP were not sufficiently aware of these limitations, and no preceding ecological and socio-economic basic surveys had been made, some facts had to be learnt the hard way. Therefore, the aims of the first Nepalese/Swiss agricultural project had to be altered to a certain extent, since a deeper insight into the complex network of relations between nature (mainly the biosphere) and man had been gained. There still remain a number of similarities between the agriculture of the Swiss Alps and the Nepal Hills, but the ecological differences are much greater than foreseen.

The results they gained from their investigations into mountain-ecology will now be explained by a chronological description of some of the most important activities and decisions in the joint development effort in the Hills. Thereafter some conclusions will sum up the key factors to be respected in future development activities in the Hills.

2. The Implementation of the Buffalo-Breeding Project in Jiri and the Later Changes in the Project Concept

2.1 The idea of a buffalo-breeding station

During the construction and running of the dairy in Kathmandu and the cheese-plants in Langtang, Thodung and Pike, the very low milk production of cows, water-buffaloes and chowries was widely recognised. The cheese-plants could operate successfully but the solution of the problem of the enlargement and overgrazing of the pasture and forest-areas, e.g. compensating for low milk yield per animal by a greater number of animals, remained far off. One of the most important and common ruminants (without religious taboos and free of tuberculosis) is the water-buffalo. From 1957 on the Nepalese Government and the FAO had planned to start a buffalo-breeding project in the Hills. The aim was to improve the milk yield and the meat production capacity of the local buffalo by cross-breeding them with Murrah-buffalo imported from India. The new breed had to be tested on pastures in different altitudes and with different fodder.

2.2 The choice of location for this breeding-station

As the need for arable land in the Hills is very great, it was impossible to buy all the farmland in a valley which could be transformed into pastures and fodder-production-fields which was necessary for this station. Farmers need their land urgently and do not like to sell it even for good payment. Even if expropriation with compensation is legal, a development project should work in harmony with the neighbouring farmers. This would not have worked satisfactorily after an enforced expropriation. Therefore, land already belonging to the government had to be considered. Of the different areas in the Hills the bottom

of the Jiri Valley in Dolakha District seemed to be the most suitable from the point of view of altitude (1800 m above sea level) and size. FAO started the breeding programme there in 1957. But - the valley bottom consisted of swampy soil which had to be drained for the later construction of the STOL-airfield. Moreover, the soil quality is completely different from the soils on the hill slopes where most of the Nepalese farmland is situated. Many plants which grew successfully in the valley bottom did not grow well in the fields of the farmers and vice versa. The quality of the soil, a major ecological factor, had not been sufficiently taken into account.

As initially only buffalo-breeding and testing were envisaged, and no other agricultural tests and programmes were planned, the quality of the soil did not seem to be very important. After the expansion of the aims of the project, this became a great obstacle, but by that time the location of the project could not be changed anymore. After 15 years of experience, the location even of Jiri seems to be too high for optimum buffalo-breeding. The buffaloes were therefore transferred to a lower place in 1975.

In addition, the fact that Jiri was very remote proved to be a further difficulty, especially during the initial stages of the project, both for the Nepalese civil servants and the Swiss technicians. The seven day's walk from Kathmandu hampered to a large extent communication between His Majesty's Government, the Jiri Board, SATA and the project executive as well as the necessary transport operations.

On the other hand, Jiri was the first agricultural project in the hilly part of the country, whereas most of the Nepalese and foreign activities concentrated on the easily accessible and economically very promising Terai and the Kathmandu Valley.

2.3 Some ecological constraints necessitate a change of the project concept

In 1958 a cattle-breeding specialist of SATA continued the FAO activity in Jiri. He constructed various stables, barns and living quarters for the staff and started the breeding with great impetus. His medicine chest was soon well

known in the surrounding villages, and quite often he was more occupied with medical treatment than with his main business. He asked for a nurse to assist him. These medical activities, which finally led to the construction of a district hospital in Jiri in 1963, had a great effect in creating trust between the technicians of Jiri and the local population. It was the underestimation of the health-situation which led to the first widening of the project. But the underestimation of the land's ecological capability of integrating the newly bred buffalo into the local farms brought about a chain-reaction of new project ideas and additional changes in the concept and philosophy of the project. First of all it became evident that there was not sufficient fodder in the main farming zone of the Hills for the proper feeding of the improved strain of buffalo which consumed greater quantities and needed better qualities of fodder. A detailed ecological survey at the beginning of the Jiri-Project (including estimates of fodder production capacity) would have made this problem apparent well in advance, but unfortunately a survey of this kind had not been conducted. Under-nourished improved buffaloes proved to be less productive than expected (only with optimum feeding did they show much higher yields than the local breeds) and were quite prone to animal diseases. Proper feeding became one of the main problems. Therefore the technicians envisaged an improvement of the classical pasture and pasture/forest areas which are situated above the usual zone of field crops or on bad quality land within the agricultural zone. In this they were dealing with a very delicate sector of the Nepalese Hill-ecosystem.

During the last century man in search of more arable land had greatly extended the terraced fields. This activity had its roots mainly in the natural growth of the population (another ecological factor) and in the decrease of non-agricultural occupations in trade and handicraft after the treaties of peace with Britain and China in the nineteenth century, and in the policy of isolation during the Rana rule. These treaties limited trade movements between India and Tibet, a service which had brought great wealth to the Nepalese and had enabled them to buy and bring additional foodgrain to the Hills from the outside. Increasingly the farmers had to be self-sufficient, and therefore marginal land was taken into cultivation: very steep slopes became permanently terraced, pastures were occasionally burnt for the cultivation of potatoes, and the forest cover was reduced year after year by tree-felling and shifting cultivation

and was finally destroyed by animals in search of fodder. On the permanently farmed fields the soil showed signs of exhaustion and the yields declined slowly. Another reason for the great distortion of the ecological balance in this region was the deforestation due to charcoal making for the iron smelting and smithies in the surroundings of Those (only two hours walk from Jiri) and due to the Daphne-paper making.

Intensive fodder production for the newly bred animals on the terraced Khet and Pakho-land was out of the question because every square metre had to be used for growing foodgrain (Rice, Wheat, Millet, Maize, Barley, Buckwheat) for human consumption. From the point of view of the farmer this is the most productive and most remunerative method of land use, and he could not contemplate reducing the area of foodgrain cultivation.

With the experience of four years' work in Jiri, but without a detailed land-use map of the area, the project policy makers were at least aware of the ecological difficulties in the pasture and forest area. They felt the interdependence of population pressure, the demand for arable land, the demand for fuel and wood for building, the necessity of using the forest as a fodder-source in the dry season, the demand for more pasture land etc. and they also recognised the heavy losses of arable land by the increasing erosion. It slowly became evident that a sectoral approach of the socio-economic problems of the Hills by improvement of the buffalo as an isolated measure could not stimulate the Hill economy which was organised in a bad, but nevertheless operative way. For the first time a kind of integrated approach was to be tried, and in 1964 the description and aims of the project were revised and fixed in a new agreement between His Majesty's Government and SATA. The project had got a multipurpose character, and therefore the name was officially changed into JIRI MULTIPURPOSE DEVELOPMENT PROJECT. In the new activities were included many ecological parts such as proper forest management and forest protection, afforestation, better use of the scarce wood resources, pasture improvement and rotation, separation of pasture and forest areas and measures for the control of erosion. But additional activities have to be mentioned as well: The construction and inauguration of a primary, a middle and a high school at Jiri and the organisation of seminars for the teachers of the Jiri area; the running of a carpentry and a smithy by the civil engineering section which was also involved in the im-

provement of bridges, the construction of school buildings, blackboards, drinking water schemes and irrigation canals in different surrounding Village Panchayats etc.; preventive medical treatment such as vaccination against smallpox was organised by the medical section; a co-operative store and a bank tried to reduce price fluctuations of foodgrain in the open Saturday market of Jiri and to reduce the heavy indebtedness of the farmers; but the main aims were the buffalo-breeding, the conducting of agricultural experiments in Jiri and the extension of the trial results either by training and demonstration in the JMDP or by visits to the farms in the different villages of the so called extension area. This extension-work included seed treatment, cattle feeding, compost preparation, the breeding of pigs and poultry, the distribution of improved seeds and fruit trees etc.

The supervision of the different activities in the JMDP was in the hands of the so called JIRI BOARD, which was composed of members of the Ministries concerned and the Swiss Team leader. As the discussion about project aims and new priorities was lengthy, it proved to be very difficult for the Jiri Board to call for a meeting. This was partly due to the organisational structure of the Board, partly the result of the remoteness of Jiri, a problem which could not be decisively reduced by the installation of a wireless connection between Jiri and Kathmandu.

A great improvement came about with the construction of a STOL- airfield in the Jiri Valley, but even then the interchange of ideas between Jiri and His Majesty's Government remained insufficient.

In 1966 the management was handed over to a Nepali agronomist who had received part of his training in Switzerland. He was able to improve the communication gaps to a great extent, but then was transferred to another development project very soon by the Ministry of Agriculture. In the short time of his directorship he extended the area of influence of the JMDP very much without being able to increase the number of technicians and JTA (Junior Technical Assistants). Jiri covered most of the Ramechhap and Dolakha Districts and included parts of the Solu-Khumbu District, but the density of attendance in the extension area became very low and a lot of time was wasted walking between the project-centre

at Jiri and the distant extension areas. From the ecological point of view I would state that a high density of integrated activities in a limited area and under permanent guidance, discussion and control (if necessary) better effects the introduction of long-lasting changes in ecological behaviour, e.g. in the relationship between man and biosphere. This change is a slow educational process to a great extent. For this purpose a close contact between the project staff and the farmers is an absolute necessity. On the other hand we have to understand the intention of His Majesty's Government to stop the most severe ecological excrescences all over the country as soon as possible and to demonstrate that the Government takes care of the problems of the farmers in the remote Hills. (The extension of the area of influence was simultaneous with the "Go back to the Village"-campaign started by the late King Mahendra). Moreover, the creation of a small and artificial development oasis with a higher standard of living within a neglected Hill zone had to be avoided. However, the benefits of the extension-work in the distant part of the JMDP-area remained marginal and mainly psychological.

2.4 The evaluation of the JMDP

The project staff met many difficulties, and sometimes the opinions of the Hill farmers and the technicians (Nepali as well as Swiss), with regard to ecology, were contradictory. The learning process was twofold, and I am convinced that the Integrated Hill Development Project (see chapter 5.3.) today benefits directly from the experience gathered in Jiri by the "trial and error method". But financially, benefit was not as great as expected, and the price for this experience was rather high.

During the evaluation of the JMDP in 1967/69 it became clear that a detailed, comprehensive and accurate basic survey would have promoted better understanding of environmental problems. Some of the bad experiences could probably have been avoided. A survey of this kind should of course include an inventory of the natural resources (distribution of different farmland qualities, mineral, dense forests, pasture, unproductive land, number of animals, density of population, potential and actual erosion areas etc.), and analysis of the economic situation of the region as a whole as well as an analysis of the economic activity of an average farmer, and of course, the social context should become

transparent. This is, of course, a very great challenge and many information gaps will have to be filled within a limited space of time. One of the methods of producing an inventory of the natural resources within a limited time is the drawing of a land-use map which can be based on the interpretation of air-photos. The delimitation of the ecological problem-areas is a must in all future air-photo interpretation.

As there already exist two or three air-photo coverages of parts of the eastern Hills (photos taken during the last ten years, especially for the Forest Resources Survey), an analysis of the trends of land-use change and loss of arable land as well as of forest deterioration could easily be done.

However, it has to be emphasized that it is still quite difficult to collect basic demographic, economic and sociological information from the local population and the Village Panchayat executives. The accuracy of the interviews has improved to a great extent during the last 20 years, but must not be overestimated. Still, most of the surveys have to start from the very bottom and therefore they are very time consuming. An optimal point must always be determined where the conducting of further surveys has to be reduced and the practical work has to start (see chapter 5.4). This is especially relevant for developing countries, where time becomes more and more scarce. Finally it has to be emphasized that survey work should be done as far as possible by capable Nepalese scientists or at least in close co-operation with Nepalese students.

The last extension of the multipurpose character in the JMDP was the addition of a Panchayat Training Center. This institution was created to give a basic administrative training to the Panchayat executives of the remote villages. This center became a very important meeting and instruction-point, for instance for the training of forest rangers in Hill forestry and erosion control. The JMDP installations were an excellent demonstration-ground for the different development sectors.

After the submission of the evaluation report the Swiss partner was willing to continue working on the JMDP with additional effort after further reconsideration of the integrated approach. The agreement between His Majesty's Government and SATA, signed in 1964, had been supplemented in 1967 and had to be re-

newed in 1970. But the Nepalese Government was not willing to continue the project in co-operation with SATA. On the contrary, the Ministry of Finance wanted to continue the JMDP with their own financial means and responsibility. This decision was firm and was accepted by the Swiss partner in a positive way, even if some sectors of the JMDP did not seem to be sufficiently independent yet for a hand-over. After the successive departure of the Swiss staff during 1971 the project continued sometimes with great success, sometimes with great difficulty under Nepalese management. Fortunately the forest section worked very well and could maintain a certain ecological control in the forests and in the fight against erosion.

3. Some Conclusions

3.1 No development project - either sectoral or integrated - should start on a full scale without a basic ecological survey. Ecology in the widest sense of the word includes the inventory of resources as well as the formal and functional structure of economic and social relations. This is a task involving many disciplines, including Natural Science, Social Science and Economy. Part of these basic surveys can be conducted by interviews, field-observation, sample taking, traffic counts, air-photo interpretation, thematic cartography etc., but another part can only be gathered by field experiments. A step by step phasing of the start of a new development project is therefore recommended, and the first steps should include both confidence creating measures as well as field experiments to determine the form and function of the ecosystem. Neither the Natural Sciences, Sociology nor Economy can in themselves provide a comprehensive analysis. Only an inter-disciplinary appraoch can fulfill this aim in the best possible way, and the practical difficulties involved in the collection of demographic, economic, ecological and social data are remarkable. Difficulties in communication can be reduced by the co-operation of Nepali Scientists with expatriate investigators during the survey period of a new project, and close co-operation during the execution of the project is, of course, of great importance.

3.2 The past two decades of HMG/SATA co-operation have proved that only an integrated project approach in the Hill ecosystem has a real chance of stimulat-

ing the process of development in the population. The sectoral approach often induces change for the worse in other sectors of life by creating benefits in an isolated sector. But integrated development work usually demands much greater financial engagement, and it would be too optimistic to think that no negative interactions between the different sectors of the environment and the social groups would take place. But a permanent discussion between Nepali and expatriate technicians in the field, including the local population, should enable the team to carry out the integrated project as a whole in the way planned.

3.3 The development activity in the Hills of Nepal is, from the point of view of Regional Planning an absolute necessity. Nevertheless, the new projects should be more easily accessible than Jiri, in order to improve the communication and mobility of the field team as well as of the supervisors in Kathmandu. Therefore a minimal infrastructure, in the form of a jeepable road, should penetrate the region concerned. This experience is one of the basic factors for the IHDP project.

3.4 The ecological environment is a very delicate dynamic system. It will never be possible to predict every reaction of this complex with absolute accuracy. But this does not relieve us of the permanent effort to evaluate the recognised reactions and later to improve the knowledge of the man/biosphere-system. This feed-back will enable us, in the long run, to reduce disappointment and wrong conclusions and to improve decisively the living conditions of the Hill population of Nepal.

5.2 APPLICATION POSSIBILITIES OF ALTERNATIVE ENERGY RESOURCES IN NEPAL

1. Introduction

Researchers around the world have started to discuss problems related to alternative energy resources. As a matter of fact, most nations have been forced by the situation resulting from the oil crisis to search for new energy sources. In addition to the consequences of oil price rises, Nepal faces a number of additional problems related to the ecological situation within this country: Because of the growth of its population, the limited forest resources are reduced every day, thus creating additional negative developments like erosion. During the coming years, Nepal will face additional difficulties in being able to allocate sufficient hard currency for the purchase of the required oil products, which, like a number of other basic raw materials, are getting more and more scarce.

These are some of the reasons, why research and development of alternative energy resources has also become a must for Nepal. For the time being, practical experience in Nepal with alternative energy products is very limited and only few basic data on this new technical field are at the researcher's disposal. However, there is already a broad range of products which could help the country to solve at least some of its energy problems and which could generate additional job opportunities.

If we speak of alternative energy resources in Nepal, we understand energy alternatives to the two main traditional supply sources:

a) Fuel like wood, straw, cowdung, sawdust etc.
b) Oil-products like kerosene, petrol, diesel oil etc.

As an alternative to these raw materials, natural energy could be converted into usable energy like electricity, gas, heat etc. In order to transform such natural energy, certain technical devices are required such as have been

developed and manufactured in Nepal by workshops like Balaju Yantra Shala Pvt. Ltd. or the Butwal Technical Institute, based on existing designs from other countries.

Our practical understanding of the term "alternative energy resources in Nepal" can be defined as follows: The natural energy resources available in Nepal, namely water, sun, wind and gas should be transformed by a simple technical device into a form which would allow the inhabitants of this country to use these new energies as an alternative to oil products and other fuels. Furthermore, such new energy sources should, from the economical point of view, prove cheaper in the long run than the traditional energy sources and should also contribute to a balanced, ecological development in Nepal.

We are fully aware of the fact that in the light of our definition of the term "alternative energy resources" HMG has been working on this line for quite some time. A number of hydro electric power plants have been and will be constructed, and this new energy has provided a substantial substitute for oil products and heating materials. (e.g. Trolleybus-line Kathmandu-Bhaktapur, electro-motors, electrical stoves and cookers). However, due to distribution problems and limited capacity of the plants, this form of energy will, for the next few years, be only at the disposal of roughly 3% of Nepal's population in a few centers like Kathmandu Valley and Terai region. A number of areas, mainly in the hills, will have to wait for years until they will benefit from the production of large hydro electric plants. Furthermore the distribution of electricity is extremely expensive and other scarce raw material has to be used.

For the implementation of alternative micro energy projects, the following criteria should be taken into account:

- alternative energy schemes should be established in regions not likely to receive energy from a large hydro electric plant.

- alternative energy schemes should be created, based on a decentralised concept, taking the following points fully into consideration:

- consumers of the alternative energy should live within a short distance of the plant, in order to save distribution costs.

- the lay out of an alternative energy scheme should be calculated in an optimal way, guaranteeing a maximum consumption of the installed capacity.

- on sites chosen for the installation of alternative energy schemes the required natural energy (e.g. wind, sun, water) should be available in abundance, allowing a later expansion of the plant in case of increasing energy demand.

During the research and development period of the undermentioned products, such criteria have been taken fully into consideration. Our main aim would be to substitute imported or scarce energies by the transformation of natural energy, which is available locally and could be consumed locally.

2. Small Scale Water Turbine Installations

Vertical axis water wheels have been in use for many decades in Nepal. They are used mainly to drive simple traditional flour mills. Their low efficiency and limited size make them adequate for this purpose only.

Balaju Yantra Shala already started producing a small propeller water turbine in the early sixties. About ten of these turbines have been installed even in very remote areas of the country. With a power output of maximum ten horsepower, these turbines are driving various mills and thus provide a reliable substitute for diesel plants.

A few years ago, a new turbine was introduced by BYS. With this cross flow turbine, the upper limit of output is at present 55 horsepower. The transportation difficulties which exist in Nepal were taken into account when this turbine was designed: The single parts may be carried on men's backs and assembly at the installation sites is quite simple. For low-cost installations,

the power transmission is preferably mechanical as it was with the previous propeller turbine. A few plants of this kind have been installed and are operating trouble free with the expected efficiency. Further valuable fields of application are possible by transmitting the mechanical power to water pumps for irrigation and drinking water supplies.

Besides such projects using the mechanical energy produced by this turbine, electricity generation now becomes possible on a rather small scale, with an output of 20 to 40 KW. This presents a true alternative to the extremely costly electricity supply by means of high tension lines from one of the large hydel projects, besides which it is an alternative for all kinds of organic fuel.

An ideal project would be one which uses the electricity in the first place to run cottage and small scale industries and, alternatively, supplies electricity for domestic purposes. Such a project would guarantee the full use of the plant's capacity, thereby making the project commercially viable. If the supply is exclusively for domestic purposes, costs might be too high because villages are often situated on ridges and hill tops, requiring a comparatively costly high tension line from the plant to the consumer. It may prove impossible for many individuals to pay a monthly electricity bill if the rate is calculated solely with accepted formulas of return on investment.

The idea of decentralized mini-micro hydel plants is quite new for Nepal. Thus the creation of a government agency which supports such activities with high priority is at a very early stage. Although river gauging data are available for the main rivers of the country, no or only very few gaugings have been made in the numerous small streams and rivers which are ideally suitable for turbine installations of this size. Flood water levels and minimal flow of these waters are unknown and pose certain risks for the installation of such plants. Furthermore, there is as yet a complete lack of experience with low-cost intake structures, the silt problem and cheap earthen canals for this size of turbine installation in heavily erosive areas.

Electricity generation brings with it a certain degree of sophistication. This calls for skilled labourers for the operation and maintenance of the equipment. Even if this manpower is available in urban areas, it may be dif-

ficult to appoint skilled operators to a remote corner of the country.

For large areas which, for many decades to come, cannot count on getting electricity from one of the big projects, Mini-Micro Hydro Plants represent a feasible contribution to the energy needs of the population. Although many problems remain to be solved, such projects will, if given high priority, improve the standard of living of many people in the near future, thanks to relatively short planning and construction periods.

3. Gobar Gas

The increasing time required to gather firewood for many villagers, leads to a chain of negative reactions: Farmers start to use cow-dung as fuel, withdrawing from their fields the much needed fertilizers which, for economical reasons, cannot be replaced by other means. This development could be stopped by introducing methan gas gained from animal's dung, an alternative, which has been partly used in India since the beginning of this century. Such an alternative energy source will be economically viable in most cases, where kerosene, wood and other fuels are becoming limited.

In order to win methan gas from cow-dung, a so-called Gobar Gas Plant is required, transforming animal's dung into the following two main products:

- Fuel Gas — This fuel gas is a colourless, odourless and non-poisonous gas. The dung of one cow mixed with water will provide enough gas to cook the daily food for two persons.

- Manure — The fermented liquid (slurry) is fully digested and has as a result a higher nitrogen content than the original cow-dung. It therefore becomes a valuable fertilizer.

The positive results of this plant are obvious: Traditional energy is replaced by the gas, the cow-dung is not lost but saved as an improved fertilizer for agricultural needs.

The working principles of such a plant are very simple: A pit, constructed with locally available materials (bricks, stones etc.) forms the main part. The volume of this pit should be 30 to 40 times the volume of the daily required gobar/water mixture (slurry). On top of this pit, a metal drum is fixed, collecting the gas produced during the 24 hours fermentation process. At the same time, this metal drum floating on the slurry provides the necessary pressure for the gas to flow through the attached pipes to the consumer. The installation costs for such a plant are often too high for the budget of a farmer, however, with governmental aid a substantial implementation programme is now being pushed.

Nepal formed a gobar gas committee in spring 1975. Before this time, only a few units had been installed, the first one about 15 years ago in Godavari, Kathmandu Valley. Now, the agricultural year has given an interesting uplift to the implementation programme of gobar gas plants. During the years 1976/77 approximately 150 plants will be built in the Kingdom.

The output of a gobar gas plant depends not only on the available cow-dung, but also on the temperature. The best working temperature is around 32 centigrade. This gives the lower regions of Nepal a natural advantage for the use of gobar gas compared to the hilly and mountainous regions, where the firewood situation is worsening due to the decreasing forest resources. This asks for new solutions: In cooler places, plants have to be insulated or heated, for instance with solar energy. For the application in the hills, the size of the drums should be small enough in order to facilitate transport. If, in the long run, solutions and possibilities for the manufacturing of cheaper plants can be found, such gas producers will have a bright future.

4. Wind Energy

Can we harness the wind? This question is asked by more and more individuals, manufacturing companies and other institutions all over the world. Many inventors even in ancient times have proved that this, at least to some extent, is possible. Today's question would be one of pure economics.

In whatever form the energy is produced by the wind, storage facilities must be incorporated for such a scheme, since one cannot rely on the wind to blow unceasingly. This storage, if one wants to produce electricity with wind energy, is the most sophisticated, maintenance intensive and costly component of a wind machine.

There are many imponderables in Nepal with regards to wind energy. Although average wind speed data exist for a few selected spots, one cannot expect these to hold true for other chosen spots in a very mountainous country. Collecting accurate data must be the first step, before a suitable wind-mill design can be chosen. Although Nepal is in the very early stages of "windmillisation", it should be possible for the first machine to be made in Nepal within the next few years. As in many other countries around the world, such a wind machine would most probably be attached to a pumping set, pumping water for irrigation or drinking water supply.

5. Solar Energy

Solar Water Heaters: The direct use of solar energy is certainly nothing new. For Nepalese standards it is not common to have hot water for household purposes such as bathing, doing the laundry, washing up in the kitchen etc.

However as the demand for hot water increases, more and more energy is required to supply this need. The common sources of heat are becoming scarce, wood, electricity or gas are maybe not even available. With the normal installations the cost of fuel increases with the amount used, and will probably become even more expensive in future. However, solar water heaters create no new dependencies once installed When fixed at the site they will produce hot water throughout the years without interruption. There are no real running costs as there is extremely little to do in maintenance (painting, tap-repairs).

The solar water heater collects the sun's energy on its black surface. The resulting heat is transmitted to the flow-through pipes or flat sheet plate

systems. These combinations are inside a weather proof box which is insulated on the bottom and sides.

The top surface is covered with window glass. If necessary an attached hot water storage tank can keep the water hot for some hours. The surface of the collector faces south at an angle of approximately 37^{o} (in Kathmandu) to the horizontal line. This provides a hot water supply of about 70 litres per square metre at a temperature of 55 - 65^{o} centigrade. Six to seven hours of sunshine a day are required and of course the more the better. There are numerous installation possibilities: Circulation systems, flat plate tanks in combination with existing or additional energy resources, depending on the hydrological situation (given head of water). Many of these products are already working very satisfactorily. Small units are often less costly than normal electric heaters. Solar water heaters have also proved very suitable for bigger installations. In the hills and mountains where the water is very cold the people would of course enjoy solar heated water.

Solar Motors: Studies are being made on solar motors. The material is ready and work on a test plant has started. Once completed it will be possible to pump water using solar energy, or run other engines. The system will work with normal collectors; the heated water will create pressure in a separate system of propane gas (a liquid with low boiling point). The pressure built up will be turned into a motor which creates mechanical energy.

Solar cooker: Studies and even a test model have been made. The results are however not yet satisfactory. Effective and cheap units are hardly available on the world market, and many of the practical problems have not yet been solved.

For example it is hardly possible to make a cooked meal depend on whether there is sun or not. The possibilities of heat storage have to be explored.

Many things are being thought over: how can solar heated water be made cheaper, are small units for mechanical energy, room-heating etc. conceivable?

The limits to the use of solar energy are not yet known, thus its potential is enormous. The economic feasibility of solar installations is not the only consideration; we should also remember that factors like saving of firewood, reducing the dependence on products from other countries and the avoidance of new dependencies, are some of the advantages of solar energy.

6. Closing Remarks

Nepal, facing not only the results of the international oil crisis, but also an acute national fuel crisis, needs a basic strategy to tackle and solve these problems. The alternative energy resources as mentioned before could play an important part in a balanced regional energy development. Such technical devices will however never become important, if no clear cut implementation programme is introduced by His Majesty's Government. Furthermore, as long as the feasibility of any alternative energy scheme is calculated on a strict economical basis only, not taking into account the much higher prices we will have to pay in the long run because of ecological damages caused for instance by reduced forests or the loss of nutrients to the soil, no existing alternative will be used on a broad scale.

We believe that a national research and development center could contribute a great deal to the development of new alternative energy resources and that careful long term planning could boost the implementation and installation of such schemes all over Nepal.

5.3 SOME BASIC ISSUES OF AN INTEGRATED HILL DEVELOPMENT PROJECT

by K. Voegele

1. Introduction

In other articles of this publication various aspects of how to maintain and improve the conditions of the mountain environment in the Himalaya regions, in particular in Nepal, have already been discussed broadly. Among other things it has been pointed out that as a result of the present behaviour of people a series of vitally necessary needs of the population can probably no longer be satisfied in the future.

We think that it is therefore not very interesting to repeat in detail in the following paragraphs, the technical and physical interaction of factors in the mountain environment or to discuss the reversible and irreversible damage done etc. and comment on all that from the point of view of a hill project.

Rather we should like in the present paper - which has been kept as short as possible and is therefore simplified and schematic - to concentrate on two problem areas of an institutional and economical kind which are in our opinion, besides the many other aspects, of great significance in an integrated regional project. - After a few introductory paragraphs in which IHDP will be briefly presented, we shall then get down to the problem of the sometimes contradictory targets of the project, to promote jointly both long and short-term aims. Following this we shall deal in another chapter with the discrepancy and differential set of expectations which can occur between the center and working base, the decision makers and those responsible for carrying out the various activities. In treating these two problem areas, we want to deal in a somewhat larger context with the further reaching question of why the forces fighting the ever more evident and increasing damage to the Nepalese mountain environment have not become stronger and more successful.

We must mention that our remarks reflect a mere 1½ years of practical experience.

2. The Integrated Hill Development Project (IHDP)

In order to make the following thoughts comprehensible, we shall here briefly describe what IHDP is and what it is trying to do.

If we look back to the history of the Project, we have at least to mention Jiri, which was the indirect result of some of the first activities of SATA in Nepal. The Jiri Multipurpose Development Project (JMDP) was a joint venture between HMG and SATA (for details see chapter 5.1).

When JMDP was handed over to the Nepalese authorities in 1970/71 the two Governments agreed to jointly carry out a feasibility study for a possible road leading into the Jiri area. - Based on the findings and recommendations of this report, which was established during 1971, the concerned authorities decided to construct a hill road of about 100 km length from Lamosanghu (on the Sun Kosi) to Jiri, with the obligation that this road should fit into the framework of an "Integrated Hill Development Project". Therefore all the planning and preparation as well as the first activities undertaken since that time have been based on the conviction, that a road project without the overall concept of integrated development would make as little sense as an integrated development project without a road. The two elements cannot be separated. Together they constitute the basis of IHDP. For the road construction HMG uses a 15 Mio Sfr. soft loan provided by Switzerland. The road should be completed by 1982. The other components of the project will be taken care of for at least 15 years. They are financed by grants.

The whole project's working area comprises about 1200 km^2 and is characterized by a high density of population and a considerable and ever increasing pressure on the arable land, on forests and pastures (there are more than 1000 inhabitants per cultivable km^2 living in the region - this figure is even higher than in Bangla Desh). It is a food deficit area, by about 20%, with an almost purely agricultural subsistence economy. The imprints of man's quest for food, fodder and fuel are visible everywhere, and the balance between hu-

man activities and natural resources is being destroyed.

The differences of altitude in the working area between 700 and 4000 m do not only imply a wide range of agricultural cropping patterns, but are also partly responsible for the variation in the social and ethnic structure of the population.

With the road as a backbone and taking into consideration the important fact that we are living in a system where everything is interlinked, the general aim of IHDP's work is to improve the standard and quality of living of the inhabitants of the project area, as well as to try to at least avoid a further widening of the gap between man's desire for better living and the available resources. At the same time we have to try to develop the region in a more even and homogenous way.

Expressed more concretely this means that the project has to work in the field of agronomy, horticulture, forestry, education, small scale and cottage industry, health and water management. The project should aim at producing more food, possibly introduce cash-crops, increase the general and practical knowledge of the people, protect nature and promote a better management of the forests, eventually utilize the comparative advantages of the area fully etc. Thereby the planning as well as the execution of the different activities has to be done in an integrated way. Only in tackling the problems jointly, can valuable solutions be found.

The work of IHDP shall be mainly oriented towards introduction trials, extension demonstration and training courses. But IHDP will not be a research organisation and will also not be an institution which lasts for ever or which creates a separate parallel structure to the already existing development institutions of HMG. IHDP will among other things plan and try out new programmes in the different fields of its activity. If they prove successful, they could be initiated in other hilly regions of Nepal as well.

After a planning phase of about 9 months, work was started at the end of 1974 in the influence area of the first third of the road (up to km 40). Out

of three planned service centers, which will function as the basis for IHDP's activities, Dandapakhar is the first one. Since December 1974 various activities have been taken up in agriculture, forestry, health, education and construction. The road construction started at the beginning of 1976.

3. Long-Term Versus Short-Term Target-Setting

In the IHDP Project agreement it is expressly mentioned that the project should set itself both long and short-term targets. The donor country should finance most of the longer term programmes, whereas Nepal itself will support, in the first place, activities which will have rather quicker results.

When walking up from Lamosanghu, which is the exit of the Jiri road in the west, to the first "Service Center" of the project, one crosses a little higher than 1800 m a ridge, adjoining which is pasture land on a slope facing south. It is relatively seldom that one finds such large grazing areas at this altitude, but it is a typical example. It is a public grazing ground which shines brown to red in the dry season (November-May) and is only green during the monsoon months. The height of the grass always remains about the same. The meagre production of the meadow is continuously consumed by roaming cows, buffaloes and goats. Only about four to five different grasses grow on this land. The less resistent species have disappeared as a result of permanent grazing.

The soil of the meadow is quite compact. In parts organic material is lacking. During the monsoon the ground becomes extremely slippery. The rain no longer penetrates but rather flows away without obstruction. If there is a lot of rain the meadow is turned into a wide flowing stream (the water remains clear), but in the areas where the slope becomes steeper and where the actual bed of a mountain rivulet begins, the water eats its way further and further into the sub-soil; in addition the start of the stream-bed becomes wider and is forced higher up each year.

An expert visiting the region would soon come up with the idea that a pasture improvement programme should certainly be started here: introducing more productive grasses and legumes, fencing, pasture rotation, rest periods, manuring, reduction of the animal population on the pasture etc. However, if you ask the farmers what they think of the suggestion, they tend to react rather skeptically: "Where will the animals get enough food from, if the pasture can only be used for a part of the year? Who can guarantee that the eventual increase in production of the pasture will benefit my animals? Other people would certainly send their animals in before me. Under these conditions I would not be able to contribute anything towards the maintenance of the pasture and of the fencing. It is all too risky for me. And in any case the total grazing area is needed for the villagers' animals. If it is sometimes forbidden to use the pasture land, some of my animals might die, in which case I could no longer cultivate my fields as I need the oxen for ploughing, and am also dependent on their dung, without which my fields would yield less. And then my family would have to go hungry."

If you then propose to the farmer that he should use chemical fertilizer on his fields (as a replacement of dung) in order to be able to relieve the pasture of his animals for a while, he will reply that he will gladly use fertilizer if it is free. He says that he does not have the necessary cash to buy fertilizer as well. From the point of view of the national economy, it is however hardly possible for Nepal to provide for some years imported fertilizer free of charge: Cash crops would first have to be introduced in the hills.

We shall break off the account of this talk here, although there were a whole series of other questions, connections and interdependencies involved. We believe that from what has already been said it is clear that this farmer as a result of his <u>own</u> economic situation is limited in his ability to place less significance on his immediate needs in the face of a possibly better, but all the same uncertain future. In order to satisfy his present basic needs he has to sometimes act in a self-destructive way. For instance he has to cut wood in the forest for himself and his family in order to be able to cook his meal. It is quite evident, that he alone cannot stop the slow destruction of the pastures and of the forest. We are faced with the fact, that

part of the basis for satisfying future basic needs is irrevocably destroyed.

In the project area of IHDP the majority of the population is living more or less at subsistence level. The natural resources (soil, forest, pasture etc.) are fully exploited. With the methods and means known to the farmers, it is hardly possible for them to extract more. An illustrative piece of evidence as to the general economic situation in the hilly regions can be seen in a recently calculated approximation made by experts. They ascertained that, "using a minimum subsistence income (that means the minimum which is necessary to feed an average size family and to purchase basic necessities), imputed net farm incomes showed, that about 97% of the farm families in the hills were below this line. If a "very small farm" is defined as one with an imputed agricultural income equal to one third of subsistence, 70% of hill farm families fall into this category." They conclude from these facts, that the poverty which exists in the hills is basically predicated by the ecological and physical conditions as well as by the population growth.[1]

From the above cited conversation and from many daily reactions of the mountain inhabitants we can conclude that the people have a very high time preference. This means that the hill population as individuals are very much oriented to the present. The present consumption is more important than that of the future. The problems of the present leave very little room for thinking about the future, for taking action which will benefit one's own children and grandchildren. - As a community however these same people aim at perpetuating their existence (society goes on for ever). Thus there exists a wide gap between the time preference of the individual and that of the community/society. The closer to subsistence level the people live, the wider this gap becomes, and the more difficult it is for each individual to make investments which will lead to "better" times for his descendants.

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1. A few decades ago one of the quite logical reasons for a family to have as many children as possible was also to get enough hands, who would then be able to work on the additional land to be cultivated. The newly claimed fields yielded in most of the cases less harvest than the already cultivated areas, however the harvest from them at least in the first years yielded more than the food needed to feed the people working on these fields. The farmers were still getting a surplus (marginal yield was more than the marginal costs which was in the form of food).

But nevertheless the social and therefore long-term target to advance the hill regions is and remains of absolute and urgent necessity. Without pursuing this aim, the basis of life for the following generations will be destroyed.

Here a conflict becomes obvious, with which the decision makers, planners and politicians are confronted. As the available financial means are often short, the interests which are of the present i.e. more tangible and which are strongly manifested, are usually given priority.[2]

The farmer quoted at the beginning acts and thinks quite rationally as an individual. It is clear, that he needs the fodder of the pasture and forests to feed to his animals, so that his cattle can reproduce and so that he gets enough dung to put on his fields. No doubt he is conscious of the fact that the environment in which he lives, is slowly changing to his disadvantage. However he is hardly likely to have ideas or proposals as to what he himself can do to actively defend himself in this situation. The necessary knowledge is lacking. Any collective activity to solve such problems is rather foreign to him.

We however are convinced, that the majority of the environmental problems can only be solved on a community basis. The nature of some of the problems is such that an individual cannot cope with them alone, therefore confidence in community work must be built-up. Only with a communal spirit as a base are the people able and willing to take over and bear the responsibility for the whole body. The people have to realise that for the problems that have to be dealt with in this connection, only communal activity can bring about realistic and long-term workable solutions (e.g. community forests, maintenance of torrent control constructions, prohibition of shingle-roofs etc.).

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2. In addition comes the fact that the criteria of the cost-benefit analysis (internal rate of return) which is often used for the selection of development programmes, rather favours those projects which benefit the present generation, the results of which can be seen as soon as possible. The higher the "internal rate of return" and thus the discount rate is, the more the benefits which will accrue in the future, are given less significance and the sooner longer-term projects will be placed at the bottom of the priority list. - The same mechanism occurs for the so called "intangibles" (= non-measurable benefits), particularly if for example an important aim of a project is to change in a positive sense the behavioural habits of the population with regard to the environment problems.

All this requires a lot of explanation and persuasion work within the concerned population.

It would certainly be illusory to believe that the mere promotion of long-term activities represents a possible way to solve the problems of the hills. The population can still cut down consumption to a limited extent even now, despite the subsistence conditions, by for example giving up small marginal areas of land for afforestation, or maybe even by planting fodder trees on very steeply terraced land. The danger is however, that without carrying out tangible programmes at the same time which rapidly increase the food production, also without educational activities etc., it will be much more difficult to arouse interest for long-term activities. Both package activities have to run side by side. They form one unit and have to be balanced.[3]

4. The Exchange of Information Between the Centre and the Periphery

The previous remarks have among other things implied, that the problems, the complexity and the system of hill economy are becoming more and more obvious. As long as the resources of nature did not become extremely short and one could continue to consume her products, the fact that everything is interdependent and one thing incessently influences the other, did not play an all too great a role in the lives of the people living in the hills. People had no cause to start thinking about the future. Moreover only 20 to 30 years ago much less was known about these problems than today.

The more difficult and complex the situation is, the more susceptible it is to disturbances, and the more carefully thought out the solutions have to be.

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3. But also within the short-term measures, the programmes have to be planned and executed in a balanced way. One cannot act one-sidedly and for example only promote food grains or the use of fertilizer. Here too, the connection and interdependence of the results have to be taken into consideration and built into the programme (introduction of cash - crops; nutritive balance: the soil cannot yield more than what is put into it, etc.).

Each intervention from outside has multiple positive and negative effects on an existent system and on the expectations of the people living in it (see example of fertilizer). Here a purely technical way of thinking is no longer suitable. It has to be thrown over board. On the other hand the time which remains for us to find a solution to the problems of the hills has become extremely short. It hardly suffices for example to make detailed consecutive statistical analyses of the different climatic and topographical conditions, of the exact extent of erosion etc. Basic research and development activities have therefore to run side by side.

The activities in IHDP up till now have shown us, that it is necessary to have a permanent and unobstructed flow of information between the field and the administration in the centre, so that both sides can remain efficient and operate well as a result of the possibility to keep a constant check on the information while testing and accumulating it. - We have already mentioned that to proceed in an integrated way is the necessary prerequisite, if the interdependencies as well as the ecological problems are to be taken into consideration in hill development programmes. The organisation of our IHDP is now such, that there exists quite a complex system of decision making bodies (ministries, departments). The integrated approach means for these bodies now, that they have to take the whole project into consideration if, as an entity, it is not to be endangered. In actual fact this entails also a permanent adaption of the institutions and forms of organisation, otherwise the aims cannot be attained as quickly as possible without hindrance.

Undoubtedly a constant feed back is indispensable for successful work in the hills. "Unfiltered" reporting from the man in the field on the effect of measures which have been carried out is the precondition for a smooth functioning of the activities. A further prerequisite however, lies in the necessity for those in the center to speak the same "language", so that they are able to understand each other completely and listen to what the other says. To do this the planners and organisers have to be acquainted with the bare facts and daily problems of the hill inhabitants and the field worker. Also from this point of view a genuine and close contact between the working base and headquarters in indispensable.

If one looks at this matter, a bit closer and from the practical side one sees some more facets of the problems: For the foreigner and also for a Nepalese graduate being sent to the project as a new collaborator, it can be a difficult and possibly lengthy process to transplant himself into the agricultural set-up and into the problems of the hills. One of the reasons for this is that his training was not specifically oriented to mountain conditions in general and the ecological interdependencies in particular. Maybe he still believes in the power and superiority of scientific and technical solutions, looks at the problems and the means of tackling them in an isolated way and as a single phenomenon which makes it also difficult for him to exactly understand the reactions and arguments of the local population. With time however he is forced to see his knowledge and theories also through the eyes of the farmers, to notice the problems as part of a whole and to strive to attain more realistic solutions.

This process is probably never absolutely complete, but one has to go through it. - In this connection it is quite obvious that it would help a lot and make the situation for mutual understanding between the hills and the center easier, if the decision makers in the center have gone through the same experience.

A further difficulty lies in the fact, that for foreigners and Nepalese alike, there is no guarantee that a collaborator will stay for a long time in a project. Either he moves away or is transferred. For this reason it is in the interest of the project that the successor is informed about the work as comprehensively and realistically as possible. It would also be worthwhile if the successor could work together for sometime with the man who is leaving. In addition the project employees should be interested and motivated to work in the hills.

It is probably a world-wide phenomenon nowadays, that the political institutions are hardly able to keep up with the necessary exchange of information between the working base and headquarters, because everything has become so complicated and it is so difficult to have an over-all view of the material.

For understandable reasons mainly only those things are done, which the existing power constellation allows to be done and which meets with less opposition, and this does not necessarily guarantee the people's future.

This is related with the fact, that also for the local population in the project area, it is very difficult - (as too much is required of them at the present moment) - to be able to articulate and precisely formulate those needs which are of extreme importance for them as a community, or even to propose solutions and carry out activities. The necessary knowledge is missing. Thinking along the lines of causal dependencies is hardly known. - In this connection we have also to see, that many influential villagers are often identical with the economic and social elite. Some of their power is based on their having been and still being able to exploit nature very intensively. These people would be especially affected by e.g. restrictive measures and thus show little interest in taking a leading position in the fight to protect their environment or to play a decisive role in educating their neighbours. These people are also those, who, because of their economic situation, are most likely in the position, at least for a short time, to be able to escape the negative effects of worsening environmental conditions.

To conclude, one can say that the more complex the situation becomes, the more the decision makers in the center are in danger of losing the overall view. The estrangement between the working base and headquarters increases. But the more difficult it becomes to view the whole situation, the more "right" decisions should be made, and the more intensive should be the exchange of information.

We believe that in this situation, which has been rather roughly and schematically portrayed here, IHDP can and must fulfill the function of a connecting link between the local population and the center which decides and carries out the development policies. This is particularly true for the longer-term problems, for which the project as a "more objective" institution (which is familiar with the problems) has to play a very important role as an information transmitter. - On the other hand the project also has the other important task of educating and convincing the local population that there are ways and means of overcoming the problems. This however is by no

means a one sided learning process in which the villagers are always in the role of pupil and the project collaborators in that of the all-knowing teacher. Rather it is a case of learning and understanding each other. Success in the end will only come from collaboration built up from and based on mutual trust.

The center must be informed about the present problems at the working base and know the overall context. For example it must know that the development of the hills contains many qualitative (change of thinking patterns) processes, without the fulfillment of which the overall aim will not have been attained. Only thus can it become conscious of a certain procedure and promote it, only thus can success be spread further afield. - If news is not passed on sufficiently, it will probably be extremely seldom that non conformist experiments and learning processes can be promoted or approved. Rather people will, for plausible reasons, stick to "tested" and "existing" methods. Without experiments however integrated hill projects, which also take care of environment problems, will not be as effective as they should be - which again shows the absolute necessity to transmit real, unfiltered and "rebellious" information.

5. A Few Closing Remarks

It is incontestable that people are motivated by forces which can be identified with their interests. But these same people most certainly also have ideals. In particular they can surely differentiate between long-term and short-term interests and acknowledge the superior significance of the long-term interests, if it is openly and convincingly explained to them. IHDP in so far does not fully and only represent the interests of the individual, as it aims also at helping the community as a whole. In doing so IHDP has to and wants to recognise the challenge - and there-in lies probably the key to the success of an integrated hill project - that it cannot remain in an ivory tower, far distant from and above the problems and the people, but it must feel its responsibility to explain and convince.

IHDP consciously places its main focus on a relatively poor region. In such areas the problems sometimes seem almost insoluble. The planners and decision makers however should neither close their eyes to these problems nor pass them

off as fate, being too big and unsurmountable as well as economically untenable. If anyone, as did recently a renowned expert, comes to the conclusion as a result of technical and economical considerations, that investments in the mountain regions are not worthwhile, that we would be much better to wait until erosion has come to a standstill and the economy of the hills has balanced itself out again, that we just have to accept the resulting catastrophes as natural phenomenona (with all their implications for the people), then this technocrat has certainly forgotten man, who has ideals and the right to be informed, trained and given the means which allow him to be able to improve his environment himself.

The non-economic factors, roughly seen the behaviour, institutions as well as effects of the very lowest living standard on productivity, have, in a country like Nepal, such a wide reaching significance that they cannot be ignored in any analysis for a hill project. - Therefore in a hill project "economic" problems do not exist. There are quite simply problems and these are complex. We are convinced that these problems can only be met in a promising way by means of an integrated approach. Such an approach however demands from the concerned authorities and the donor country as well as from those working in the field and the directly influenced population a great deal of sensibility, patience, flexibility, frankness, willingness to innovate and readiness to inform.

5.4 PRACTICE AND RESEARCH IN INTEGRATED DEVELOPMENT PROJECTS

by R. Hoegger

Compared with other densely populated areas of the world, the amount of research on the social, economic and ecological situation of the Nepalese Hills has not been very considerable in the past. Even so, the present situation and prospects for the future seem to be quite clear. H. Chr. Rieger sums up a number of studies concerning the deterioration of the ecological system in the Himalayas (chapter 2.1) while G. Toffin provides as an example one specific valley (chapter 2.2). Both authors confirm what Wolf Donner has put very bluntly: that fifty years from now large parts of Nepal may well look like Afghanistan or Iran today if proper measures of land and forest conservation are not implemented immediately.[1]

We know that the population growth will not slow down to any considerable extent during the last quarter of our century. Even if massive emigration from the Hills continues (which considering the limited resources in the Terai cannot be taken for granted), the net growth rate of the Hill population, at present about 1.3% p.a., will add considerably more than another ten lakhs of people to the 7.7 million of today.[2]

We also know that, due to the increasing pressure on agricultural land, soil fertility is dwindling. According to a recent estimate the agricultural land area of Nepal was increased at the rate of 3.58% p.a. between 1960 and 1970, while agricultural production grew by only 2.4% p.a.[3] Productivity is thus declining.

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1. Wolf Donner: Nepal. Wiesbaden 1972, p. 236.
2. NPC Secretariat: Draft Proposals of Task Force on Land Use and Erosion Control, August 1974.
3. Y. P. Pant and S. C. Jain, quoted in Motherland, July 27, 1974.

In addition, we know that both the destruction of the natural environment and erosion have speeded up to such an extent that they have become visible processes even for casual observers. It was calculated that the Karnali river is moving some 75 million cubic meters of silt and debris every year, an amount that corresponds to a 1.7 millimeter soil cover of the whole Karnali Watershed.[4] As a comparison: these 75 million cubic meters of solid material are two and half times more than the Kander, a river in the Swiss Alps, has deposited in the lake of Thun during the last 263 years, i.e. since 1713 A.D. (Kander Delta).

These are a few details of the picture emerging from the limited research that has so far been undertaken in the Nepalese Hills. Do we have the slightest chance of success in tackling problems of such magnitude? Does it make any sense to start practical action in order to change the course of present development?

If the population explosion were only an expression of human shortsightedness, then educational and technical measures could easily be conceived and implemented to stop it. But to fight against a further increase of population inevitably brings us into contradiction with important human values, social structures and economic constraints. If, on the other hand, the decline of productivity as well as the destruction of agricultural land and forest areas could be halted by administrative schemes or political decisions, there could be no doubt that the present ecological trend would be rapidly reversed. But again: the pillage of man's natural environment is not the result of a single cause, neither could it be stopped by choosing one line of action alone; it is due rather to the interaction of innumerable natural and cultural factors. To regain an ecological balance between man and his environment is to modify the whole organism of a culture which has developed within a given environment. Is it realistic to envisage the future development of Nepal (and the world at large) in such dimensions?

Personally I do not believe that the complex of problems hinted at in this publication is entirely manageable.

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By "manageable" I mean the possibilities of slowing down or halting all the negative trends within a relatively short period. I am convinced that - in spite of even the most courageous efforts that might be undertaken - Nepal (and many other countries) will have to face enormous difficulties and further destruction before the end of our century. Any other interpretation of our present situation and its dynamics would seem to me neither realistic nor honest.

But this attempt to consider the task lying ahead with as few illusions as possible does not mean that the task itself is senseless. The dynamic complexity of the relation between society and its environment not only pose major difficulties for the planner and the technician: the prospect of rapid change also opens up the possibility of new ideas and new spontaneous efforts. True, we have not the slightest guarantee of positive developments. The future is open - but open in more than one direction. We may not be able to prevent all regional disasters, but we do have the opportunity to work on the foundations which make survival and reconstruction possible. We know that it depends on the efforts of today whether and how we withstand the trials of tomorrow. This is the rationale behind our activity - the perspective of both our practice and our research in the Nepalese Hills.

Numerous attempts to provide policy guidelines for operational projects have already been made. Among the more recent papers I pick the "Draft Proposals of a Task Force on Land Use and Erosion Control" which were drawn up during the summer of 1974.[5]

According to this paper, conservation-oriented land use and development will always necessitate a number of simultaneous activities: with a view to preventing soil erosion and a degeneration of land resources, measures will have to be taken to control further expansion of cultivation on steep slopes and marginal lands. Other policy lines would need to concentrate on generating the institutions which could help to take marginal land out of cultivation, regulate grazing on overgrazed lands, and regenerate forests in those areas where they are essential from an ecological as well as an economic point of view.

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5. NPC Secretariat, August 1974.

The need for better utilization of the land resource also calls for the planting of fruit trees. Cropping intensities and yields are already substantially higher in the Hills than in the Mountains or the Terai, but since they have reached their limits under the existing technology, further increases would need to come from the improvement and extension of irrigation schemes or new techniques. Rearing of livestock has to be considered as part of a mixed farming system, whilst the tourist industry should be expanded in those areas where agricultural development is most problematic.

It cannot be doubted that all these proposals are pertinent, although everybody would probably agree that the list could easily be extended and completed. However, completeness is not the point we are aiming at: rather we are interested in understanding some of the conditions under which practical work along these lines becomes meaningful. One of the most important is research.

The success and policy designed to fight poverty and ecological destruction will obviously depend on detailed and reliable information regarding, e.g.:

- the nature, availability and actual use of various land categories;
- the mechanism and extent of erosion;
- the potential, conditions and limitations of more intensive agricultural production in the Hills.

We do have an increasing general knowledge on these problems, but when it comes to detailed planning of specific projects in specific areas, we soon find ourselves helpless in the complexity of a local eco-system or the traditional pattern of agricultural production.

Then we realize that the nature of the Nepalese Hills and its culture leave only little room for change and economic improvement - an area which has to be proved very carefully by experiments and research.

As an illustration of this an example[6] concerning the difficulty in increasing food production may be cited: potato cultivation in large parts of the Hills

6. Information from the Integrated Hill Development Project, Sindhu-Palchowk and Dolakha Districts.

seems to be hampered by four major drawbacks:

- First: Late frosts in the higher altitudes. They occur sometimes as late as the middle of April.
- Second: Lack of humidity. Until the end of April or even May, growth of potatoes on pakho (unirrigated) land in the valleys is very limited.
- Third: Hail storms during April and May.
- Fourth: Phytophthora infection. During the second half of June it usually destroys all potato plants completely.

For two of these drawbacks: there seems to be - at first glance - a remedy in the form of new Mexican seeds showing good resistance to phytophthora. These seeds develop so quickly during the first months that they also prove to be considerably more resistant to the heavy hail. However, their total vegetation period is longer than that of local varieties, and their late harvest makes it difficult to use them (as seeds) in the lower part of the country, where the potato harvest must be completed before the rice is planted. Thus, the introduction of new elements (e.g. improved seeds) into the actual agricultural production cycles and under the given climatic conditions is an extremely delicate task. It probably leaves much fewer policy options than one might expect.

Practical action to overcome long-term problems in the Hills has therefore to be supported by specific research programmes. This conclusion is as evident as it may be dangerous: it must never be interpreted in such a way as to defer practical action.

While it is true that our awareness of what is actually happening in the Hills is not detailed enough, we have to admit that our knowledge is sufficient to draw at least these inescapable conclusions: the time for development is running out and resources are extremely limited; that we cannot possibly afford to lose another decade before involving ourselves with the every-day problems of the Hill population; and that it is only out of such practical involvement that the crucial questions will arise and be tackled by researchers. As we have seen in connection with the production of potatoes, research is important, but not as a precondition to all operational practice. Rather it is an indis-

pensable complement to practical activities. Research must never become an isolated undertaking, because then it might possibly serve many as a comfortable alibi for the perpetual postponement of hard, practical work.

It is for such reasons that I, personally, fail to see the necessity of establishing in Kathmandu an Institute for the study of mountain environment. Not that such a center would be useless! But given the present scarcity of academically-trained manpower, given the limited funds available, and given the time and efforts needed from so many people already overloaded with heavy responsibilities in the development of the country: given all this, an Institute for the study of mountain environment should have no priority among the many urgent plans to safeguard the Hill ecology. Instead, more human and financial resources should be channelled directly towards the implementation of projects. There - and probably only there! - applied research becomes possible and meaningful as a process of cautious learning through trial and error and in close cooperation with those who already have very specific and pertinent experience: the Hill farmers. We shall have to come back to this point in the last part of our paper.

But first, we have to deal with another problem. While we know that we cannot possibly delay action to break the vicious circles of ecological destruction, we also know that research on many aspects of our undertakings is badly needed. How can we reconcile the differing challenges of action and research? How can we make them complementary in day-to-day reality?

Some ideas on this may be illustrated by the following set of examples:

S. Mauch has argued in chapter 4.2 that regionalization of the Hill economy is an indispensable condition to breaking the vicious circles of ecological deterioration. The construction of simple roads - according to him - is one (not the only one!) possibility of achieving such regionalization. Road construction in the Nepalese Hills necessitates the application of labour intensive technologies leaving large parts of the monetary benefits to the local population. All this seems more or less obvious, but it does not mean, of course, that the regionalization of the economy or the construction of roads would not also create serious problems and raise a multitude of questions:

Could not the orientation of a traditional economy towards new markets and the massive inflow of cash into the Hill area disrupt existing price relations and production patterns? Would not the extensive construction activities along a given axis result in temporary concentration of too many workers, thus creating unbearable pressure on the forests (the need for firewood) and on the markets (the need for food)? And would not all these trends finally work out to the disadvantage of the poorer sections of the population?

We do not know!

So we must find out. However, as we also mentioned earlier, large-scale research programmes before the beginning of construction could hardly provide satisfactory answers to these questions. Anticipating the future flow of cash within traditional economic structures and evaluating its hypothetical effects on a highly intricate social situation is a matter of sheer impossibility. Even a modest attempt to undertake it would call for extremely intensive research work. The "pressure" exerted on the local people in collecting so much socio-economic data might well be psychologically and politically counterproductive. The results of the study would necessarily remain inconclusive. They would never justify the efforts.

Therefore, much of the project work in the Hills has to be started pragmatically. We have no guarantees of pre-ordained mechanisms leading to success, and there is - so far - no research method which would provide us such guarantees. This uncomfortable situation reveals the heavy responsibility we assume while planning and implementing development projects in the Hills. We have to ponder its consequences.

One of the most important conditions in this connection is that we move very cautiously. If the over-all ecological situation of the Nepalese Hills forces us not to tarry any longer, if it is also extremely difficult to predict the effects of specific projects in a given social and economic context, then the pace of our activities must be such that a permanent control of all effects and side-effects of a project becomes possible. The lack of suitable methods to anticipate the manifold results of our activities has to be compensated by a

series of effective control measures in connection with the project implementation. In other words: evaluation of what we do has to be built into the practical work we undertake.

This proposal is not at all original and would probably find the approval of most responsible planners. However, if we try to take it seriously and apply it to our present tasks, an important conflict will soon become apparent. It is the conflict between the necessity of built-in evaluation on the one hand, and the operational and political need for solid targets on the other hand. Where the mind remains open to new daily experience, but critical towards quick results in quantitative production or technical achievements, there the traditional targets of development work are of a relative value only. They might have to be modified or even abandoned in a short time if the results of built-in evaluation indicate grave side-effects of a given project component. Also the merits of project staff can no longer be measured only in the easy terms of palpable quick achievements, but should equally be weighed by their willingness to adapt their programme to unexpected circumstances. Needless to say, this is difficult.

Nevertheless, built-in evaluation is a necessity - perhaps the most urgent and pertinent need within the wide range of possible research activities in the Nepalese Hills. Government authorities and foreign agencies have to cooperate in applying it to their development projects.

Let us look at some of the practical consequences of this challenge.[7]

Right from the beginning of a project, a fraction of each staff member's attention has to focus on recording and storing different kinds of information relevant for the evaluation of the project. Such data collection should be done on a routine basis; checklists and diaries will facilitate it. And above all one should not think that all data has to be quantified. Small observations, and rumours in the villages may be equally important if properly recorded and assessed.

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7. Drawn from notes by S. Mauch and H. Buchmann concerning built-in evaluation in the Integrated Hill Development Project.

The responsibility for assessing the multifarious information collected by the project team will probably have to be assigned to one of its members. If the creation of a separate post for this work proves to be impractical, there should be one staff member, with more time than the others, who takes on the task of evaluation and counselling his colleagues in doing their part of it. The work of such an evaluator consists in identifying dangerous side-effects of the project and formulating new questions. On this basis, the evaluator will have to plan and conduct separate studies in order to clarify such questions and to obtain additional information. His task is to create links between practical experience and complementary studies, to integrate research and practice.

In connection with one of our examples - i.e. the unknown effects of labour-intensive road construction in the Hills - built-in evaluation would have to deal, among others, with the following questions:

- Who are the contractors, sub-contractors, foremen, and workers employed under the project? Where do they come from? What are the socio-economic conditions in their villages?
- What is the relationship between the four groups mentioned above? Are salaries paid regularly and according to fixed rates? Is any group taking undue advantage of its situation and what are the consequences of this?
- For what and by whom is the money spent that was earned in connection with the road work? How much of this money is used up for short-term consumption, how much for longer-term investment? Can structural changes be observed in the local economy, and if so: are they for better or for worse?

Probably the regular staff of a road project will not be in a position to collect sufficient information to answer all these questions within a short period. The evaluator will therefore have to arrange for separate studies by one or several researchers. The results, however, will only be useful if they immediately serve as a basis for additional or corrective measures within the framework of the existing project. Such measures could possibly in the case of our example be the following:

- If contractors, sub-contractors and foremen are mostly recruited from other parts of the country: training of local inhabitants to become foremen or contractors.

- If workers are being exploited by their (sub-) contractors: establishment of an effective control-system concerning work-organisation and financial management.
- If the money flowing into the local economy is used for ostentatious consumption purposes: building up of an attractive savings system and offering viable possibilities for small-scale investment on individual farms.

By such new project components, the circle between the initial project plans, built-in evaluation, research and new activities is being closed. The traditional competition between researchers and operational staff becomes obsolete. There should not be any such conflicts once researchers and operational staff have both become aware of their interdependence. Neither one nor the other can effectively work without constant reference to the work of his colleague. Research does not necessarily precede practice, nor does practical action always precede research. As evaluation, i.e. research, has to be built into practice, operational trials should be built into every research plan. It is not in arguing by opposites or simple priorities, but in thinking by circular complementaries that integrated projects become really feasible.

Having said all this about research and practice, the notion of "integrated projects" becomes larger and more meaningful. While "integration" usually stands for "combination" of various technical activities, it appears from our context that certain human dimensions of "integration" might even be more important. A few concluding remarks on this topic may be useful.

It is clear that the effective implementation of conservation-oriented development projects depends to a large extent on capable and well-trained staff. Development work under the conditions of the Nepalese Hills require an amount of dedication and perseverance considerably bigger than that necessary in any career in Kathmandu or abroad. The personnel selected for such programmes should be motivated to know and understand the farmer, his family, and community, and to assist them to improve their production, income and welfare.

This is almost a truism. It is not our intention to discuss the shortage of trained manpower in agriculture, forestry, watermanagement and other related fields. Nor is it within our competence to analyse existing difficulties in training and motivating field-workers for their demanding task.

The statement on the decisive role of the available staff (whether Nepalese or expatriate) was made in order to give additional emphasis to what has already been said about practice and research.

There can be no question about the fact that doing research is a job with much more prestige than trying to learn from the experience in every-day life of Hill farmers. Building up a research institution must definitely be less frustrating than trying to build up confidence and new determination among poor peasant communities. I think it is - among other reasons - the inevitable attraction of "basic and pure" research, where things can be put in analytical order, which makes practical work under the disorderly conditions of the Hill economy so terribly discouraging. Therefore, what we have to learn and promote is not so much the perfection of scientific analysis in abstraction of frustrating realities, but much more the perseverance to live up to these realities with courage and a critical mind. Where we thus succeed in integrating operational chores with scientific research and prestige, there a decisive step will have been made in overcoming the shortage of trained staff and towards the solution of actual problems.

But the notion of an "integrated approach" to the problems of mountain environment and development has still other meanings. Not only is it important to integrate project work in the Hills with research. It may be decisive to integrate the thoughts and the feelings of all individuals and groups participating in a project. This is specially true where local farmers and their families meet and cooperate with development workers of the government or expatriate personnel. Such relationships are not without problems. Often unpopular decisions have to be made. Choices have to be made between short-term and long-term benefits, social and economic priorities. None of these problems can be solved either by unreflected activism nor by scientific studies. Even the most dynamic plan and the most scientifically collaborated scheme will have no chance of winning the support of those people for whom the plan was made unless we succeed in winning their <u>hearts</u> for what we think is a good project.

This is only possible if we integrate our efforts and our decisions with theirs, if we share their way of life and their preoccupations, if our plans are as

much a reflection of their needs as of our scientific concepts. Integration becomes a question of human communication and comprehension.

What conclusions have to be drawn from this? Development workers and researchers who aim at winning the confidence of the Hill farmers have to make great efforts to adapt their standard of living to local circumstances. It is clear that - for practical as well as for psychological reasons - there are limitations to such efforts. But it is equally clear that in many projects of the past the optimum level of such adaptation has not been reached. On the contrary: the nerve-centers of development projects, where important trials and research were conducted, have become islands of relatively privileged living, thereby causing emotional disintegration between staff and farmers rather than the contrary. We all have to learn from these experiences and try to find new forms of cohabitation with those people for whom development is meant in the first place.

Lastly, the notion of "integration" also focuses on the relations between His Majesty's Government and foreign institutions. To integrate the ideas and proposals of such agencies with the research and development plans of the Government is sometimes a difficult task - a task which again cannot be solved by scientific rationale and factual arguments alone. Here also a minimum of emotional integration between the partners and their mutual awareness of each other's intentions and difficulties may be more important. Periodical "commando-style" missions from foreign capitals to Kathmandu will not provide a sufficient foundation for building up realistic concepts and administrative structures of integrated projects. These projects should not be regarded only as technocratic instruments, but rather as flexible, slow growing organisms drawing their strength from the continued discussions and common conceptual thinking of the sponsors. This becomes possible in continued contacts between Government officers and residential representatives of foreign organisations who should both keep in close touch with the field staff of their joint project.

Integration is more than management and goes beyond scientific schemes. It is also the corollary of the understanding and confidence between partners, a question of growth rather than a matter of organisation. And it is within this framework that both practice and research must find their place.

THE AUTHORS:

RIEGER, Hans Christoph; Ph.D. in Economy. He is a senior economist at the South Asia Institute of Heidelberg University, West Germany. He has spent over five years working in India and Nepal. From 1972 - 74 he was German adviser to CEDA. In 1975-76 he undertook a study on deforestation and erosion in the Himalayas for the Federal Ministry of Economic Cooperation, Bonn.

TOFFIN, Gerard; Ph.D. in Ethnology, Paris-Sorbonne 1974. Research associate at the Centre National de la Recherche Scientifique, Paris. Member of RCP 253 (CNRS), French research team on the Himalaya. Author of several articles on the life of the Newars of the Kathmandu Valley.

PANDAY, Krishna Kumar; Graduate from the Tribhuvan University, studied postgraduate Agricultural Engineering at the Swiss Federal Institute of Technology Zuerich.
K.K. Panday was a Liaison Officer for the Jiri Multipurpose Development Project before entering the Swiss University.

NEPALI, Shiva Bahadur; M.Sc. (Agri.) Horticulture.
Spent major part of his service working for the development of Horticulture. Worked as Assistant Horticulturist, Horticulturist, Chief of Fruit Division and at present works as Deputy Director General (Crop Research).

ACHARYA, Bed Nath; Civil Engineering; Graduate of the University of Queensland, Australia. He worked for 10 years in the various research investigation development activities of HMG Nepal and other private firms and organizations.

SHRESTA, Kamal Kumar; Ph.D. in Nuclear Chemistry, Tribhuvan University, Kathmandu. He is staff member of the Chemistry Instruction Committee, Kirtipur Multiple Campus, Institute of Science, Tribhuvan University. He is teaching Nuclear Chemistry, conducting research work and is involved in Environmental Science. Member of Nepal National MAB-Committee.

DOBREMEZ, Jean-François; Ph.D. in Science. Professor at the Institute of Vegetal Biology, University of Science and Medicine, Grenoble, and member of the RCP 253 CNRS, Paris. Author or Co-author of six ecological maps of Nepal and of various articles on the same topic. Closely cooperating with the Department of Botany, Tribhuvan University, and the Department of Medicinal Plants, HMG.

RANA, Ratna S.J.B.; Ph.D. University of Pittsburgh, USA. Hon'ble member National Planning Commission HMG, Nepal. He was Director of CEDA. Thesis: "A Game Theoretic Approach to Agricultural Land Use Patterns: An Indian Example." Various articles on regional planning in Nepal.

MAUCH, Samuel P. ; Professional Training in Civil Engineering and Planning at the Swiss Federal Institute of Technology, Zuerich, and at MIT Cambridge, USA. Assistant Professor (1970/71) at MIT. Since 1966 head of group for long range planning, at Basler + Hofmann Consulting Engineers + Planners, Zuerich. Mainly involved in development problems related to transportation, energy and environment.

RANA, Pashupati S.J.B.; Hon'ble Member of the Rastra Panchayat (for Sindhu Palchowk District, since April 1974) and National Development Council. He was Director of CEDA. Publications: "The Fourth Plan - A Critique" (Yeti Pocket Books, 1971) - "Bikas Tatha Yojana" (CEDA - 1973) - Edited with K.P. Malla "Nepal in Perspective" (CEDA - 1973) - Jointly authored with M. Moshin "The Pattern of Emerging Leadership in Panchayat (1976).

SCHMID, Robert; Ph.D. in Geography, University of Zuerich. Thesis: "Contributions to the economic Geography of Nepal with special reference to transport and communication problems in the Eastern Hills." Member of the evaluation team of JMDP 1967/68. Road Feasibility Study Lamosanghu-Jiri 1971. Land Use Mapping in Hill Country, Eastern Nepal, Geogr. Publications Ltd. London 1971. Teacher for Geography in a College and lecturer at Zuerich University.

BYS STAFF MEMBERS: JOST, Friedhelm - Deputy Working Director, Balaju Yantra Shala Pvt. Ltd.; BACHMANN, Andreas - Engineer Plumbing Division BYS; LAUSSELET, Hansruedi - Adviser Electro Division BYS; MEIER, Ueli - Engineer Research and Development Unit BYS; SCHRANZ, Kurt - Manager Plumbing Division BYS.

VOEGELE, Kurt; Studies at the University of Basle, lic. rer. pol (economy, 1968). Since 1969 collaborator of the Swiss Technical Cooperation. 1972/73 he was in India as an "Attache" for Technical Cooperation activities in New Delhi and in the Indo Swiss Project in Kerala. Since September 1974 working in Nepal as a Project Co-Manager of the IHDP.

HOEGGER, Rudolf; Ph.D. in History. 1967: Research on the rehabilitation of Tibetan refugees in Nepal. 1968-70: Nepal Desk in the Technical Cooperation Service of the Government of Switzerland. 1970-74: Director of the Swiss Technical Cooperation in Nepal (SATA). Since 1975: Back to the Technical Cooperation Service in Berne. Publication: "Die Schweiz in Nepal", Berne 1975.