REPORT OF THE TASK FORCE FOR THE STUDY OF ECO-DEVELOPMENT IN THE HIMALAYAN REGION

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FOREWORD

The Sixth Five-Year Plan has outlined an integrated approach for the development of the hill areas based on sound principles of ecology and economics. Hill areas present some very special agro-ecological and socio-cultural features. These features have to be specifically taken into account in the formulation of programmes in the hill regions, so that there is compatibility between plans and the need for sustainable development.

2. Experience of development planning during the past has underlined the fact that unless programmes based on the concept of development without destruction are evolved for the conservation and proper utilisation of the resources of the hill areas, not only the problems of the hill areas will continue to remain unsolved, but the economy of the plains may also be adversely affected. For example, what we do or do not do in the Himalayan region to-day will have considerable impact on the future of agriculture in the Indo-Gangetic plains. Development of the resources of the hill areas is hence necessary both for enabling the population living in these areas, who are by and large very poor, to have their share of the benefits accruing from modern science and technology and for safeguarding the security and health of the crops cultivated in the adjoining plains.

3. In order to look into the problems, potentials and strategy for development of the Himalayan region, a "Task Force for the Study of Eco-Development in the Himalayan Region" was set up by the Planning Commission. This Report of the Task Force dealing with "Socio-Economic Development", "Transport Planning", "Post-Harvest Technology" and "Coordinated Research on Action Oriented Basis" in the Himalayan Region has focussed on a few important problems and suggested action programmes for being undertaken by the students and staff of Universities, by the people and by Government agencies. The relationship between action and reaction has been highlighted, as for example the inter-relationship between road construction and land slides and post-harvest technology for fruits and forest conservation. It is hoped that this report will be of use to State and Central Governments, Universities and to all interested in protecting the fragile eco-systems of the Himalayan region. Some of the suggestions contained in the report are worthy of immediate implementation, while others may be of value in the preparation of the Seventh Plan.

4. Past experience has indicated that unless an integrated approach based on a systems analysis is introduced into developmental planning for the hills, eco-catastrophes will continue to occur. While various committees and groups have made recommendations from time to time on how to arrest further damage to the Himalayan eco-system and how to repair the damage already done, a high level institutional mechanism for converting ideas into reality at the field level is yet to be developed. The Task Force is, therefore, of the considered view that a Himalayan Eco-

Development Commission should be set up as soon as possible with the Prime Minister as its Chairman. This will facilitate speedy and coordinated attention to the numerous ecological problems which transcend State boundaries.

5. I would like to acknowledge with gratitude the wholehearted co-operation received from all members and participants of the Task Force. Particular thanks are due to the Chairman of the Sub-Groups set up by the Task Force in its first meeting, viz. Shri J.S. Lal, ICS (Retd.), Shri A.D. Moddie, Dr. S. Kedarnath and Dr. K.G. Tejwani.

6. I would also like to record on behalf of my colleagues in the Task Force and myself our thanks to Shri D.D. Joshi, Member-Secretary of the Task Force, for organising the work with competence and dedication.

M S Swaminathan

March 25, 1982
Planning Commission
New Delhi

(M.S. SWAMINATHAN)

REPORT

OF

"THE TASK FORCE FOR THE STUDY OF ECO-DEVELOPMENT IN THE HIMALAYAN REGION"

Dr M S Swaminathan .. Chairman

Shri Madhava Asish	"	Shri J S Lal, ICS (Retd.)	Member
Dr S Z Qasim	"	Prof Ramachandra Rao	"
Dr S Kedarnath	"	Dr Virendra Kumar	"
Shri K M Tiwari	"	Dr D N Borthakur	"
Dr C K Atal	"	Shri S K Bhatnagar, IAS	"
Shri A D Moddie	"	Shri Mukul Sanwal, IAS	"
Smt P P Trivedi, IAS	"	Dr K G Tejwani	"
Dr Vidya Joshi	"		

Shri D D Joshi, IAS (Retd.) - Member-Secretary

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C O N T E N T S

CHAPTER I

INTRODUCTION

1. The Himalayan region extends from the West to the East for 2,500 kms and varies in its width from 250 to 300 kms. Geographically, the Himalaya are divided into three sub-regions viz. (i) the Western Himalaya consisting of the States of Jammu & Kashmir and Himachal Pradesh, (ii) the Central Himalaya consisting of eight districts of Garhwal and Kumaon Divisions of Uttar Pradesh and (iii) North Eastern Himalaya comprising the States of Sikkim, Assam, Manipur, Meghalaya, Nagaland, Tripura, Union Territory of Arunachal Pradesh and Mizoram and hill areas (Darjeeling district) of West Bengal. The region is a complex eco-system spread over an area of 5,94,427 sq.kms which is 18% of the total area of the country. According to the provisional figures released by 1981 Census, the population of the Himalayan region is 42.94 million accounting for 6.3% of the total population of the country as against 32.47 million (5.9% of the total) according to 1971 Census The population of the region has recorded an increase of 10.47 million i.e. 32.2% in the decade 1971-81. The area and population of the Himalayan States UTs areas is given at Annexure I.

2. There are large variations in topography, climate and soil conditions in the Himalaya representing areas from tropical valleys and hills to arctic mountains. As seen from the land use pattern given at Annexure II about 53.2 per cent of the reporting area is classified as forest land though there are large variations from minimum of 8.3% in Meghalaya to a maximum of 91.3 per cent in Arunachal Pradesh. Besides the land under forest, about 28.2 per cent of other land is classified as pasture land. The net area sown is hardly 9.7 per cent of the total reporting area in the region.

3. The hill areas present with some very special ecological and geo-physical features. The terrain is mostly rugged and steep. The unit cost of infrastructure development in the region is high and the returns are relatively low. The cost of infrastructure is high largely because of rugged nature of terrain and the need for access to widely dispersed population. Besides, it would take a considerable time for these areas to build up an adequate resource base.

4. Keeping these considerations in view, the hill States/areas have been treated as special category so far as Central assistance is considered. For the speedy development of both categories of hill areas of the region viz. (1) those that are co-extensive with the boundaries of the State or the Union Territory and (2) those which forma part of a State like U.P. Hill Areas, Assam Hill Areas and West Bengal Hill Areas, not only the pattern of assistance has been liberalised but also the quantum of Central assistance has been steadily growing since the Fourth Plan. Thus the total Plan outlay

in the region has gone up from Rs.447 crores in Fourth Plan to Rs.3,915 crores in Sixth Plan (Annexure III) representing an increase of 900%.

5. The accelerated pace of development in the region particularly activities like road construction and mining, has unfortunately also resulted in considerable damage to fragile eco-systems. There is no doubt that due to speedy development, the per capita income in the States of Himalayan region has been increasing over the years (Annexure IV), but the per capita income has been below the national average of Rs.1,379 for instance in 1979-80. The magnitude of poverty is discernible from the fact that the number of persons below the poverty line in the region was as high as 60 per cent in Tripura with lowest in Nagaland i.e. 4.11 per cent against the all India average of 48.13 per cent in 1977-78 (Annexure V). The indicators of the per capita income and number of people below the poverty line reveal that the States/areas of the Himalayan region are backward. The pace of its development has to be further accelerated, consistent with ecological preservation.

6. Eco-development is that approach to economic development which aims at development in harmony with ecological balance and to promote the quality of life of hill-people. In this sense it is an attitude, a way of doing things, with soil, water and plant life which minimises disturbance to eco-systems and promotes sustainable productivity in all aspects of development; apart from minimising the impact of floods in the plains and the siltation of reservoirs, rivers and ports.

7. The need for preparatory action for the preservation of the eco-system is gaining urgency with the increase in developmental activities which disturb the natural ecological balance. It is being increasingly appreciated that ecological conservation in the Himalayan region is of crucial importance not only to the region itself but also to vast areas of the Indo-Gangetic plain. As mentioned earlier, the eco-system of the region has already been greatly impaired due to denudation of forests, indiscriminate grazing, unscientific land use practices, uncontrolled mining, road construction etc.

8. The Government of India have been seized of the need to incorporate environmental and ecological considerations into the developmental activities going on in the Himalayan region so as to ensure that short term gains are not accompanied by long term impairment of the health of the eco-system that sustain these activities.

9. Conscious of these problems and the urgent need to arrest these trends, the Planning Commission in the Sixth Five Year Plan have outlined a detailed strategy for the economic development with the imperatives of environmental conservation of the hill areas in the Himalayan Region. A scientific land and water use and human resource development plan with the involvement of the entire academic community in the hill region into the mainstream of national thinking on plan formulation has been one of the major policy thrusts for the Himalayan and other Regions during the Sixth Five Year Plan.

10. In view of the need to balance the indispensability of economic development with the imperatives of environmental conservation and to formulate realistic and manageable programmes for tackling the interlinked problems involved in eco-development of the Himalayan Region, the Planning Commission constituted a Task Force for the study of "Eco-Development in the Himalayan Region" under the Chairmanship of Dr. M.S. Swaminathan, Member Planning Commission. The composition of the Task Force and its terms of reference are spelt out in the Planning Commission's Office Memorandum No.PC(P)19/1/HIM/80-MLP dated 3.6.1981 (Annexure VI).

11. The Task Force in their first meeting discussed the problem in detail and after deliberations constituted four sub-groups viz. on "Co-ordinated Research on Action Oriented Basis", "Post Harvest Technology", "Transport Planning" and "Socio-Economic Development" for detailed consideration of specific subject areas. The composition of these sub-groups with their terms of reference have been given in the Planning Commission Office Memorandum No.PC(P)19/1/HIM/80-MLP dated 21.7.1981 (Annexures VII, VIII, IX and X).

12. The reports of these Sub-Groups were discussed in the meetings of the Task Force. Experts from various fields, organisations and institutions participated in the deliberations of the Sub-Groups and Task Force. But for their wholehearted cooperation, which is gratefully acknowledged, it would have been difficult for the Task Force to complete the work assigned to it.

13. The recommendations of the Task Force which are timely, practical and sound will, we hope, be of value to the Planning and Development agencies in the formulation of policies and programmes for the Hill Areas of the Himalayan Region so that the people living there are enabled to have their share of the benefits accruing from modern science and technology and the precious environment is preserved in a suitable condition for the generations to come. The great challenge ahead is the formulation of programmes which can lead to sustainable development and thereby result in lasting human happiness.

14. In this report we have selected a few areas for special consideration in order to illustrate the concept of eco-development. For example, we have considered fields such as road construction and post-harvest technology of horticultural and silvicultural products as well as livestock reform and habitat planning, since these are crucial issues in Himalayan development. Above all, we have suggested mechanisms for involving the faculty and students of the universities located along the Himalayas in a co-ordinated and continuing manner in the task of ecodevelopment.

CHAPTER II

SOCIO-ECONOMIC DEVELOPMENT

2.1 INTRODUCTION

2.1.1 Socio-Economic Development covers practically all the Development aspects of planning in the Himalayan region. The Task Force has attempted to cover the field but are only too conscious of the limitations of the Report. The report therefore has confined largely to suggesting a core strategy for development, compressing the treatment as much as possible.

2.1.2 The Report deals principally with the economic parameters. So far as the socio-cultural aspects are concerned these are of very great variety "People should develop along the lines of their own genius and we should avoid imposing anything on them" Jawahar Lal Nehru. In line with this statement of policy, our emphasis is on providing the people with a system of education related to their everyday life, realising the minimum needs programme and providing them with the necessary infrastructure for development. It is felt that if people have the tools and the know-how, they can best shape their own response to the challenge of development.

2.1.3 If hill people can be brought to understand the precarious situation to which they are exposed by depletion of the resource base, and introduced to a way of thinking which leads to a perception of the need for change, they would often themselves demand the very changes which are required.

2.1.4 It should be emphasised that hill development cannot get into gear unless official attitudes are radically changed. Public association, it is only too obvious, has become an empty slogan. It can be made a reality once again if, and only if, there is active official involvement in the process that make public participation a reality. The old system of touring and of living and working amongst the people must be restored to revitalize the whole effort of hill development. Prolonged night halts if necessary in tents, will have to be firmly enforced once again.

2.1.5 The operational recommendations should be read in the light of the analysis in the Report, but the Task Force has tried to make them self-explanatory. As has been stated in the Report, the recommendations have necessarily been framed in general terms so that State Governments and other agencies can apply them in the light of local circumstances.

2.2 TERMS

2.2.1 Objective of Socio-Economic Development

The Task Force should, at the very start, define what it means by socio-economic development so as to keep both the analysis and recommendations properly targetted. The conception throughout has been that the term means improvement both of the economic and social texture of life. The aim must be to increase economic well-being and improve the quality of life In the Himalayan context, socio-economic development can only be achieved through optimal management of the slender and, in many cases, highly depleted resource base, which is subject to increasing depletion. Hence, the urgency of socio-economic development.

2.2.2 Resource base

This term has been used to cover the entire complex of natural resources available in the Himalaya. The principal resources are the land, forests and water, not forgetting the human skills which can revive and sustain the resource base, but which, so far have unfortunately succeeded in diminishing its productive capacity. The resource-base in the Himalaya has been endangered principally on account of over-population, over-stocking of cattle and misuse of land and forests, Those responsible have not always been the local people. There are other agencies involved in utilising Himalayan resources, particularly the forest departments and the road construction agencies. The report has, therefore, concerned itselves with an analysis of the principal resources and have made recommendations for what it considers to be the method of utilisation compatible with sustainable yields. In the recommendations, the highest priority has been given to the most endangered areas particularly the so-called village forests.

2.2.3 Support capacity

This concept, to which reference has been made, time and again, is a variable which depends on the existing level of productivity. In much of the Himalaya this level is lower than the optimum obtainable by a factor of between two and ten. This is due to decades, if not centuries, of bad management at all points of human impact on the resource base. The main purpose of this report is to suggest how the support capacity of the resource base can be raised to provide a better life for its inhabitants.

2.2.4 Eco-system

> "Eco-system is an arbitrarily defined unit in which there is a distinct pattern of energy flow and chemical cycling."

Only one modification needs to be made for our purposes. The unit is not arbitrarily, but is defined by nature. In the plains this definition may not be easily apparent but in the hills the unit is more clearly and sometimes sharply defined from watershed to watershed. The resources within such a unit are integrally related to each other. At its best, the eco-system functions in nature as an organic whole, eco-development is development which harmonises with the organic integrity of the unit.

2.3 LAND AND PEOPLE

2.3.1 To be effective and meaningful, plans for socio-economic development of the Himalayan region must be dynamically related to the socio-cultural

conditions of the people. These conditions, to a very large extent, have been determined by the unique physical features of the Himalaya. Apart from the immensity of scale, the most striking feature of the Himalaya is its abundant variety. It is, therefore, necessary to start with a description of the land and people.

2.3.2 Physical features

This greatest of all mountain system extends roughly 2500 kms. from NW to SE and is between 250 and 300 kms. across.

2.3.3 Longitudinal belts

The Himalayan system consists of three major longitudinal belts. Separated by fault lines, their geological and topographical character are strikingly difficult. Immediately north of the plains is the Sivalik belt, or foothills, rising to an average height of 1000 m. This is an autochthonus zone. The next, this is a para-autochthonus zone consisting of unfossiliferous rocks, is known as the middle Himalaya. Its width ranges between 65 to 75 kms. and the average height rises to 3000 m. This zone is profusely dissected; it is a tangled mass of ranges and valleys, with the major rivers cutting across it, sometimes in deep gorges. The third belt is the Great Himalaya, rising to an average of 5,200 m.characterised by granites, gueisses and metasediments. The giant Himalayan peaks are concentrated in this zone. There are 92 peaks over 8000 metres in height.

A fourth subsidiary zone beyond is known as tethys or trans-Himalaya and is marked by folds imbrication and counterthrusts. The Indus suture in Ladakh separates this zone from the Great Himalaya.

2.3.4 Transverse zones

These are three

i) Western - starting from the Indus watershed and comprising J&K and Himachal Pradesh;

ii) Central Himalaya - which includes U.P. and Nepal;

iii) Eastern Himalaya - from the Singalila range upto and including the Brahmaputra watershed.

2.3.5 Zonal differences

There are marked differences between these zones in respect of climate, topography and vegetation. At the edges, these differences shade off into the next.

(a) Rainfall

Western Zone : Middle Himalaya and Sivaliks 1000 to 2000 mm

Great Himalaya - 600 to 1000 mm

Trans-Himalaya - a semi-arid desert, with rainfall decreasing to about 75 mm in Leh.

Central Zone : Rainfall increases to between 2000 and 2500 mm.

Eastern Zone : This is an area of copious rainfall of between 2500 and as much as 5000 mm.

(b) Vegetation

The Western zone, being farthest north, is the coldest and driest and the eastern zone the wettest and warmest. Although to a considerable extent the vegetational differences arising from climatic zoning is offset by the effect of altitude, the western zone is marked by temperate flora and the eastern by Chinese genera and tropical broad-leaved varieties in the lower and middle Himalaya. In general, the Central zone is an area of transition between West and East.

(c) Topography

The middle belt, the criss-crossing valleys have the effect of creating sub-climates and ecological differences, sometimes within short distances. This belt receives the highest rainfall.

The drainage lines of the Western Himalaya are aligned with the mountain features and largely flow east to west. In the Eastern Himalaya, the drainage lines are predominently north to south, while the Central region is transitional.

The Himalaya are geologically young and naturally prone to wearing processes. This weakness is aggravated by two additional factors :

i) Its great height and the steep descent of the drainage channels;
ii) concentration of the high-water period in four summer months from June to end of September.

The setting of the Himalaya across the monsoonal clouds results in heavy rainfall on the southern slopes. The drainage channels bring down large quantities of detritus from the catchments, creating an erosion problem perhaps without parallel in the whole world. The erosion has been further intensified by man's faulty land use practices, mostly in the middle Himalaya.

2.3.6 The Himalaya - A contact and Refuge zone

Because of its height, length and other natural features, the Himalaya have been described as a contact zone between three different physical systems, the Indian sub-continent, the Tibetan plateau and the Central Asian mainland, with their different climates, ethnic groups and social systems. In addition, the Himalaya constitute a refuge zone for natural species and human communities. As such, the Himalayan system as a whole has had a profound effect on the sociocultural institutions of its people, their conditions of life and the resource base on which they depend

2.3.7 The People

The population of the Himalayan-region is now about 43 million. As may be expected, the Himalaya shelters an unusually large number of ethnic groups at various stages of development. Arunachal alone has as many as 110 scheduled tribes, Assam 23, Manipur 28, Tripura 18, Meghalaya 12, Mizoram 12 and Nagaland 5. Even the older administered territories of U.P. and Himachal Pradesh have 5 and 7 respectively.

2.3.8 The middle and lower Himalaya are strongholds of the traditional caste structure. This has operated to the disadvantage of the socially underprivileged classes. In these two regions, the old sense of responsibility to the community as a whole has been eroded by the competitive pressures of the response to the modern age.

2.3.9 There is very little in common between many of the ethnic groups in the Himalaya. In the highest zone, the Tibeto-Buddhist population has for centuries been dependent on Tibet for grazing and trade. In the winter they brought their wool, borax etc. to the plains trading them for necessities and consumer goods for trade in Tibet. Their life-styles have been deeply influenced by Mahayana Buddhism. The middle Himalaya enjoy most of the natural advantages of fertile valleys, milder elimate and access to the plains. Small towns have sprung up in the valley, floors and ridges of the middle Himalaya. The people of the Sivalik belt have always been most closely linked to the plains in respect of social customs and economic dependence, but, except for the Duns, it is also poorer than the middle zone in natural resources.

2.3.10 The variety of socio-cultural conditions of the people of the Himalaya, and the differences of the natural resources on which they depend, are so great that it is not possible to adopt a uniform pattern of development throughout the Himalaya. For example, the people of the Great Himalaya made a division of functions between men and women. While the men looked after animals and were absent, for several months of the year as they traded in Tibet, the women did all the farm work, including sometimes even the ploughing. In the middle Himalaya, most of the farm work is done by the women, even if the men happen to be there. The only contribution made by the men to farming operations is ploughing. In a general way it would be true to say that the men in the middle Himalaya have not yet learnt how to make productive use of their time. Many of them leave the hills in search of employment in the plains. Conditions in the lower Himalaya are very similar in this respect to those obtaining in the middle belt.

2.3.11 Because of the great variety of ethnic groups, socio-cultural features and physical conditions of life in the Himalaya, the approach to development should best follow Jawahar Lal Nehru's dictum: "People should develop along the lines of their own genious and we should avoid imposing anything on them. We should try to encourage in every way their own traditional art and culture".

2.3.12 This philosophy was evolved in respect of what was then called the North-East Frontier Agency, now Arunachal Pradesh. Failure to understand the people and the circumstances of their lives can lead to unfortunate consequences. For example, the U.P. Zamindari Abolition Act was applied to the Bhotia communities of the Great Himalaya without adequate consideration being given to the fact that the long absence of the men, as they traded in Tibet, forced the Bhotias into sometimes making other arrangements for cultivation of their holdings. Zamindari abolition thus deprived them of considerable areas of land; and the closure of the border after hostilities with China deprived them of traditional trading and grazing rights in Tibet. They lost both ways. This is an example of misapplication of standard policies.

2.3.13 An example might also be given of how development should be dynamically related to local customs. In Kameng, specific oak trees in community forests are allocated to individual households, from which leaves are collected for compost. This local custom should be woven into arrangements for community forestry in the area. Similarly, many communities in the Great Himalaya already boast functioning village communities which determine farming, grazing and other activities. The dynamism of these village communities should be utilised in the application of development processes in such areas. An attempt to replicate standard procedures and structures, by-passing traditional community organisations, will neither be successful nor conducive to the survival of traditional organisations

which have proved their worth. Application of measures which may be perfectly valid elsewhere should, therefore, be preceded by study of the socio-cultural conditions of the people of the Himalaya and suitably adapted to them.

2.4 SOCIO-CULTURAL BASIS OF ECO-DEVELOPMENT

2.4.1 People in the Indian Himalaya have everywhere made their own unique response to the resource base and to the challenges presented by developmental planning in the India of today. The recommendations made are, therefore, framed in general terms. They are intended to be imaginatively applied by the State Governments in a dynamic relationship with the socio-cultural circumstances of the people and the conditions of the resource base.

2.5 SURVEY OF MAIN RESOURCES

2.5.1 Statistics

A major difficulty is the lack of reliable statistics. No one knows, for instance the area of the village forests that retain the character of forest. The actual extent of irrigation is uncertain. The resource survey which we have attempted must, therefore, be viewed as indicative rather than definitive. Nevertheless the picture presented is substantially correct.

2.5.2 Tables at Annexures XI and XII summarise the existing pattern of land use.

2.5.3 Depletion of resources

The Himalaya as a whole are geologically young, and the environment, which is a composite of all the natural features, is extremely fragile. This is a brief statement of a well-known and well-accepted position. Generally speaking, the eastern part is more unstable than the west. The soils are poor and highly erodible.

2.5.4 It has been clearly established by several authorities that resource use has reached a stage when the resource base itself is gravely endangered. The resources principally affected are land andforests. This is due to a combination of factors, chiefly overpopulation and overstocking of cattle. No more graphic picture of the overall situation is available than the one given by Dr.S.L.Shah in his Presidential Address at the Forty-first All-India Agricultural Economics Conference. Projecting present rates of population growth, consumption of forest stock, numbers of cattle and grass stock consumed by cattle, the results obtained are tabulated below :

Year	Population (million)	Forest stock (million cubic metres)	Cattle units (millions)	Grass stock (dry matter) (mill. tonnes)
1981	4.787	66.00	3.40	8.86
1991	5.995	36.30	3.46	5.30
2001	7.508	19.96	3.52	3.17
2011	9.404	10.98	3.58	1.90
2021	11.777	6.04	3.65	1.14
2031	14.750	3.32	3.71	0.68
2041	18.472	1.77	3.78	0.41

(Source: Presidential Address, dated, 25th December 1981 at Dharwad, Karnataka University).

2.5.5 The all-important question arising from these projections is whether the relentless slide towards a position of zero forest and grass stock can be reversed and converted into an ascending curve of growth.

2.5.6 Man-land ratio

The percentage growth of population during the three decades 1951 to 1981 as compared with the previous 50 years is tabulated below :

	1901-51	1951-81
Western Himalayas	37.70	72.02
High Himalayas	26.69	74.20
Mid Himalayas	52.23	67.07
Siwaliks	35.20	76.59
Central Himalayas	46.43	80.11
High Himalayas	49.47	73.81
Mid Himalayas	47.08	47.39
Siwaliks	42.49	119.14

(** From a Study conducted by the Delhi University, Department of of Geography, under P rof. S. Burman).

2.5.7 The same study has shown that the overall man-land ratio in the last two decades was as follows :

	1961	1971	1981
High Himalayas	94.46	76.62	50.2
Mid Himalayas	4.98	4.35	4.1
Siwaliks	2.70	1.99	1.4

2.5.8 A diminishing man-land ratio graphically illustrates the pressure of population, but the critical relation is the number of people supported by the land compared with the net area sown. Taking the two States of Himachal and Uttar Pradesh into consideration, the density of population per hectate of cultivated land in the Himalayan area is nearly four times higher than the density in the plains, while productivity is much lower. The position has become very acute in Garhwal District where the population of local able-bodied males has been diminishing as a result of migration. People have to seek their livelihood elsewhere because the support capacity of the land under present systems of management cannot be extended any further. A study of some villages in Bhikiasen block (U.P.) has disclosed that over 60 per cent of family income was generated outside by migrant males and remitted to their homes. Out-migration has, therefore, become a necessary means of augmenting family incomes which would otherwise be too low for family support. In the forseeable future, out-migration will continue to be an inescapable feature of large parts of the Himalaya until the support capacity is increased enough to keep them working in their farms.

2.5.9 Fragmentation of holdings

While holdings have been diminishing in size, under pressure of the existing social systems, holdings themselves are becoming more and more fragmented. It is not possible to make a general statement applicable to

the entire Himalayan region. Selective studies made in Uttar Pradesh reveal that an average, holding might be distributed in 5 or 6 localities, broken up into as many as 25 pieces. It is obvious that fragmentation of this order must militate severely against productivity.

2.5.10 Depletion of topsoil

Agricultural practices have almost everywhere been responsible for serious loss of top soil. In irrigated fields banding is done but in some areas rain-fed crops are grown on unterraced hill sides. Inevitably, the top soil is washed away year after year. On the whole, soil in which agriculture is practised has become very poor in essential nutrients.

2.5.11 In the eastern Himalaya, where jhooming is practised, the cycles have been diminished in the last few decades. The average has fallen as low as between five and eight years. In these circumstances, the soil and soil cover cannot recover before the cycle is repeated.

2.5.12 Erosion

The consequences of depletion of forest cover depicted above are extremely serious. The loss of forest wealth is the first direct effect. The second is large-scale erosion of top soil. The third, of which faulty agricultural practices are a contributary cause, is the degeneration of existing agricultural land. The fourth effect, felt principally in the plains below, is the increasing havoc of floods. Siltation rates in the main river basins do not appear to have been intensively studied in India. An estimate made in Nepal has disclosed that the Karnali brings down 75 million cubic metres of solid material every year into the Ganga Basin. This is equivalent to a 1.7 mm layer for the whole catchment. Investigations made by the Central Soil and Water Conservation Research and Training Institute, Dehradun, under Dr. Tejwani's direction have revealed the disturbing fact that siltation in 21 storage projects is 182 per cent higher than what was provided in the projects themselves. The sedimentation rate in the Ramganga Project has been exceeding the design rate by four times, thus reducing the effective life of the reservoir from 185 to 48 years.

2.5.13 Irrigation

Accurate statistics about irrigation are not available. It has been estimated that the net irrigated area as a percentage of the area cultivated varies from 0.3 per cent in Arunachal Pradesh to 6.7 per cent in Himachal Pradesh. The main concentration of water is in the rivers and streams in the valleys. Springs have been drying up in the last few decades due to felling of forests. Consequently, large areas are entirely dependent on rainfall and snow melt. In such areas in the Great Himalaya as Ladakh, Lahul-Spiti, where water is extremely scarce, people have shown remarkable engineering skill in utilising snow melt and other available water. For instance, precious water is brought down below the stones from Khardungla to Leh. In the lower valleys, irrigation has remained underdeveloped, even when streams are perennial.

2.5.14 The land cannot be used effectively for productive purposes unless better use is made of available water for irrigation, and a production strategy is worked out which is directly related to water availability. The point being made here is weakness of the soil and the lack of irrigation facilities to strengthen the support capacity of the hills.

2.5.15 Forests

Generally speaking, there are three main categories of forests: reserve, village and private. While not going into a detailed history of these three categories, it is important toremember, however, that the approach to reserve forests in the last 100 years has been essentially commercial. Village forests which at one time may have sufficed for village use, can no longer meet the needs of the village people. At one time, in the older States, village forests covered approximately 33 per cent of the total area. Studies made by the Delhi University, Department of Geography, reveal that the forested area has diminished dramatically to between 6 and 8 per cent. The so called village forests have been reduced to scrub and grassland. Villagers, who need forests for fuel and fodder, have perforce been compelled to poach in reserve forests. Their cattle graze freely wherever grass can be found. The consequences are disastrous not only for the so called village forests but also the reserve forests. Trampling of young plants impedes regeneration and fodder tree seedlings are destroyed by grazing. Fires to promote growth of grass also destroy young plants. The Kumaon University, Nainital, has found that natural regeneration of quercus incana is not happening. At this rate the village forests will soon become non-existent and even reserve forests will be very adversely affected.

Private forests, on the other hand, have been very much, better maintained.

2.6 CORE STRATEGY

2.6.1 The brief analysis of the processes of depletion affecting the natural resources of the Himalaya lead on to what might be called the inviolables of a core strategy of eco-development. The principal measures visualised in this core strategy are :

Protective
Regenerative and
Productive.

The justification for these measures will now be apparent. The present resources must be protected from further damage and what has been lost must also be regenerated. At the same time, support capacity must be increased to enable a growing population to live a better life. These three measure, therefore, comprehend the whole range of socio-economic development in the context of ecological security of the Himalayan region.

It must be emphasized that the measures advocated are processes, not stages of a sequence of development. Unless the productive part of the strategy is launched simultaneously with the protective and regenerative, the people of the Himalaya will necessarily make further inroads in the resource base in the struggle for existence.

It must also be recognised that the natural resources of the Himalayan region are closely inter-related, much more so than in the plains. As has been pointed out, for instance, loss of soil nutrients lowers the productive capacity of the soil and thus impairs its capacity to support the people who depend on it. In this way the inter-relatedness of natural resources are also intimately bound up with the well-being of the people. These affinities are aggregated in what might be called the natural collectivities in the Himalaya, which are the catchments and mini-catchments that occur in nature. The n a tural collectivities must

be made the basic units of eco-development. This aspect will be dealt with later in this chapter. Here it is necessary once again to stress the inter-relatedness of the three elements of the core strategy and the over-riding importance of launching them simultaneously in the eco units.

2.6.2 It should also be emphasized that the three-fold processes advocated in the core strategy take time to produce tangible results. It has been estimated that it takes anything between 500 and 1000 years to create one inch of topsoil. Re-establishing lost forest cover to full maturity may take between 50 and 100 years. Rotational afforestation may be speeded up by introducing quick growing varieties, but in most areas it will be necessary to restore pristine ecological conditions by planting the species which are being lost. The measures introduced will, therefore, have to be sustained over a long period of time. More than that, they will have to become an established process for sustainable growth. For this purpose, it should be recognised that the resources of the eco-units are the inviolable heritage of the natural collectivities and the people who inhabit them. For example, departmental forest operations must subserve the interests of the eco-units, and the inhabitants must be associated with the planning of such operations, and their consent taken. This consultative process will be expressed through catchment development boards, consisting of multi-disciplinary district staff and the elected representatives of the people. The constitution and operation of these boards has been dealt with separately. Here, it should be emphasized again that the resources of the natural collectivities are the inalienable heritage of these units and their people, and must be utilised, regenerated and developed in the interest of the units as a whole.

Apart from the people of the Himalaya, the main agents of change include national and state governments who have projected their activities into the Himalayan Region in a big way in the last three decades. Roads have been built to the farthest passes, and at considerable speed, using the latest earth-moving equipment. Macro multi-purpose projects have been built to realise the enormous water potential of the Himalaya. Some of the most serious damage to the environment has been done in the course of this activity.

2.6.3 The core strategy must also take account of the objectives of government in establishing schemes for national development. Realisation of these purposes need not be necessarily incompatible with environmental security and the needs of Himalayan people, but it is clearly necessary that new methods of resource use and national development should be devised to harmonise with the fragile ecology of the Himalayan region. Proposals have been made with regard to road construction in the chapter on Transport Planning. The safeguards outlined there would apply mutatis mutandis to realisation of other projects as well. In this chapter, the Task Force is primarily concerned with the manner in which the reasonable needs of Himalayan people should be met.

2.6.4 Priorities

From what has been said above, it is clear the protection, regeneration and development of the Himalayan resource base must be given the highest priority. It would thus be possible to progressively meet the needs of the Himalayan people and to increase their well-being. To put it concretely, the priorities suggested are as follows :

i) Protection, Regeneration and Development of the Himalayan resource base;
ii) Progressive realization of the well-being of the Himalayan people; and

iii) Utilisation of Himalayan resource for national benefit.

The proposals in this Chapter are confined to the first two priorities because these alone cover the subject of socio-economic development of the Himalayan region.

2.6.5 Unit area of development

To be meaningful, eco-development must conform to ecological realities. In mountainous country, the topographical division of the valley systems govern the pattern of agricultural settlement with their lines of communication and trade. Each valley has its peculiarities of soil, water, vegetation and microclimate, and these constitute the resource base of the local population.

2.6.6 It follows that the topographical features which determine the distribution of human settlements usually also determine the areas which must be treated as units for regenerating the resource base. This is particularly true in the middle and western Himalayas where damage to the resource base is directly linked to the need based activities of the inhabitants. Here also, the socio-economic development of the people cannot be separated from the regeneration of their resource base, consequently the unit area for resource regeneration roughly coincides with the unit area for socio-economic development. The unit area corresponds to the water catchment, and this is a convenient unit to adopt.

2.6.7 For practical purposes, however, the catchment may be too large a unit of development. No hard and fast rule can be laid down, but is clearly within the competence of the local authorities to determine appropriate units of eco-development, whether they be catchment, sub-catchments or mini-catchments.

2.6.8 In most cases, the boundaries of traditional territorial units will conform to the natural boundaries. In some cases, there may be overlap. As far as possible an attempt should be made to fit the administrative boundaries to the natural boundaries. Where overlaps occur, and redistribution is not possible, the overlapping area can be represented in the local bodies.

2.6.9 Adoption of the eco-unit for development is desirable though not absolutely essential. Local adaptions may have to be made but congruence between natural boundaries and administrative boundaries is a desirable objective, and an attempt should be made to bring the two together.

2.6.10 Organisational Pattern

Keeping in view the objectives of hill development as stated in the Introduction, the Task Force has given considerable thought to the pattern of administration and public association in the development process. All the available evidence suggests that the existing structures are not able to deliver the goods at pace called for by the critical resource situation and the urgent needs of the people. Whereas in the older hill States, such as Himachal Pradesh and Uttar Pradesh, the existing administrative pattern is more or less similar to that of the plains, variations have been introduced in such areas as Ladakh and Arunachal Pradesh. When the administration was set up in NEFA, as it was then called, emphasis was laid on investing district officers with adequate powers to deliver the goods on the spot. The main feature was the integration of the activities of all line departments in respect of each

administrative unit. This system of single-line administration has fully proved its worth. This pattern should be adopted throughout the Himalaya. The people in the hills are isolated, backward and widely dispersed. Communications are difficult and the public look to the authorities for immediate solutions of their many acute problems. The sooner the single-line system is adopted the better.

2.6.11 The integration of administrative and development agencies is necessary for another reason. Resource management within the eco-development units has to be a multi-disciplinary effort. Therefore, the official manpower resources must be integrated under the district officer to ensure that the resources, both natural and human, within each eco-development unit are developed so as to realise their full potential. The evidence on coordination by District Officer is rather mixed. The authority for such coordination exists, but is often not exercised to the extent it should. Various factors are responsible. Some officers are interested, others less so. The State Governments can best deal with this question, but it is suggested that the need for effective coordination should everywhere be insisted upon in practice.

2.6.12 Once the recommendation for a single-line administration is accepted, the implications will have to be worked out by the State Governments concerned. Necessary Central guidance will need to be provided. It should be emphasised that this recommendation applies to all departments functioning in the field, namely, agriculture, animal husbandry, horticulture, forests, P.W.D. irrigation, power etc., and others that may come into being.

2.6.13 The next level in the standard development pattern is the block. It is not necessary to introduce changes at the block and village levels. The existing representational and developmental pattern could provide the motive power for progress if properly handled.

2.6.14 Considerable variations are apparent in the level of official performance as between the different States in the Himalayan region. In the exclusively hill States, the official cadres are permanently committed to work in the mountains. They have thus acquired a fair level of expertise. This, regrettably, is lacking in Uttar Pradesh, which is predominantly a plains State. Consequently, the degree of commitment and expertise found in other States is lacking. A separate hill cadre in Uttar Pradesh is an essential organisational change. A beginning has already been made in this direction but the separation of an exclusively hill sub-cadre in U.P. should be carried through under a time-bound scheme. This should cover every Department functioning in the hills.

2.6.15 A place must be found in the administration for women workers at block and village levels. Village women play a vital role in the whole range of farm activities. This cooperation is essential to the success of any programme dealing with these subjects and they will respond more readily to woman than they will to men. The objectives should be to fill 50% of V.L.Ws posts with women. Educational qualifications should be relaxed, but not knowledge, experience and training.

2.6.16 There is considerable diversity in the performance of representative bodies. Some have made a significant contribution to the public interest while others have been less successful, but the potential is always there. Our main anxiety is with respect to diversion of resources to benefit local power elites and neglect of the interests of the underprivileged sections of the community. It is, therefore, imperative that the organisational structure set up should operate in such a way that the

interests of the under-privileged are safeguarded. The report has suggested direct association of the village people, rather than elective officials only, in the key processes proposed. Resource planning must become a lively popular, democratic process. This would ensure that the neglected sections are not neglected any longer, but vigilance by official agencies will be necessary at all stages.

2.6.17 Catchment development boards

The Report has avoided recommending additional administrative agencies. The Task Force feel, however, that some re-structuring and reallocation of functioning within the existing organisation is necessary for efficient performance. This reallocation should conform to the eco-development units, which have been identified as the catchment, sub-catchment, mini catchment. The technical multi-disciplinary staff available in the District, at the district level itself and at Block level should be deployed in such a way that they can provide technical advice and services for the eco-development units. The various Pramukhs and Sabhapattis of the eco-development units, along with the technical staff, would constitute the Catchment Management Boards. The functions of these Boards will be as follows :

i) Preparation of resource survey (to be reviewed every 5 years);

ii) Preparation of resource use plans, with particular emphasis on indicating areas suitable for agriculture, forests and horticulture;

iii) Generally to oversee the welfare of the people of the unit, particularly in provision of minimum needs.

2.6.18 It will be apparent that the basic tasks of resource development have been assigned to the Catchment Management Boards. It will be their function to dynamically relate programmes of development and resource regeneration to the motive power of popular associations. In discharging their tasks, the Catchment Management Boards should involve fully the people in the catchment area.

2.6.19 Resource survey

Having regard to the sociological conditions prevailing in the hill areas and the fact that necessary expertise to plan utilisation of local resources is not available at the level of the block, it is urged that the district development committee should itself play an active part in planning resource utilisation in each eco-unit.

2.6.20 This can be done by deputing multi-disciplinary teams of technical district staff to the various catchment areas to survey existing resources, to draw up plans for regeneration of the resource base and constructively to plan for the development of each area. The teams should be headed by senior responsible officers not lower in rank than SDO. These teams should ensure that the peoples' representatives are fully associated with these processes. It is visualised that resource investigation should proceed more or less on the lines of a pre-settlement revenue survey. Resources have to be identified on the ground. The visits of the multi-disciplinary teams should be programmed and announced in advance so that all the local people can be present at some convenient place. Similarly, prescriptions for resources use should be made known within the village and the people's reactions should be obtained on the spot. This form of public association would act as a safeguard against some of the distortions which have occurred when only Pramukhs and

Sabhapatis have been involved. The success of the development process ultimately depends on the whole-hearted participation of the people, and this will not be available unless they are actually involved. Moreover, they have vital inputs to make in the shape of local knowledge of resources and the motive power for development.

2.6.21 Planning for the protection, regeneration and development of the resource base necessitates one essential preliminary. The status of existing resources in the eco-development units has to be determined. For this purpose it is necessary to make an intensive survey of each unit and to prepare a descriptive statement of resources that exist, the kind of resource use practised, and the form of use that would be appropriate. Simple proforma to elicit information should be adopted. Central guidance would be desirable. It should cover the main and subsidiary resources and should be prepared for each patti or village. State Development Departments will have to work out the proforma very carefully in advance. The success of the survey will depend, to a large extent, on the clarity of the questions asked. This resource survey will constitute the basic bench mark for future development.

2.6.22 In general, public opinion is considered the most effective base on which public cooperation can be built. It is, therefore, highly desirable that educational and public relations programmes should precede administrative action in the field of development. These programmes should be introduced to educate the population in the simple principles and processes involved, such as the limits which should be placed on population and the advantages to be gained by sustained rates of production of fuel and fodder from unit areas. Hopefully, this educative process will provide a common ground of understanding out of which a dialogue can grow between the people and the administration with a shared concern for ecological regeneration, socio-economic development and national progress.

2.6.23 Popular involvement in the form suggested will ensure that the women, who are directly involved in most of the farm work in the villages, will be able to participate. The input that they will be able to make is vital to the success of development. If they are not involved. the chances are that their interests will be ignored. Women pay a crucial role in farm and forestry in the hills and their active participation in these activities, in an organised manner is essential. A separate organisation of women's mandals should be set up, as a distinct organisation, specially to manage areas with which they are principally concerned, such as fuel and fodder reserves.

2.7 MAN'S NEEDS

2.7.1 Specialists of all concerned disciplines are unanimous that reversal of the present inexorable descent towards resource exhaustion cannot be halted unless human needs for subsistence and creative development are fully met. Basically, these are the four Fs - Food, fuel, fodder and fertiliser.

2.7.2 Food

It must be emphasised that until man's needs are met, consistently with full socio-economic development, the support capacity of the Himalaya will continue to be overstrained and its resources diminished. His needs for food are met chiefly by what he can grow. Imported consumer goods are a relatively recent phenomenon, made possible by production of cash crops.

2.7.3 Since agriculture cannot be expected to make up the difference between production and man's need of food, it has been proposed that needs for essential foodstuffs should be estimated and the quantity required supplied through an effective, honest and reliable public distribution, system at uniform rates.

2.7.4 Basic cultivation strategy

As a complementary effort, encouragement should be given to cultivation of cash crops - nuts, fruits, flowers and vegetables, backed by a network of roads, feeder tracks and transport systems. Justification for the strategy is as follows :

(a) The Himalaya are particularly suitable for such cultivation;

(b) The net cash returns are much higher than in the case of cereals;

(c) That the strategy will benefit Himalayan economy;

(d) Smaller areas of land are required for agriculture and it will thus be possible to safeguard the ecological security of the resource base and enhance its support capacity.

(e) Cereals should be grown in terraced fields provided with irrigation, thus enabling greater concentration of inputs with expected increase of yields. In this way, support capacity will be further increased.

FUEL

2.7.5 Except in a few urban areas, wood and very small quantities of char coal (a wood derivative) are the only source of fuel. The total and areawise consumption of bio-fuel in the Himalaya has apparently not been estimated. It has been estimated that 190 million tonnes of coal equivalent are consumed annually in India as a whole. In Nepal, 87% of the energy consumption is from forests. It cannot be less in the Indian Himalaya. The yearly loss of forests (in hectares) has not been estimated. It must be very considerable in view of the fact that in the Indo-Gangetic basin, the forested area, including that in the higher catchments, is now not more than 14%.

2.7.6 Perera has said : "The unrestricted use of the forest bio-mass for energy, as well as other unregulated practices, coupled no doubt with the population explosion has led to an alarming depletion of the resource base with its attendant dire consequences"....."These consequences, in the DVC, were an outflow of silt from the catchment of 3102 million tons annually, or 345 tons per hour. The silt outflow in the Himalaya must be several times greater for each catchment.

2.7.7 After examining the various options (in fact there is only one), Perera's conclusions in "Man-made biofuel plantations or energy farms may be the only remedy and the only answer".*

2.7.8 It has been estimated that 1.96 million hectares should be brought under fuelwood plantations in India as a whole by the year 2000. This represents only 0.6% of the total land area. A sectoral projection for the Himalayan region must be drawn up in the course of the resource surveys/prescriptions, catchment by catchment.

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* Biofuel systems of plantations - Energy Farms: The environmental consequences. East-West Centre, Hawai, 1979 pp 20, 28, 33.

2.7.9 It has been estimated (Perera) that the annual planting programme expressed as a percentage of the total land area (in the early'70s) was 0.01%. Now it may be upto 0.02%, which is a very small and manageable area, provided effective planting/maintenance programmes are introduced (recommended later).

Bio-fuel Plantations

2.7.10 Enough is known about types required to make an immediate Start. Intensive experimentation should also be taken up. The species need to have the following properties amongst others:-

Fast growing;
High calorific value;
High cropping potentiality;
Increasing soil fertility;
Leaves suitable for fodder and fertiliser;
Suitable for watershed management;
Conducive to the general shaping of the environment.

2.7.11 Rough calculations indicate that only a portion of the uncultivated village land needs to be plated in the first instance with biofuel/fodder trees tomeet the requirements provided the area is fully covered and the rotation completed according to the detailed schemes prepared by Shri Madhava Ashish in consultation with Pant Nagar University. The scheme is appended (Annexure XIII).

2.7.12 In addition, strategic areas, ridges, boundaries etc. in individual holdings, should be selected for this purpose. Landholders will gain from a fresh source of fuel/fodder and commercial wood.

2.7.13 Forests are rapidly disappearing. The plantation programme should be backed by law or executive orders having the force of law. Without proper sanctions no such scheme will succeed on the ground. Plantations in Bhutan have been highly successful. There is no question that it can and must be done in the Indian Himalaya.

Nurseries

2.7.14 A massive plantation programme, which will necessarily be continuous, will need to be supported by plant nurseries in each catchment.

2.7.15 Mistculture, as poineered by the Roorkee University, is a recommended system. This is a continuous generation system, with something like ten times the yield of ground nurseries in equivalent space.

2.7.16 The margin of profit per tonnes from fuel wood plantation has been estimated (Perera) to be:-

for fuelwood - $ 10.00 (Rs.70-80)

for Commercial Use - $ 275.00(Rs.1925-00-2000)

2.7.17 The benefits are :-

(1) Fuel becomes available
(2) Fodder - ditto -
(3) Environmental
(4) Commercial

Fertilisers

2.7.18 Because of the need for soil nutrients, farming families in the hills tend to keep more cattle than necessary. Women also collect leaves for being used as bedding for cattle and such urine and dung soaked leaves are also used as manure. If the practice of applying chemical fertilisers is popularised it will not be necessary for keeping so many heads of cattle just for the sake of collecting dung. Livestock reform will be facilitated in the hills if alternative arrangements are made for fuel and fertiliser.

Minimum Needs

2.7.19 National educational models have been applied without any variation to the hill areas. This model is essentially aimed at producing literates, leading eventually to higher education. It is not related to the business of earning a living in the local environment. A faulty educational system is bad enough in the plains, in the hills, where much more specialised knowledge is necessary, the results are disastrous in two principal ways. Firstly, what is learnt in the classroom, cannot be applied in the field. Secondly, the type of education imparted promotes a desire for the adult males to seek their fortunes in the plains.

2.7.20 Clearly, therefore, what is needed in the hills, more than anywhere else, is a system of education which will provide the people with the necessary know-how for living, earning and prospering in the hill areas. The software will have to be completely redesigned. Children should be taught from the earliest age about forestry, erosion control, appropriate systems of agriculture and so on.

2.7.21 Learning in the classroom should be supplemented by practical education. Small demonstration fields around educational institutes are not enough. When they are old enough to work, school children should be put on to public work in their catchments, such as afforestation, erosion control and the like. In Sikkim, a very interesting scheme has been introduced under which educational institutions are allotted specific areas for afforestation. Wages, which might otherwise have to be paid to itinerant labour, are paid to the children instead. In this way they learn as well as earn.

2.7.22 While the details of an appropriate system of education have not been attempted the primary aim of this Report is to suggest new objectives and new methods which will establish a direct and organic link between software and the needs of hill people. It is appreciated that a major reform will be necessary. The sooner the Government buckles itself to the task the better.

2.7.23 Recognition will have to be given to diplomas of education furnished on the completion of the various stage. of such practical education. These will have to be equated with the standard certificates such as middle, matric, school leaving etc. A youth who has done practical afforestation in his catchment is likely to be much more aware than a youth of the same age educated under the present systems. A few months house training may be necessary to fit him for specific tasks. Unless Government is prepared to take these steps education will continue to be unrelated to activity and will continue to breed the evils with which we are only too familiar.

Public Health and Medical Facilities

2.7.24 These two essential services have not been adequately provided in the hilly areas. The primary necessity is to provide healthy drinking water. This can only be done if springs are tapped at source and the catchments protected from pollution. Polluted drinking water is the common cause of the commonest of diseases in the hills, namely, worms, Proper sanitation has to be ensured. The highest priority, therefore, should be given to provision of contamination-free drinking water. It will be one of the major function of the Catchment Management Boards to specify springs and catchments for this purpose.

2.7.25 Medical facilities in outlying areas are generally wanting in respect of qualified staff, medicines and medical equipment. Catchment Management Boards will be in the best position to bring out the deficiencies in respect of medical services and to make suggestions in detail. The tendency of staff to absent themselves from difficult stations should be dealt with administratively. In the U.P. it would help matters considerably if a total separation is made of hill and plains cadres. Suitable incentives should be provided for technical staff posted in difficult stations in the form of children education allowances etc.

2.7.37 Domestic consumption of fuel is only one aspect of the problem. Considerable amounts of wood are burnt to distil turpentine from resin. Road, dam-site and similar construction gangs together with mine employees, are also responsible for reckless felling of timber for fuel. So far as road labour is concerned, communal kitchens, be introduced and the road construction gangs should plant up areas denuded of trees. Labour employed for work on special projects generally make reckless use of fire-wood available in the neighbourhood. Project authorities should strictly organise the use of fire-wood and provide alternative fuel wherever possible. Gas connections for domestic use should be given priority in the towns' of the hill regions.

2.7.38 The whole subject of energy use calls for special study. Some of the research organisations should undertake studies on sources of energy, economical use of energy and other matters connected with preservation of the environment. These studies should be directly related to community responses. Too often it has been found that technologies, which are excellent in themselves, are recommended but which are impractical in actual use. A great deal of importance has been attached to solar energy but its application in conditions prevailing in the Himalaya presents various difficulties. For one thing it is too technical for village people and for the other too expensive to operate. Simple and cheap systems should be introduced and tried. Biomass, it is understood, is inaffective above 1000 meters. It is felt that some use could be made of the enormous quantities of wood waste resulting from timbering and other forest operations. Wood chips are known to be a source of methane gas which could be used as a source of power. "Energy research", should be given the highest priority by research establishments.

2.7.39 A good beginning in micro-hydel development has been made in Arunachal Pradesh. Elsewhere, micro hydel potential has been largely neglected. Micro-hydel at present is generally more expensive than power from macro schemes, but it is felt that the approach to the supply of power from micro schemes should not be essentially commercial. Since the main object is to provide an alternative source of power to bio-fuel, hydel power should be made available at rates below those prevailing in the hills, uniformly throughout each State.

2.7.40 What is, therefore, visualised is :

(i) An all-out effort to raise bio-fuel plantations;

(ii) development of micro-hydel schemes as an additional/alternative sources of energy, the rates being subsidised and uniform throughout each State;

(iii) introduction of smokeless chulahs under a vigorous campaign;

(iv) continuing research in sources of energy and methods of combustion so as to minimise waste of wood.

2.8 RESOURCE MANAGEMENT:

Integrated Catchment Management:

2 8.1 This term implies the integrated management of all the resources within the catchment to achieve optimal benefit to the catchment itself as an eco-system and to the people who live there.

2.8.2 In practice, it means that the protective, regenerative and productive plans will be carefully integrated. This integration should cover;

a) control of erosion;
b) afforestation;
c) water management;
d) intensification of agriculture in the areas selected for this purpose;
e) horticulture, etc.; and
f) ancillary occupations.

It will be seen that the main thrust of integrated catchment management is essentially resource oriented.

Irrigation Potential of Himalayan Rivers (million hectares):

2.8.3 An estimate given in the Sixth Five Year Plan 1981 is as follows:

	Ultimate irrigation potential	Potential		Utilisation	
		1950-51	1979-80	1950-51	1979-80
1. Surface Water	73.5	16.1	34.6	16.1	30.6
(a) Major & Medium	58.5	9.7	26.6	9.7	22.6
(b) Minor Schemes	15.0	6.4	8.0	6.4	8.0

Source: Sixth Five Year Plan, 1981, page 149.

2.7.26 In this section of the Report 'Communications' has not been dealt with as that has been covered separately. However, the importance of providing feeder roads to mainline communication is emphasized so that the produce of outlying areas is easily marketable.

Water

2.7.27 Water is as important as food. Man needs it to drink and also to grow food to eat. Human habitations have come up around streams, rivers

and springs. Drinking water is mostly obtained from springs. Due to deforestation, springs have been diminishing and even drying up in the last few decades. Only a minute fraction of the water available in streams and rivers is used for irrigation in the hills. The same rivers are a major source of irrigation benefiting the plains.

Drinking Water

2.7.28 Springs in protected catchments are generally potable. Elsewhere they are carriers in disease, worms being the commonest in the hills. Intensive study is needed to provide potable water in the catchments. This should be one of the functions of Catchment Management Boards. The catchment springs should be protected to ensure purity of water. All catchments should have a suitable number of off-take points to provide potable water to the people of the catchments.

Irrigation

2.7.29 In order to meet the requirements of intensive agriculture on the lines recommended, in defined areas suitable in all respects for this purpose, and all out effort has to be made to provide the vital input of irrigation. So far, irrigation has been largely neglected in the hills in all these altitudinal belts. Studies should be undertaken in the catchment with the object of providing maximum irrigation from streams and rivers in the areas selected for intensive agriculture. These should be treated as public works for which funds should be provided in States/ District Plans.

2.7.30 Elsewhere, a procedure has been recommended from which the Catchment Management Boards will earn income. Funds for minor irrigation, in addition to the existing subsidies, can be provided from this income.

2.7.31 Assistance should also be provided to individual farmers in utilising streams/springs for irrigation.

2.7.32 Storage tanks for rain-water can be provided above the stream level, lined either with coaltar or plastic. The latter last upto 10 years. Special units for manufacturing of plastic storage tanks should be set up at convenient places and purchase should be subsidised.

Energy

2.7.33 The various sources of energy at present in use are, in order of intensity:

(a) wood fuel;
(b) electrical power;
(c) cattle manure (used only to limited extent mostly in the lower hills);
(d) water power in panchakkies;
(e) bullock power (for ploughing but only rarely for transport); and
(f) human labour and drought animals for carrying load.

2,7.34 Cooking of food and heating constitute the major fuel use in the Himalayan region. While it may be possible to improve the system of combustion, it is felt that it would be impractical to think in terms of replacing wood as a major source of fuel. Substitution by electrical power has, however, already started in the urban areas, and this process is likely to continue. Electrical energy is also used to some extent in chakkies, oil presses and some other processes.

2.7.35 One reason why diversification of occupations has proceeded at small's pace is the limited availability of electrical energy and current pricing policies. As suggested elsewhere, development of micro hydel schemes is essential for local development, diversification of occupations and the like. Extension of supply of electrical energy in the hills will benefit future development but is not likely to substantially reduce the reliance on the traditional sources of energy, principally wood,fuel. Nevertheless, even a slight decrease in the use of wood as a fuel will be a significant step in the right direction.

2.7.36 Improved methods of combustion will result in substantial saving of wood fuel. Smokeless chulahs have been tried successfully as a process but have been questioned on the ground that smoke was beneficial for preservation of wooden roofs. It should be possible for research organisations to work out an effective system of combustion to overcome this problem as well.

2.8.4 The theoretical irrigation potential should be viewed in the context of eco-development of the Himalayan region. The priorities adopted are firstly, the Himalayan region itself, secondly, the needs of the Himalayan people, and thirdly, the needs of the country as a whole. In this perspective, each National plan will have to be examined on merits, because as would appear the feasibility of major schemes has come under question.

2.8.5 If a major scheme is taken up, it should be emphasised that biological measures necessary for protection of the catchments should form an integral part of the project itself. Furthermore, such biological measures should be completed before the other project works are done so that the environment is stabilised in advance. Earlier, schemes were costed for their engineering works alone. The biological measures that accompany the schemes should be costed as well and the total regarded as the cost of the project.

2.8.6. Hydro-Resources Potential (MW) at 60% Load Factor:

Region	In operation	Under Construction	Studied	Under Investigations	Total
Northern	3300	3000	6200	15500	28000
Eastern	700	1200	1300	4000	7200
North-Eastern	200	100	100	19800	20200
Total Himalayan Region	4200	4300	7600	39300	55400

Source: TV Jaganathan Hydro Power Development in India, Int. J. of Water Power and Dam Construction, March 1981 pp. 43-46.

2.8.7 The above statement shows that the hydro potential is immense, but again, as in the case of irrigation potential, it is theoretical at present. The remarks made with respect to irrigation potential are equally valid with regard to hydro potential. There is no question of depriving the country as a whole of the resources of the Himalaya in respect of water and hydro power, but project formulation must take into account all the priorities stated in paragraph 2.8.4 above.

Water Management:

2.8.8 Water flow is at once the biggest devastator and benefitor of the Hills. Both aspects are covered by the term 'Water Management'. As devas-

tator it causes the havoc of erosion. As a beneficient agent it provides irrigation & power. We have dealt briefly with irrigation. Because of the critical situation caused by uncontrolled water flow, control of erosion has become the most urgent need in the Himalayas.

2.8.9 It is a recognised principle that Water Management must start from the top and travel downwards. For this reason, the Task Force has recommended afforestation of strategic areas, starting from crests of water sheds. The resource teams will have to identify areas which must be held to be strategic from the point of view of protection of the catchments. These must be given the highest priority in the land use prescriptions.

Water Use:

2.8.10 Control of run-off is the protective aspect of water management. Water use is the other. Correct water use is equally important because faulty use can also cause various forms of erosion. Main irrigation channels should be lined with stone which is available throughout and horizontal flow and utilisation for irrigation so arranged that seepage is minimised.

Water Management Planning:

2.8.11 The combined anti-erosion and water use plan for catchments constitutes the Water Management Plan. It will be appreciated that this is largely a technical matter. While the public must be associated at all stages, so that the plan is understood and supported by them, the technical view must prevail. It needs hardly be said that the water management plan for a catchment will have to be reviewed at convenient intervals of, say, 5 years.

Multiple Projects:

2.8.12 Dams have been built in the hills almost exclusively for multipurpose projects whose benefits are derived by consumers in the plains. Recent siltation investigations have created doubts about the feasibility of such projects. The high siltation rates noticed have been referred to elsewhere. The shortened life of such engineering works have diminished their viability. In addition there are serious sociological problems connected with uprooting of people from homes and lands. In the circumstances, our strategy for multi-purpose projects, has to be seriously reconsidered.

2.8.13 Experience in the Sivalik belt has demonstrated the feasibility of minor projects to control erosion and provide irrigation (Sukho Majri). Such projects are recommended in the Sivalik belt. In the middle hills, such medium and small projects can be viewed as multi-purpose projects to control erosion, provide irrigation and generate power. Run-of-the river schemes for hydel generation have proved their worth (Lagyap Scheme in Sikkim). A series of medium schemes can generate as much power as a major scheme without creating some of the problems connected with major schemes. Micro schemes are essential for provision of power in the Himalayan valleys

Animal Husbandry:

2.8.14 It has to be stressed that animal husbandry is an integral part of hill farming. Besides supplying milk products, wool, meat and energy for ploughing, animals play an essential role in maintaining soil fertility by converting fodder into dung. However, deterioration in fodder resources, due to overstocking, has resulted in the reduction in the quality and value of all these returns.

Sheep and Goats:

2.8.15 As a consequence of these conditions a regretable tendency has been noted in some areas towards an increase in the number of goats. This tendency is universally recognised as an index of environmental deterioration, because goats can thrive on the coarse fodders which replace succalent grasses on overgrazed pasture lands. Though they thrive, however, goats continue the degenerative process by preventing the regeneration of trees. Goats therefore have to be excluded from all areas where regeneration of forests is required.

2.8.16 The only areas wholly suitable for grazing sheep and goats are the alpine pastures above the tree line. Even there, numbers must be kept well within the carrying capacity. Winter pasturing of these flocks should be restricted to areas where damage will not be done to forest regeneration. Improvement in yields of wool and meat may be aimed at through improvement in breeds and veterinary services, and not through increase in numbers.

Cattle:

2.8.17 The temperate climate of much of the Himalayan belt makes the area suitable for high yielding exotic pure bred and cross bred cows which, in the plains, tend to suffer from heat stress. The milk yields of these exotic breeds does not drop in cold wheather, as happens with buffaloes and most Indian breeds. Moreover, a cow, being a smaller animal than a buffalo requires a smaller maintenance ration, which means that a cow, giving the same milk yield as a buffalo, eats less. In addition, the inter-calving period of exotic breeds is twelve months, whereas that of an ordinary hill bufalo is usually twenty-four months, with the result that the total yield of milk fat from an exotic cow over twenty-four months is far in excess of the yield from a buffalo, in spite of the fact percentage being less.

2.8.18 All these points add up in favour of the introduction of high yielding exotic breeds of cows in the hills. However, high yields can be expected only from stall-fed animals, given as much care as is normally given to a stall-fed buffalo.

2.8.19 It should, therefore, be clear that no marked improvement in yields from hill cattle can be obtained unless a change is first brought about in cattle management practices. Progressive introduction of stall-feeding will permit regeneration of village grassland and fodder forest, so that the nutritional level of fodders can be raised, both in quantity and quality.

2.8.20 The logistics of cutting fodder for stall-feeding may set a limit on the number of animals a family can maintain at stall, irrespective of the availability of increased fodeer supplies from regenerated grasslands. It is, therefore, essential to provide renumerative avenue for the disposal of surplus stock, such that the sale of a sterile cow or an unwanted male will be a more attractive proposition than keeping it for the manure it provides. This would be the most effective incentive for reduction in cattle numbers.

2.8.21 Vigorous steps are required to demonstrate and popularise a suitable yoke for crossbred, humpless bullocks. In the absence of this, the old breeds of cattle are kept, solely to produce humped bullocks for ploughing. It may be noted here that a single cross bred bullock with properly designed barness and modified plough can sometimes replace two hill bullocks.

2.8.22 MITHUN AND YAK are important species prevalent in the upper reaches of the Himalayan region. These animals have lots of potentialities. Preservation and utilisation of those livestock in breeding programmes and development of sanitable health care and management programmes are necessary.

2.8.23 Planned provision for watering of cattle in village water supply schemes may often be crucial to the acceptance of stall-feeding.

Improvement in bullock utilisation and possibly reduction in bullock numbers may follow consolidation of land-holdings.

In some areas great stress should be laid on the introduction of non-waste feeding stalls. Where animals are looked on primarily as sources of manure, fodder tends to be regarded as potential manure rather than potential milk, thus leading to great wastage.

Veternary services will have to be greatly improved, with particular attention paid to in-service training and refresher courses.

Breeding Programmes:

2.8.24 Breeding programmes call for serious review. The inefficiency of some of the A.I. services is so bad that they should either be scrapped and replaced by natural service at bull centres or they should be completely overhauled.

2.8.25 The success of any breeding programme depends entirely on supplementary feeding of heifers from the day of their birth. A 35 kg. cross-bred heifers, requiring a minimum of 3.5 kg. milk per day, increasing as its body weight increases, cannot be adequately fed from a mother giving 1.5 kg milk per day. If the heifer is fed only its mothers milk in childhood, it will not grow properly and will not give more milk than its mother when it calves. This aspect of calf rearing has been almost entirely neglected by government programmes.

2.8.26 Funds for supplementary feeding of cross-bred heifers are essential input. Each State will have to work out methods best suited to its area which will ensure that heifers receive the milk they need. Without this, most of the effort or expense put into breeding programmes is wasted.

2.8.27 A further point which has to be considered is the practical level of milk production to be aimed at in relation to attainable levels of animal nutrition. One cannot expect to flood hill areas with scarce and expensive supplies of concentrates in order to produce 20 kgs. milk per day from village cows. But it ought to be possible to obtain 8 to 10 kg. milk per day on local fodders.

Forests and Pastures:

2.8.28 The degraded condition of village forests and pastures demonstrates that the carrying capacity of the land, under traditional land management, has been exceeded. The aim must be to restore the productivity of these lands by improved management. However, even though improved management may succeed in increasing yields of fuel, fodder and timber, in some cases by as much as ten times, it must be clearly understood that there is a limit to the degree of possible improvement. It is, therefore, imperative that every effort must be made to decrease the growth rate of human and cattle population, so that their subsistence demands do not again outstrip the productive capacity of the forests and pastures.

Forests:

2.8.29 Over the entire length of the Himalayan hills it is apparent that reafforestation alone would restore the ecological balance, safeguard the nation against floods and the consequences of erosion, and restore the subsistence base of the hill population. In fact, if it is aimed to satisfy the population's subsistence needs in terms of fuel, fodder, timber fibres and other secondary forest products, while placing restrictions on agricultural activities which either damage or permanently remove areas from forest cover, then most of the ecological and national components of the problem will be solved simultaneously. Regeneration of village forest lands would also permit restocking of commercial forests because biotic interference could be reduced.

2.8.30 Implementation of this aim calls for a complete restructuring of national and State forest policies in respect of the hill regions. Statements of Forest Policy made as long ago as the 19th century and again after disturbances in U.P. hills in 1921, laid down that the people had the right of use even of reserve forests. Recognition of these rights, however, was not accompanied by any programme of regenerating the village forests. With the growth of population, both human and bovine, deterioration of forests has become so acute that radical departures are necessary inregenerative and management policies. It was forecefully argued that the needs of the people must be met even if it means exclusion of some area of forests and their transfer to village forests. In our considered view this would only compound the damage. The incentive to place forest administration on a sound basis would be weakened and measures for regeneration might be delayed and diluted. It is, therefore, imperative that the major policy decisions should be taken without delay.

2.8.31 It must be recognised that the forests constitute a vital element in the ecology of the catchments in which they occur. Forest Departments should function as the guardians of ecological balance and not merely as managers of the forests commercial resources. If eco-development is to have any meaning, a wholistic view has to be taken of the resources in each catchment. It is for this reason that emphasis has been given on the importance of integrated catchment development. While for purposes of administration village and reserve forests may be subject to different administrative patterns, the purpose must be the same, namely, the conserve and develop resources of the catchment in an integrated manner. This can only be done if these resources - are treated as the resources of the catchment subject to the control of the Catchment Management Authority.

2.8.32 In this view of things reserve forests will continue to be reserved subject to the control of the multi-disciplinary catchment management boards. Regeneration of village forests will also be undertaken by the Forest Department under the supervision of the Catchment Management Board. In practice, therefore, there may appear to be little change in administration.

2.8.33 After the needs of integrated catchment development have been met, priorities for the utilisation of forest resources should be as follows:-

a) the local people, in respect of their personal subsistence requirements only (fuel, fodder and timber from dwellings);

b) commercial exploitation for national industries, pulp, packing cases, etc. only after subsistence needs of the local population have been met and ecological safeguards are fully satisfied;

c) People should be encouraged to develop commercial forestry in such areas of their holdings as are unsuitable for agriculture, horticulture and vegetable cultivation.

Utilisation under (b) will be administered by the Catchment Management Boards.

2.8.34 A number of paper pulp factories are being established, particularly in the North-Eastern Region, based on the bamboo resources. However, the rate at which the bamboos are being removed, without a programme of regeneration, it will soon have its deleterious effects. There is thus a need for a programme of regeneration and also for selection/breeding of suitable variety which will mature early. A survey of the large number of varieties of bamboos will be necessary for this purpose. It has to be mentioned that bamboos play a very important role in the economic life of the rural population.

2.8.35 Up till the present, financial benefits have accrued exclusively to the Forest Department, and the product benefits to contractors, government departments, and others. The exclusion of the local people from the category of beneficiaries cannot be justified on any ground. If local people are expected to utilise resources in a way that is consistent with ecological security, it follows that a fair proportion of the financial benefits which accrue from the working of the forests in their areas must be allocated to the local community. A minimum of 10% should be reserved for this purpose. In addition, the actual working should so far as possible be entrusted to the local people. In practical terms labour should be recruited from within the catchment.

2.8.36 The whole subject of forest contracts need to be brought under review. In some States, the evils were so manifest that Government have switched over to their own forest corporations. This change has perhaps not brought positive benefits. For example, there is no guarantee that the State Corporations will not denude the forests as recklessly as the contractors, particularly because the corporations still work through the same men who were previously contractors. The real safeguard is that the working plan for each catchment must be viewed as an integral part of the catchment development plan. This being so, the working plan should be submitted to the catchment authority for its approval alongwith other plans for resource development in the catchment.

2.8.37 The system of forest management introduced by a foreign colonial power in its own imperial interests should be speedily liquidated. The British empire needed timber for railway lines and other commercial purposes, and established a system of forest management suited to them. It bears no relationship to environmental security and the needs of the local communities. If it serves these purposes at all, it is purely coincidental. The Task Force, therefore, recommends that the utilisation of forest resources within a given catchment should be determined solely by the environmental conditions within the catchment and the needs of the local people. Unquestionably, also, there are national needs. These must be woven into the systems of catchment management.

2.8.38 It is appreciated that this suggestion marks a radical departure in forest management. It calls for a totally new approach on the part of the forest department. Apart from its own intrinsic justification, the Task Force feel that the system advocated would effectively eliminate the underlying causes of tension between forest departments and the local people of the Himalaya.

A suggested strategy for village forests:

2.8.39 The principal needs of the local people are fuel and fodder. Fuel is used for direct conversion into energy, and fodder represents indirect transfer through fertility, viz. animal waste. These two uses of forests may be considered separately.

Fuel:

2.8.40 Extraction of fuel from civil forests has reached the stage when there is hardly any left. People are being compelled to steal fuel from the reserve forests or to walk for several miles to pick, cut and collect whatever they can. Typically, one able bodied member of the household is engaged everyday in collecting fuel and doing nothing else. It does not help now to point out that this situation has developed owing to total official neglect in the last 100 years or so.

2.8.41 Scarcely anything has been done to establish a cycle of regeneration plantation and extraction of fuel for the needs of the local population. To make up for past neglect, will call for an all-out effort by the official agencies concerned and the people themselves. The justification for the measures which will be proposed subsequently is as follows:

a) provision of fuel and fodder for the local people on a regulated basis;

b) regeneration/replantation of uncultivated village land to protect it from soil loss;

c) protection of reserve forests from widespread pilferage, grazing, forest fires, etc.

All these three objectives are closely inter-related.

Fodder:

2.8.42 The need for fodder is just as pressing as the human need for fuel. The relative depletion brought about by the two kinds of use has not been worked out, but it would appear that cattle grazing and extraction of fodder from existing forest areas are considerably more damaging than extraction of fuel by itself. Therefore, no plan for intensive development of uncultivated village land would be successful without an effective plan for limitation of herds, regulation of grazing and improvement of pastures to provide fodder.

Grazing:

2.8.43 Regulation of grazing is already being practised very successfully by several high altitude communities, such as those in Sikkim, in Kameng, the Bhotias of U.P. and the Highland communities in Himachal Pradesh. Rotational grazing must be made universal. Rotations will have to be worked out by the village communities in consultation with departmental experts with reference to the carrying capacity of the land. Wherever possible, stone fences will have to be put by the local people, and maintained by them. Subsidies for this purpose may have to be considered. Stone fences it is felt are preferable to barbed wire because the necessary material is everywhere. If possible, five year rotations should be adopted to allow for regeneration of grass. Improved varieties of grass should be introduced and this may be considered in the long term development programme. In general, however, it would be preferable to replace grazing by stall-feeding since the advantages are far greater, particularly where fodder is in short supply.

Alpine Pastures

2.8.44 The carrying capacity of Alpine pastures needs to be established, and steps taken to ensure that this is not exeeded. Control could be achieved through issue of Forest Department permits to graziers for specified numbers of animals. Careful conservation of fodder resources in these areas will simultaneously check the danger of erosion. No information is available as to the actual state of these pastures. It would appear unlikely that their carrying capacity could be significantly increased. However, it is possible that introduction of improved grasses combined with introduction of improved breeds could raise the total production of wool and meat.

Other Pastures

2.8.45 With the exception of alpine pastures above the three lines, there are no natural grasslands in the Himalayas. Existing grass areas are the results of clearing of forest through a combination of commercial felling and the satisfaction of village subsistence needs. These have been kept bare of trees by the practice of firing of forests to obtain spring flush of green grass, by grazing animals and, on occasion, by deliberate destruction of new growth in the interest of grass production. Due to the increase in number of cattle and goats, the grass areas are now badly damaged by overgrazing. Even areas protected by villages for cutting are in poor condition, and the grass, cut late on account of weather conditions and post-monsoon work scheduel, is low in nutritional value. Degradation of village forests into grass land is proceeding steadily and the demands of increasing number of animals has led to increasing encroachment on reserve forest, with consequent reduction in their replacement of broad-leafed fodder forest by pine mono-culture, because pine seedlings are not eaten by animals, and pine trees are less vulnerable to fire than are most of the fodder trees.

2.8.46 It is generally true that grassland in good condition is a more efficient check to solid erosion than is forest. However, it is less efficient check to solid.

2.8.46 It is generally true that grassland in good condition is a more effieicnt check to solid erosion than is forest. However, it is less efficient than forest in its ability to retain water. Fodder forest produces a considerable higher sustainable yield per hectare of fodder than does grassland, and it produces green fodder at seasons when there is no grass. In addition, heavy animal grazing on steep hillsides invariably break up the soil and cause it to erode. All the evidence therefore points in favour of fodder forests over grass, and in favour of stall feeding over grazing. For an immediate and practical strategy, the model (Annexure XIII) suggested by one of our members (Shri Madhava Ashish) after practical experience extending over several years is commended.

2.8.47 Regulation of grazing on the lines suggested above should be combined with regeneration/replanting of degraded village forests. The replanting programmes should concentrate on fodder trees and on quick growing fuel species. Varieties will have to be identified, nurseries for multiplication established in each eco-development unit and a massive programme of plantation launched. The village communities should be made fully responsible for labour and maintenance, but technical guidance would have to be provided and the saplings distributed free for an initial period of five years, so as to complete the first rotation cycle.

2.8.48 The question as to whether community rights should be maintained in the uncultivated village land brought under the above-mentioned measures of development was carefully considered. There are advantages in retaining community control because in the long run community consciousness in the surest safeguard of the preservation of Himalayan resources. The contrary view is that most people disregard the sanctity of community ownership and need for community effort. On this view, it is argued that specific areas/ trees should be allocated to individual farmers in the uncultivated village land which is to be put under development. The system in vogue in several border communities is based on the simple principle of community ownership of land and individual ownership of fodder trees growing in the land. This combines obligations to the community with individual incentives for care of the trees. This model should be adopted.

Industry:

2.8.49 The topography and the fragility of the hill environments, together with the lack of raw materials, militate against the establishment of heavy industry in these areas. Furthermore, the existing degradation of the hill environment is strongly linked to the subsistence needs (fuel, fodder, and timber in particular) of a population which is excessively high in relation to the land productivity. It follows that no policy should be pursued which would have the effect of holding the hill work force in the actual hill areas, where the supply of their subsistence needs will add to the degenerative effect upon the environment. If it is desired to create industrial employment opportunities for hill people, in order to check outmigration to urban centres, such heavy industries should be located in plains areas adjoining the hills and, preferably, in new townships. Large concentrations of labour in hill areas should be avoided, firstly because of their environmental impact and, secondly, because almost all their food, fuel and other supplies will have to be transported from the plains.

2.8.50 An obvious exception to these considerations must be made in the case of mines, whose location is necessarily determined by the locations of mineral deposits. In these cases, it is essential that the work force be supplied with coal, gas or other cooking fuel, and that they be effectively prohibited from cutting fuelwood in the vicinity.

Again in the case of mines, imposition of controls needs to be far more effective than at present. The devastation of an entire range of hills at Mussoorie, U.P., is a glaring example of disregard for elementary environmental requirements. In this context, attention has to be drawn to the failure of the administration to meet the challenges of powerful vested interests. In the same area, atmospheric pollution by lime kilns and carbide factories is producing and increasing threat to the biosphere.

2.8.51 There is, clearly, scope for small industrial units, such as pharmaceuticals, electronics, watch manufacture, etc, whose products have high value and low bulk, and which can take advantage of the low temperatures.

2.8.52 Definite encouragement must be given to plants for fruit processing, milk processing, pine-needle har-board manufacture, and similar industries whose development is directly related to the environmentally oriented eco-development programme.

2.8.53 On the other hand, it is recommended that the numerous small-scale turpentine factories, whose economics depend upon the free supply of huge quantities of fuelwood (2 kg pinewood for each 1 kg of resin boiled) should either be closed down or be removed to the railheads where coal is cheaply available, or some other method of heating can be used.

2.8.54 Very small scale units such as flour mills, oil presses, carding machines, and other similar operations which are related to local needs and resources, should be encouraged. Their introduction in remote areas may be linked to cheap power supplies from micro-hydel installations.

2.8.55 To what extent sawmills should be encouraged depends upon local forest resources and the policies framed by Catchment Management Boards. In general, however, the policy should be followed of keeping as much as possible of the value-added component of timber exports in the area of timber production, provided that profit is not made at greater costs to the environment, as is the case with turpentine factories. Waste from sawmills will either be sold at fuel, or it may be processed into wood-wool, chipboard, or other similar products.

2.8.56 Under the present circumstances, where, in some areas, the demands of the fruit market for wooden packing cases are exceeding the productive capacity of the forests, so that alternative materials (paper cartons, pine-needle boards) are being recommended, the production of packing cases by sawmills may need to be discouraged. This may be achieved by removing subsidies and by refusing concessional rates on timber purchase, so that wooden cases have no price advantage over alternatives.

2.8.57 Traditional handicrafts should clearly be encouraged wherever they may be. If it is desired to expand their markets, design studies and marketing studies are necessary.

RECOMMENDATIONS

Land and people

2.9.1 A-Consolidation of Holdings:

(a) A time-bound programme of consolidation of holdings should be adopted in all the States so as to complete the operation within 10 years.

(b) It may be advisable to consolidate irrigated and unirrigated land separately because the difference in yields is very high. On the other hand, the benefit-cost ratio of fruit, vegetables and commercial forestry is considerably higher than it is for cereals (See Annexures XIV, XV & XVI).

(c) Principles for apportionment will have to be worked out. But this is routine for experienced consolidation staff.

B-Population Control

Population control has become an urgent necessity in the hills. All educational and practical measures should be undertaken for this purpose in consonance with the 20-point programme.

Resource Surveys

2.9.2 Multi-disciplinary teams headed by experienced SDOS should be constituted in the districts to:

(a) define eco-development units;

(b) undertake surveys of resources within these units.

2.9.3 Resource Inventories.

(a) The Multi-disciplinary teams will make detailed inventories of the resources available in the eco-development units (which will be catchments, sub-catchments and min-catchments). These surveys will clearly specify the various kinds of land and their suitability for the various kinds of use. The main uses are agriculture, horticulture, animal husbandry and forestry.

(b) Resource survey teams will also identify potential for:

i) irrigation,
ii) micro hydel power,
iii) feeder roads, for which specific proposals will be made.

2.9.4. Prescriptions for resource use

(a) The multi-disciplinary teams will, on the basis of the resource inventories, draw up prescriptions for the use of resources within the eco-development units.

(b) The prescriptions will have three main objectives, namely, protection, regeneration and development. The tasks under each of these heads are dealt with below.

2.9.5. Protection

(a) Areas that are subject to impermissible levels of erosion must be located. In the absence of a system of measurement, the only way to establish the areas is through visual evidence.

(b) Strategic areas, there forests must be developed to protect the eco-unit from erosion, should be clearly specified. In most cases, these will be crests, watersheds, endangered areas, areas required to be under forests for aquifer re-charge.

2.9.6 Regeneration

The main task will be to regenerate village forests. This important matter has been dealt separately.

2.9.7 Production

Protection and regeneration will positively benefit production. In addition, there have to be specific productive uses of the resource base. The resource teams will constructively examine the eco-development units to assess their suitability for productive purposes. Knowledgeable staff, in consultation with the local people, will be able to identify the predominant productive capacity of the unit, the areas of suitability, subsidiary uses, etc. (Example high altitude watersheds in Sikkim are suitable for buck-wheat, barley and horticulture and potatoes). General and specific areas should be indicated. Similarly, in the wet regions, areas suitable for cardamom cultivation, paddy etc. can be quite easily identified.

2.9.8. Training of resource teams

(a) Staff of resource teams should function as a unit, viewing the eco-development unit as a whole. Brief training courses should be arranged at the divisional level.

(b) The training process is vital to the success of the whole sequence, of making resource inventories and prescriptions for resource use.

(c) It is desirable that the Planning Commission itself should take the initiative and associate itself continuously with the training and functioning of resource teams.

2.9.9. Agriculture

(a) The strategy for agriculture should be replacement of extensive by intensive agriculture as far as possible in irrigated terraced areas only (crops to include cereals and vegetables, the latter for commercial production). Unirrigated hillsides should be devoted to tree crops (fruits, nuts and commercial crops).

(b) In the whole length of the western Himalaya as well as Sikkim and Darjeeling district, agriculture has been extended into areas unsuitable for this purpose. Until the resource teams identify areas suitable for agriculture, no further extension should be permitted. As has been recommended elsewhere, resource teams will also review the suitability of existing agricultural land and make recommendations.

(c) Resource teams will identify areas suitable for wet and unirrigated agriculture. (The area specified as suitable for wet agriculture will take account of irrigation potential in the catchment. Irrigation will be dealt with elsewhere).

(d) Wet agriculture must necessarily be practised in terraced fields. Resource teams should specify the mode of unirrigated agriculture recommended, that is in terraces, tree crops on slopes. etc.

(e) A mix, based on soil suitability and availability of irrigation, should be specified for each catchment. The main divisions are wet, unirrigated agriculture, tree crops and forests.

(f) Irrigation in the hills increases the yield three or four times. Cereal crops should be grown in terraced fields to which irrigation can be extended. In this way the productive capacity can be significantly increased.

(g) Related to local needs and activities, an intensive programme of agricultural education should be imparted, backed up by provision of such inputs as fertilisers, improved seeds and improved implements. Packages of practices suitable for each catchment should be designed by the specialist staff (iron plough is practically unknown in large areas).

(h) Conversion of dry to wet land, introduction of improved implements and seeds should be subsidised to start with. The extent of subsidy will naturally depend on availability of funds. It must be remembered, however, that hill agriculture suffers from extreme handicaps which can only be overcome if generous provision is made for financial assistance.

(i) The Himalayan area suffers from an absolute deficiency of cereals and other necessities such as sugar and salt. Even after allowing for possible increase under intensive development, the net deficit is almost certain to persist. Therefore, supplies must reach the farthest areas through an effective public distribution system.

(j) Jhuming

(1) Jhuming is a special case. A general shift to settled cultivation will have to be introduced in phases, with demonstrations of economic viability at each stage.

(ii) Apatani Model is useful. (wet cultivation, tree plants and forests);

(iii) People's acceptance will have to be won by persuation and example. Financial assistance will be needed for conversion to terraces.

2.9.10 Public distribution system

(a) The public distribution systems, which the States may set up, are outside our scope. It is however necessary that to reduce pressure on scare resources in the Himalayan vegain an effective public distribution system should be set up. Grains, sugar, kerosine-oil, and other essential commodities should be readily and easily made available to people living therein through fair price shops. We should, however, recommend that supplies should be made at uniform rates in the hill areas of each State.

(b) Particular care is necessary to ensure against misuse of fair price shops by licences. Such misuse is wide-spread in the hills because bazars are small and incorrect practices flourish unnoticed. The State Governments may consider suitable safeguards such as frequent rotation of licences, change of locating etc. Inspection by community agencies is an another important safeguard.

2.9.11 Food

(a) Cereals and other essentials to make up the shortage of production must be supplied through the public distribution system.

(b) A complementary policy of promoting cultivation of suitable cash crops should be enforced. This will promote capital formation to provide for necessary inputs, and improvement of the quality of life.

(c) Cereal crops should be grown intensively in areas specially suitable for this purpose, as far as possible in terraces and irrigated fields with necessary inputs.

(d) This dual strategy of concentrating on food crops in irrigated areas and cash crops elsewhere will increase the support capacity of the land.

(e) Research & Extension
(i) Special research units for the hills to be established.

(ii) Seed suitable for the hills to be developed.

(iii) Seed/plant multiplication farms to be set up.

2.9.12 Fuel

(a) Man made bio-fuel plantations/energy farms should be developed with immediate effect to provide for fuel/fodder.

(b) Species selected should be suitable for fuel and fodder, have high coppicing potentially and increases soil fertility.

(c) In additiin, uncultivated village land should be fully forested progressively. Grazing should be strictly controlled as suggested in the scheme.

(d) In addition, all strategic areas such as watersheds, endangered areas, aquifer re-charge areas should be forested.

2.9.13 Sanctions

The afforestation, bio-fuel plantation/energy farm, proposals made here should be enforced under sanctions having the force of law.

2.9.14 Nurseries

Mist culture nurseries for propagation of plants/seedlings should be established in each catchment/sub-catchment/mini-catchment.

2.9.15 Research

Intensive research should be undertaken to :

(i) determine cptimum forms of fuel plantations/energy farms; and

(ii) establish possible alternatives to local bio-fuels.

2.9.16 Erosion control

(a) Highest priority - protection and regeneration of the resource base.

(b) Erosion control - this is the first task, to be done by afforestation of

(i) strategic areas - crests and watersheds.

(ii) endangered areas - effected by serious erosion.

(iii) areas of acquifer recharge.

Agriculture (a) to be restricted to areas specially suitable for it, with potential for irrigation;

(b) Extension of agriculture to be ruled out, except with the authority of District Officer, on the recommendation of Catchment Management Board.

2.9.17 Use of resources

Priorities:

(a) regeneration of resource base,

(b) satisfaction of needs of Himalayan people,

(c) utilisation for national benefit.

2.9.18 Unit of development

(a) The eco-unit, which in most cases will be the catchment, sub-catchment or mini-catchment.

(b) Congruence of administrative and natural eco-boundaries desirable.

2.9.19 Administrative pattern

(a) Single line administration of all development departments, effectively integrated and headed by district officers.

(b) In the eco-units, resources to be managed by Catchment Management Boards, consisting of all multiple disciplinary staff and block Pramukhs and Sabhapatis.

(c) A separate and permanent hill sub-cadre to be formed in U.P.

(d) At least fifty percent of the block and village workers should be women so that they can mobilise the development potential of the women whose role in farm activities is of crucial importance.

(e) Owing to scarcity of expertise, the District Development Committee should play an active part in the development process, particularly :

(i) conducting resource surveys;

(ii) framing of resource use plans;

(iii) taking critical decisions regarding extension of cultivation, afforestation and forest use, extension of irrigation etc.

(f) In general, the District Development Committee will lay down guidelines for development strategies in the catchments and monitor progress.

2.9.20 Resource surveys

(a) Taking the eco-units (catchment etc.) as the unit for development, the process should proceed through two main stages; firstly, preparation of resource surveys and secondly, resource use planning.

(b) District level multi-disciplinary teams headed by the Senior SDO will be responsible for both. The vital input of public association will be obtained by announcing programmes of visits well in advance so that the maximum number of members of the public, men as well as women, are present.

(c) Proforma for these processes should be adopted and distributed in advance.

(d) The cardinal objective of eco-development is integrated catchment management.

2.9.21 Energy

(a) The inexhaustible renewable source available in the form of water flow should be utilised in developing micro projects for each catchment.

(b) This should be supplemented by a subsidised issue of cooking/ heating equipment.

(c) In addition clusters of villages should be provided with an electric light/power for development of cottage industries, etc.

(d) Other renewable sources of energy should be introduced, e.g., bio-gas below 1000 metres, water flow for 'panchakkis'.

(e) Research in other forms of renewable energy such as solar and wind power should be taken up.

(f) The intention of the for-going recommendations is to replace bio-fuel by renewable energy to the maximum extent possible. However, for inescapable cooking/heating bio-fuel plantations should be set up under a massive programme. The species should be specially selected.

(g) Smokeless 'chulahs' and other more efficient methods of combustion of wood should be introduced under subsidised schemes. After an initial period of education and adjustment sanctions to enforce the introduction of efficient chulahs should be considered.

2.9.22 Irrigation

(a) Irrigation potential from streams and rivers hitherto largely neglected, should be developed intensively.

(b) In addition to the gravity flow daighis/storage tanks to be made wherever feasible from where water can be pumped/raised by electric power/hydrams into channels for use higher up.

(c) It is recognised that large areas may remain outside the scope of such irrigation devices. In this area springs with adequate flow can be utilised via storage tanks or even directly. This needs to be corelated with use of springs for drinking water, the need for which must have priority.

(d) Storage for rainwater can be made from plastic or lined with coal-tar. These are specially valuable for intensive, small scale agriculture. Subsides for 'Community' and 'individual' reservoirs is already available, and should be made use of extensively.

2.9.23 Education

(a) An occupation based design for education should be devised.

(b) Extension work should be done by older children in the eco-units in accordance with resource plans prepared by Catchment Management Boards. In this way education will be directly related to actual development. This kind of extension has been found particularly useful in plantation and maintenance of forests.

(c) Health education is another primary necessity.

(d) Adult education should be designed around occupations and improvement of conditions of life. (sanitation, methods of cooking and use of fuel, use of human waste for manure, making bio-gas, compost making, etc.).

2.9.24 Animal Husbandry

(a) Regeneration of the hill environment requires that goats be effectively excluded from areas under afforestation. Even elsewhere, keeping of goats should be discouraged.

(b) In respect of Alpine pastures, where goats can be grazed without damage to trees, increase in yields of wool and meat from sheep and goats, to the extent possible, should be achieved through improvement in breeds and in veterinary services, and not through increase in numbers.

(c) Gradual upgrading of local cattle by crossing with high yielding exotic breeds is strongly recommended. This may be done either by establishing bull service stations, or by first improving and then extending A.I. services. This programme must be supported by:-

(a) Improved veterinary services.

(b) Regeneration of the fodder resource base.

(c) Progressive introduction of stall feeding and of non-waste feeding stalls.

(d) Provision for supplementary feeding of cross-bred heifers.

(e) Provision for remunerative disposal of surplus cattle.

(f) Provision of yokes, harness, and modified plough for utilisation of cross-bred (humpless) bullocks.

(g) Establishment of organisations for collecting, processing and marketing milk and milk products.

(h) Provision for watering of cattle under village water supply schemes.

2.9.25 Forests and Pastures:-

(a) The primary policy is to provide the hill population with sustainable supplies of fuel, fodder and building timber for their subsistence needs. This requires apropriate reafforestation of bare and degenerate village forest areas.

(b) Each village or group of villages should be allocated such areas of afforestable land as are capable of providing the necessary sustained yields of fuel and fodder, calculated on the basis of per capita requirements.

(c) Fuel plantations should be planned on the principle of maximum obtainable yields of biomass, or of maximum calorific value, while fodder plantations should be on the principle of maximum sustainable yields of leaf-plus-grass fodder per hectare. In particularly bad areas, regeneration of grass cover should also be undertaken. Planning must provide for continuous replanting of fuel plantations.

(d) Where there is insufficient village land to meet these basic needs, sufficient areas of Reserved Forest may be released to make up the difference. Only where surplus land is available may plantations be planned for subsidiary forest products, such as nuts and fruits, or for such minor industries as silkworm cultivation. Plantations of commercial species may also be made on surplus land and on marginal or high gradient cultivated land.

(e) All plantations must be walled and protected by chowkidars, except where individual villages agree to stall feed all their animals.

(f) After the population's subsistence needs have been provided for, intensive regeneration of Reserved Forests may be undertaken and their management made to conform to the resource needs of the catchments in which they are situated. Working plans must, therefore, be submitted to the Catchment Management Authority for approval.

(g) Strategic areas for planting forests should be identified and planting programmes adopted. Many of these are crests and water-sheds at high altitudes occupied by the Army and Para-military formations under the Army's control. The Army's cooperation should be obtained for plantation programmes in their areas, subject to security considerations.

2.9.26 Alpine pastures

The carrying capacity of Alpine Pastures must be established. The number of grazing animals must be kept within the approved limits. An effective system of controls must be introduced.

2.9.27 Other pastures

(a) The aim must be to reduce, and if possible, to stop all grazing and to replace it with stall feeding. Since village agreement to stop grazing is related to improved returns from cattle under the breeding programme, it may be necessary to enforce rotational grazing in the interim. Under no circumstances should grazing be permitted - in areas under reafforestation.

(b) Women's Mandals should be established to ensure fair distribution of fodder resources.

(c) In respect of fodder trees growing on common land, it is recommended that individual families should be allotted permanent rights on the produce of identified trees.

Industry

2.9.28 Industry

(a) Heavy industries, or industries requiring high concentrations of the work force, should not be located in actual hill areas. If such industries are to be established in furtherance of a policy to check out-migration, they should be located in adjoining plains.

(b) Unavoidable concentrations of labour, such as at mines and dam sites, should be provided with alternative fuels and prohibited from cutting fuelwood at and around the sites.

(c) Codes for environmental protection at mining sites must be drawn up and strictly enforced.

(d) Small industries (Electronics etc) whose products have high value and low bulk, and which can take advantage of low temperatures, should be encouraged.

(e) Definite encouragement to be given to fruit processing milk processing, pine-needle hard-board plants, etc., which are directly related to the environmentally oriented eco-development programme.

(f) Small industries, such as turpentine factories, whose economics depend on wasteful use of cheap fuelwood, should not be allowed in the hills.

(g) Flour mills, oil presses, carding machines, and other minor installations related to local needs and resources to be encouraged, particularly in connection with cheap power from micro-hydel plants in remote areas.

(h) Policies in respect of local sawmills to be decided by Catchment Management Boards. As far as possible, they should be used to retain added value within the catchment.

(i) Sawmill waste to be processed into wood wool, chip-board, etc.

(j) Supply of cheap or subsidised timber to sawmills for wooden packing case production to be stopped. Alternative packing materials to be encouraged.

(k) Pulpwood demands for paper factories may be met only after meeting ecological and local needs. Nothing which can be converted into high value timber should be sold for pulp.

(l) Traditional handicrafts to be encouraged by design and marketing studies, marketing arrangements, advances/grants for equipment and investment capital on easy terms.

2.9.29 Technical Training

(a) Till intensive rather than extensive agricuture increases the support capacity of the land, out-migration is inescapable. In the plains out-migrants have to compete with better qualified candidates.

(b) With increasing technicalisation of agriculture/engineering/hydel and other services, technically qualified staff will be needed in the hills.

(c) For both purposes polytechnics should be established at convenient centres so as to provide a pool of technical manpower.

2.9.30 Socio-cultural Impact of In-migration

(a) Considerable numbers of outsiders are moving into the hills as road construction gangs, etc. Generally they stay on. This is increasing the pressure on a slender resource base.

(b) Employment agencies should ensure engagement of outsiders for temporary periods only. Border Roads and other such agencies are particularly concerned.

CHAPTER III

COORDINATED RESEARCH ON ACTION ORIENTED BASIS

3.1 Introduction

The Task Force felt it incumbent to make recommendations for a longer term coordinated institutionalisation of Himalayan Eco-development studies in the bio-physical and in the social sciences with the participation of 14 hill region Universities, non-University institutions and voluntary organisations in the Himalayan region.

3.1.1 The overall concept and the enormous diversity of the Himalayan region for ecological and administrative considerations require treatment under the following broad spectra.

(a) The Western Region i.e. J&K and H.P.

Despite the large area and population (8 million in 1971) they share some major common problems. Hence the approach to eco-development problems may admit of much common ground and efforts may be pooled in this region.

(b) The Central Region i.e. U.P.

This too is a fairly composite region having the advantage of coming under a single state administration.

(c) The Eastern Region

(1) Darjeeling District and Sikkim

(2) Arunachal Pradesh

The North Eastern Hilly Region (the remaining North Eastern States) strictly speaking is not a part of the Himalayan region proper, but as a sizeable hill extension of it, its eco-development problems are very important.

However, notwithstanding the vast differences in the geophysical, climatic, biological and social aspects, there exist certain well-marked problems common to the entire range.

3.1.2 For effective institutional participation for eco-development of the Himalayan region, it would be necessary that the envisaged research studies are action-oriented and well integrated. The concept of inte-

grated studies would essentially require intersectoral and inter-disciplinary work. The academic aspects leading to Ph.D degree by a research scholar should also fit into the programme.

3.2 Analysis

3.2.1 The preliminary analysis of the problem of educational institutions' participation in eco-development has revealed following drawbacks which would need rectification:

(a) Eco-development objectives were not clearly and explicitly built into the hill universities and non-university research institutions, though some were addressing themselves to aspects of the problem. It may not, therefore, be reasonable to expect coherent responses to this from these institutions.

(b) Non-university institutions, e.g. FRI, Central Institute for Soil and Water Conservation, Wadia Institute of Geology, Vivekananda Institute, were by their very nature, only sectoral in character.

(c) The life-sciences seemed to be in the lead and the social sciences were seriously lagging, even though some of the basic problems were social, economic, and cultural. In fact, there is a major lacuna in Himalayan social science studies related to eco-development problems, which calls for serious attention.

(d) There has been a lack of policy direction in research related to the end objectives of Himalayan eco-development even on a regional basis. Research is mostly ad hoc, stimulated by the interests of individual researchers. Nor is there some institutional basis for exchange and coordination. There are hardly any links with inter-sectoral attack on specific priority problems of the region(s).

3.2.2. In the context of above, the agricultural universities at Palampur (H.P.) and Pant Nagar (U.P.) applied their scientific resources to solve many regional problems. But the efforts have, so far been limited, except for a very useful Ford Foundation sponsored project by Pant Nagar on Bhikisasen study of developmental methodology for hill areas.

3.2.3 However, in 1976 a very useful meeting of the Vice-Chancellors of 10 hill universities was held at Shillong, sponsored by Indian Council of Agriculture Research. In its publication the 'Role of Universities in the Development of the Himalayan Region', 19 specific areas for graduate and post-graduate studies for the region were identified and 3 groups made specific recommendations for future collaborative actions in the following fields:

(a) linkages of general universities in the region with ICAR/CSIR and implementation of a IRL programme in a district;

(b) plans for specific task forces on topics like Lantana eradication, tree planting, protection of grasslands, agro-horticultural operations, mass eradication of apple scab, training in fish breeding, water resource and supply systems, and rodent control; and

(c) the training, organisation and motivation of staff and students for specific development tasks.

3.2.4 Regretfully, there was no follow up action to implement the envisaged programmes. However, while preparing the Sixth Five Year Plan

document, Planning Commission took note of the important need of institutional participation and a meeting of the Vice-Chancellors of the hill universities, Development Commissioners, scientists, social workers and Government officials was held in October, 1980. It was stressed that on the basis of major themes, which had emerged out of the previous Vice-Chancellors meetings, suitable funding allocations be made in the Sixth Plan.

Universities were urged for their active participation by developing appropriate coordinated action programmes and applied field-oriented research in solving the regional socio-economic problems and the ecological restoration tasks.

3.2.5 The Task Force has attempted to provide better institutional and planning answers for more sustained efforts. The comparative analysis table (Annexure XVII) will show the enormous differences in the institutional situations, with reference to the organisational objectives, funding, and results between ICAR & ICSSR and the Himalayan Universities.

3.3 Approach

3.3.1 In the context of the inter-sectoral coordinated applied research work in the hill universities, attention has to be paid to develop integrated and coordinated approach at intra and inter-institutional level in the region, inter-se and effective linkages with regional planning and implementing agencies, and the main Central Coordination Body at the Planning Commission. This task would be most difficult and challenging since it will involve many far-flung decentralised and unrelated institutions, with multiple funding sources and accoountability Centres. In comparison the ICAR's coordinated functioning it would appear - was simpler since no multiplicity was involved in the funding and accountability source. However, this fact should not act as a deterent to our proposed approach, an outline of which is given below:

(a) A basic requisite for good research institutions, even before linkages, is a measure of real autonomy, within the regions eco-development problems and objectives. Both existing and new institutions in this field should possess this essential attribute of autonomy.

(b) Real autonomy also means an internal institutional capability to set internal organisational objectives and performance criteria for research work. For this an inter-disciplinary Research, Planning & Evaluation Committee may be necessary in each institution.

(c) Apart from formal structures, the best way of involving official planning agencies in eco-development research is to involve them in the discussions on specific problems, tasks and programmes.

(d) There should be a built-in learning process over years in this inter-change between researchers, official agencies and local people.

(e) Special measures may be necessary to link Social Scientists to actual social problems in eco-development. Here, links with official agencies like extension, may be essential. Inter-disciplinary links will be needed between the disciplines of Economics, Sociology, Anthropology and Environmental Sciences.

(f) Research institutions may consider involvement in eco-development consultancy work with official agencies.

3.4 Problems

3.4.1 Institutional problems and development of inter-linkages

Besides the nature and complexity of programming and executing the concept of eco-development, and the overall state of lack of clear policy directions in research, autonomy, coordinated linkages and reliable continuous funding from multiple sources, it is necessary to deal with the most crucial, regretfully often ignored qualitative aspect of our institutions. Therefore, one should be realistic in not expecting a fine 'Taj Mahal' to be built on the existing structure, due to inherited complexity of problems and institutional situations.

3.4.2 Qualitative Aspects of the Problem

The science of 'Organisation Development' points to two basic lessons, apart from others, that:

(i) institutions do not possess any built-in mechanism/programmed genes in their constitution for success; and

(ii) no major problem can be solved by a single Department or discipline in isolation.

3.4.3 Therefore, the process of development has to depend upon institution-building, and establishing inter-institutional linkages, coordination and decisional competence to realize the development objectives. Any sound response from the universities and non-university institutions for their effective participation in eco-development programmes would require an analytical understanding of the problem.

3.4.4 In this context, it is appropriate to reshape ourselves for decisional competence and our institutions to deal with realities relating to the new demands for eco-development.

3.4.5 In the context of Himalayan eco-development problems, the Government has been too big to take care of small problems around the poor hillman e.g. land use and land tenure, drying up of hill springs in remote isolated areas, and the basic needs of fuel, fodder and food. The solution of these apparently small but very significant problems, could only be resolved by linkages of bureaucratic structure and village social structure for remedial social action through eco-development. On the other hand the capabilities of the Government have remained limited to effectively deal with the problems which turn out to be too big viz., effective and timely measures to provide organisation and resources for conservation of vegetation, soil and water, afforestation of large scale, scientific measures for flood control and to sort out inter-State river based developments.

3.4.6 The national unpreparedness to tackle the impact of multiplying man and the utilization of Himalayan resources unjudiciously, and unleashing of developmental activities detrimental to the fragile Himalayan environment, has resulted from ineffective sectoral policy formation, planning and not too realistic evaluation.

The institutional failures have resulted due to :-

(a) Over-centralization of research and planning with limited resources and limited understanding;

(b) under-autonomy of local institution with limited powers and initiatives to research, plan, experiment and evaluate at grass roots;

(c) lack of policy direction and functional linkages with actual implementors of the programmes in the field, official agencies and the local people.

3.4.7 These drawbacks led to existence of bureaucratic bosses, inhibiting the spread of learning process, adding duplication led to often lacking comprehension of inter-relatedness of all eco-development problems, coupled with fierce institutional loyalties, often incompatible for speedier economical and harmonious growth and development.

The remedies to the problems cited above have to be found in evolving a fellowship of researchers and policy and plan makers. It will help in widening the perception of words like 'inter-disciplinary', 'coordination' and 'ecological balance' in terms of experience. The urgent need is to find a breakthrough to the barrier, which has prevented the implementation of the numerous useful guidelines of the past - e.g., on hill road construction, forestry, soil conservation or development of hill people. Whatever success could be achieved has been too limited for the scale and complexity of the problems.

How best it would be possible to prevent (i) inadequate efforts (ii) operational delays and the consequent uneconomic costs, cramped institutions; and (iii) limited, un-cordinated and unresearched actions. It has to be realized that the departments are to be inter-related, coordinating their plans and expenditure and most essentially with the active and close participation and shared responsibility of the local people.

3.4.8 The other view of the qualitative aspect of the problem:

As we are largely concerned with the work of research institutions in the Himalayan region, in universities and Government Departments,it may be useful to emphasize a qualitative aspect, which has been ignored in bureaucratic processes by both development and research administrators. As Shil's has emphasized, universities and research institutions are more than administrative limbs of government, more than mere seekers of budget grants for annual purposes. Nor should Governments suffer from the notion that they are "buying research" like a commodity. There is need for a better appreciation of all good research institutions as on-going sources of "intellectual capital"; capital which has a human, a scientific, a community investment, besides a financial one. Together these elements could add upto an intellectual tradition, far beyond the dimensions of a research project or a budget, or the routine of the year. This means long-term high quality investment; high-quality not necessarily implying high cost. They require high quality persons, and a culture of inter-disciplinary cooperation for wider visions of the society and the environments around them.

3.4.9 For this they, the researchers require two basics; first, autonomy in their external and internal relationships. Second, they also require to be in the stream of inter-linked on-going learning processes; not isolated in sterile ivory towers, nor confined to ad hoc Ph.D., dissertations and the publication of numerous research papers.

3.4.10 The concepts of autonomy and the "Learning Process" which are basic organic needs of institutions with "intellectual capital", call for more explicit explanations in our context, which is attempted below.

3.4.11 Autonomy

Autonomy first. What does it call for in real organisational and behavioural terms?

3.4.12 Practical implications and suggestions for transferring autonomy in the institutional hierarchy:

(a) The decentralisation of selection processes and powers from Chancellors to Vice-Chancellors and the Executive Councils. In due measure, this aspect of autonomy should be passed on to the inter-disciplinary research teams for executing the specific research projects. As an aid to this process, the UGC has laid down conditions for internal autonomy of principal investigators and research teams. This regretfully is applicable to only some universities.

(b) The removal of the antiquated veto power of the Finance Officer. It being a relic of colonial administration, has fortunately been dispensed with in public sector and has found no place in the modern professional management. Since it was realized that other powers without matching financial powers are meaningless, the financial veto in one person could easily castrate an institution.

Therefore, it is suggested that the financial powers should be shared jointly, to allow performance of functions entrusted to the institution or the research project team as a collective responsibility.

To implement this concept, the financial authority should vest in the Chief Executive Officer (i.e. the Vice-Chancellor in the universities) and the Board of Management of Eco-development Research, which may include the Registrar/and or the Finance Officer. This group in totality should take over the collective responsibility and should be answerable for the degree of success or failure in implementing the assigned tasks.

The process of decentralisation, essentially the transfer of responsibility and financial power should continue to the lower rungs of organisational hierarchy. It should essentially include the powers to hire the required technical staff. This needed change mentioned above would require inducting new quality of administrative and academic leadership.

(c) The educational bureaucrats, and academic administrators should inculcate a new quality of administrative and academic leadership by concerning themselves with research policy, objectives and results rather than preoccupations with budgets and regulations. It would imply providing autonomy to younger members of the active research teams. The primary task of the senior researchers and educationists is to transfer the wisdom, knowledge, the values of ethics which are conducive for high quality research, which is the only yard-stick to determine the quality of an educational institution.

(d) The academic autonomy would in turn demand professional integrity, high quality performance and a genuine sense of mutual esteem. Each individual scientist, whatever may be the level of hierarchy develops a passion for excellence for the assigned task and the capabilities for integrating his best talents in the work performance.

The internal setting of high and sound academic standards in terms of insights for quality design and analysis of the research problem will be the basic needs. The senior scientists should become more

supportive of juniors and help to develop their potential with demanding standards and give due recognition.

3.4.13 To find appropriate solutions to Himalayan eco-development problems, it will be essential to look at different facts of the problem with inter-disciplinary approach. It would also essentially require to view the wholeness of the problem, the scientists and social scientists should live and work in close proximity of the physical environment and the people who live in the area are being researched.

3.5 Eco-development and Learning Process:

3.5.1 The very fact that the Himalaya and its people are facing complex ecological and human problems of Himalayan magnitude, calls for a very intense, sustained and mutual learning process, by administrators, scientists working in close collaboration with the local people, to fathom the complexity, vastness and severity of the problems, which might vary from one region to another.

3.5.2 This learning process, which would form the very basis of suggesting remedies to be implemented by sound eco-development programmes, must involve inter-dependencies and linkages for understanding the problem and its solutions in wholeness by involving the experts of diverse fields - biologists, geologists, social scientists and others.

3.5.3 It will then be realised that great problems like affecting the Himalayan environment and the low income generation capacity of the people are inter-linked. The environmental degradation amounted to depletion of resources and in turn kept the local people struggling at subsistence economy levels. To bring about any significant change for betterment say by means of social forestry, community water management, shifting to settled cultivation, the public health problems, would essentially require a greater focus for understanding by studying the socio-technical aspects of the problem. It has now been realised that the neglect of this part of study prevented best of the technical programme to gain any worth while degree of success.

3.5.4 Therefore, to gain a better perspective of the knowledge of the problem from macro to micro stage it would require policy planners, researchers, operational agency, to work together to learn the problem at close proximity and dialogue with the local people.

3.6 How to develop the new premises in the Himalayan Eco-development Action Programme

3.6.1 Since the stake of the local community is primary, the responsible participation of the people with official agencies is most essential in developing environment oriented management of the primary natural resources like land, water and forests. By following this approach considerable success was achieved for eco-forestry and pasture in earlier Chipko area in Garhwal; for soil, water conservation and social forestry in Sukhomajri in Himachal Pradesh and in small scale irrigation in Luzon, Philipines. These success stories need to be replicated, as these point out the strikingly new start for eco-development. The basic principle involved has to be learnt by the bureaucracies and institutions.

3.6.2 The official agencies should assign for themselves the new role for effective functioning as 'service agencies', to assist researchers and local people with more flexibility in rules and permitting experimental approaches. Obviously, the usual annual plan-target functioning would only have a very limited role to play.

3.6.3 A good policy approach would imply that a proposed programme should be first tested by a sound pilot scheme, before multiplication.

3.6.4 It will be essential to bring into action new official training and organisational responses. These will help in training for innovation, experiment, changed attitudes for the new eco development objectives and the performance criteria.

3.7 The Learning Process and Devising the Eco-development Project Strategies:

3.7.1 Stage 1 To survey for clear identification of the major eco-development problems and the interlinkages. To offer a relatively simple example around hill road construction, the major element of problem may be:

- the technology choice for the given economic purpose, e.g. road or ropeway? What kind of road for what kind of traffic, with traffic potential studies?
- the cost-benefits of options in above;
- the necessary ecological inter-faces with Soil/Water Conservation and Forestry;
- the involvement of the local people with regard to alignment, employment, landuse and traffic needs.

The inter-linkages will flow from the above.

Stage 2 will be a clear definition of eco-development objectives. This has often being unstated, badly stated, or taken for granted. Both World Bank and international project evaluations have shown that the major single reason for the failure of projects to reach development objectives lies with the failure of project planners to formulate these clearly and soundly from the start. Operational people often mistake the means i.e. personnel, equipment, vehicles, budgets for the ends. As a result, the real development objectives are lost at the end of expenditure.

Stage 3 is the Research phase, in which it will be necessary to -

- identify priority knowledge gaps and research tasks in the physical and social sciences;
- undertake a documentation of the realities of the situation, or situational research. These for example may be the laws and regulations of forestry, on the one hand; and their implications for eco-development. At this stage, there may be social profile studies of land-tenure and land-use systems, water systems, social structures, local rights and practices, social attitudes to eco-development etc., which offer factual, well-documented insights into the problem and may also lead to predictive possibilities. It is necessary to document the action processes of people and official agencies, especially in pilot projects for mutual learning.

Stage 4 is that of a joint workshop of official agencies, researchers, and the best representatives of the local people. The results of the earlier 3 stages are placed before them, for a common analysis of the problem, factually documented, and the best eco-development

responses to it. By now, hopefully, there is a sharing of views and experiences based on researched realities, not on ad hoc limited experience or on individual hobby-horses. From the joint workshop should evolve the best practical responses, which should then be tried out in stage 5.

Stage 5 is that of the Learning Laboratory in the field, where the results of stage 4 are tried out on limited scale in some representative areas. There is a danger of calling these 'pilot projects' prematurely, as past perceptions of such projects are that they are already cut and dried, ready for widespread implementation soon. This is a mistake, and eliminates the learning process in the field laboratory, in which an interchange between all disciplines and departments is important.

Stage 6 may be regarded as that of pilot projects in representative areas, with organisation and resources capable of widespread replicability, as soon as possible. To do this successfully it may be necessary to modify existing organisational structures, laws, regulations and approaches. By this stage, it will be necessary to evolve new qualitative and quantitative performance criteria for planning and implementing agencies to ensure the achievement of eco-development objectives, beyond mere physical targets and expenditures.

3.7.2 Hopefully, the experimentation, flexibility and new time-spans for eco-development responses will now be apparent if such "Learning Processes" are adopted. They may take 2 to 5 years to introduce. But if they are undertaken over a range of eco-development problems, the cumulative results in that relatively short period should produce far better results than the processes of the past 20 to 30 years, with which no one is happy, not even official agencies. This Learning Process is a systematised, better informed, and better integrated application of what Dr.M.S. Swaminathan himself has earlier described as a "Malady/Remedy" approach to development problems.

3.7.3 It will be seen from the above, that we have significantly departed from the traditional model of research institutions going their way, and official agencies going their's. All the succeeding recommendations about the forms and inter-linkages of organisations follow the same principle, and this is meant to be a crucial turning point from the past, which can best be achieved in the crucible of the six stages of the Learning Process.

3.8 The Recommended Organisational Set-up for Himalayan Eco-development:

3.8.1 The following three-tier arrangement is suggested to develop our organisational resources to attend to the problems of Himalayan Eco-development.

3.8.2 First-tier Organisational Set-up:

To inculcate a sense of direction and Central Coordination in Eco-development, there was consensus in deriving the inferences that:

- there has been an overall sense of lack of direction in formulating priorities for each of the Himalayan region.

- the Central and State research and development agencies are too numerous, often far-flung and functioning at cross purposes, retard the development programmes and were responsible for bringing about environmental and close linked human development distortions. It resulted not only in efficient utilisation of public funds leading to enormous wastages, but also bringing about untold misery to hill and also plain people. For example, the rail embankments, altered drainage system and other developmental changes in Gauhati were responsible for recurring floods in low-lying areas.

3.8.3 Suggested Organisation Structure -

A Central Coordination Council for Eco-development

Therefore, the first step to rectify this drawback is to recommend setting of a Central Coordination Council for Eco-development of the Himalayan region. This Council should be set up by the Planning Commission, with the following composition:

1. Member, Planning Commission (Incharge of Science, Education & Agriculture).
2. Vice-Chancellors of Hill Universities.
3. Heads of relevant Central Govt. Research Organisations.
4. Hill Development Commissioners.
5. Senior representatives of -

i) Defence Science Organisation (DRDO)
ii) Deptt. of Environment
iii) Science & Technology
iv) Indian Council of Agriculture Research (ICAR)
v) Indian Council of Social Science Research (ICSSR)
vi) University Grants Commission.

3.8.4 The major functions of the Central Coordination Council may be as follows:

a) To formulate central and regional eco-development policy objectives and priorities of national and regional significance, and to give all concerned a sense of direction in the next decade for planning, research implementation and evaluation.

b) The appointment of Task Forces to deal with some major overall problems transcending the problems peculiar to regions, e.g. massive afforestation, soil & water conservation, remote sensing of priority eroded areas, collection of germ plasm, the promotion of inter-regional and inter-departmental networks for Research and Planning.

c) The allocation of Plan funds for Himalayan Eco-Development to ensure 'critical mass' at each stage of the development process. For example, resources may have to grow significantly from the stage of Learning Laboratories in the field, to representative pilot projects, and finally to extensive implementation on scale. All three may be envisaged in a 10 to 15 year period, realistically, if there is the political and administrative will to do it effectively.

d) Establish a Central Coordination Cell located in the Central Himalayan region to monitor progress, to act as a facilitating institution for grants to universities; and to keep the Central Coordination Council informed. The Coordination Cell will be headed by a Project Coordinator who will collate the data collected by the different centres of the Coordinated Research Project on Himalayan eco-development and publish an annual report. He will also organise an annual workshop for the staff working in the Coordinated Project.

e) The Council may also assess progress and evaluate specific programmes annually on the basis of annual reports submitted by Regional Coordination Committees, suggested later in this report. The Council should provide some funds for the evaluation of research and planned programmes on the ground. For this purpose, evaluation panels of the best persons may be set up periodically for objective, analytical evaluations, which should themselves have the objective of learning experiences for all concerned.

f) The process of coordination at this and other levels is necessary because of the existence of plurality of institutions in the Himalayan Region. It should, therefore, attempt to synthesise, not impose conformity; to pool experience and to respect the basic principles of "Autonomy" and the "Learning Process", so that the 'networks of theparticipating bodies coordinate themselves as an internal autonomous process on agreed clear and specific objectives pursued with a certain integrity of purpose.

3.8.5 It is necessary to avoid this Central Council becoming oversized. Because of the large number of institutions and non-officials likely to be involved, invitations may be restricted for specific meetings to those specifically concerned. The functional aspects should take precedence over more representations.

3.8.6 Second Tier Organisational Set-up:

The Central Coordination Council for Eco-development, referred to above is meant to provide a sense of coordinated direction to the eco-development processes. For executing the policies we have to turn our attention now to the organisational set up on the regional basis which would involve the participation of the 14 Hill Universities.

3.8.7 It is recommended that each University should act as the nucleus or focal, point for making a network of learning processes with all relevant agencies, so that each University could effectively probe into the regional eco-developmental problems. Based upon this basic survey and analysis of theproblem could build inter-disciplinary coherent

groups for the specific research task by utilising the high quality internal academic resources. Besides, the participation of the scientists and social scientists, it is also an essential step to organise the participation of students at different levels of learning and experience.

3.8.8 Coordinated Research, Planning & Evaluation Committee (CRPEC)

Towards developing this regional focal point for eco-development, each university may set up a Committee, with Vice-Chancellor as the Chairman. This Committee should also serve as a senior level service and coordinating agency for researchers. It may conduct the functions as elaborated below:

3.8.9 (i) Functions of Coordination - To build regional networks for initiating the learning process, and probe for major problem areas utilising the resources of the University and with local operational agencies at senior levels. For the sake of examples : problems concerning forestry, soil conservation, agriculture, horticulture, animal husbandry, water, minerals, road development and other major or minor development programmes like dam buildings, setting up of industries and others.

3.8.10 The problems referred to above would make it essential to develop linkages for coordination with relevant State and Central agencies (see the list of such identified agencies in Annexure XVIII). Besides, Government organisations, other significant and useful non-official and voluntary organisations and individuals who may be of assistance be also drawn into this network coordination.

3.8.11 (ii) Function of Planning:

A. Identifying priority research projects - This function would in part be guided by the Central Coordination Committee at the Planning Commission who would advise for broad policy and clear-cut eco-development objectives and assist in inter-sectoral linkages.

B. To formulate sound research proposals in consultation with each inter-disciplinary groups for all supportive measures including funding.

C. It should assist in solving administrative problems and delays involved in research projects through the State or Central funding agencies, which greatly impede work and results.

D. It may prepare research projects in advance, preferably 3 - 5 years ahead to get funding support in time.

E. It may submit annual reports and be accountable to funding agencies.

3.8.12 (iii) Function of Evaluation - The Committee should evaluate all research projects biannually and send reports to the Central Coordination Council, at the Planning Commission.

3.9 Recommendations for streamlining the administrative channels in the Hill University for smooth functioning of the Coordinated Action Research Projects.

3.9.1 Transfer full financial authority in the Vice-Chancellor and the Central Research Planning and Evaluation Committee. The Registrar/

Finance Officer's proper role should be to act in an advisory role with regard to financial regulations, the most economic use of funds, the use of cost-benefit analysis and to act as a co-facilitator of the University's eco-development research objectives, sharing the joint responsibility with the Vice-Chancellor and the CRPEC, as one of the members. However, it should be kept in view that funds provided for a specific task have dual accountability achieving the research objectives within specified time and funding targets. The regretful emphasis on the mere economic use of funds has very often defeated the entire purposes of a project, with consequent wastages of efforts and demoralisation of research workers.

3.9.2 It may also be necessary to reduce the Chancellors' functions in such details, in particular the appointment of staff, only to the top levels in the University. Others, conforming to the principle of autonomy should rest with the Vice-Chancellor, the Executive Council and also some delegated authority to the C.R.P.E.C.

3.9.3 The above two recommendations are necessary to implement to enable the University's effective participation involving new approaches, the assigned new tasks, regional eco-development. The Universities should not be ketp prisoners of past in-effective systems.

3.9.4 If the Hill Universities cannot acquire the suggested requisite autonomy, without which the demand of urgent Himalayan tasks would not be fulfilled, the public interest may demand setting up of new autonomous institutions for the purpose. These institutions may be built around clusters of highly qualified and purposeful scientists. Such an approach has been tried in Atomic and Space Research with rich dividends. Such autonomous institutions could be linked with local universities at Post-Graduate levels.

3.9.5 This suggestion is made keeping in view that time is the essence with increasing pace of ecological degradation and human misery, striking painfully each year with more deforested hills and with higher flood damages in the Indo-Ganga-Brahmaputra basins. The writing on the wall is clear.

3.10 Involvement of the Teachers and Students in Eco-development Tasks

3.10.1 The endemic 'tribalism' between different disciplines in a single university and also between universities, government research institutions and planning agencies has been responsible for the general lack of often needed inter-disciplinary and inter-institional effort to solve the eco-development problems.

3.10.2 Since it is generally accepted now that developmental problems cannot be solved in sectoral isolation, rather it would need a comprehensive integrated approach involving a variety of knowledge base inputs. To achieve this end, clear cut direction and guidance has to be provided by the governing councils which would mean the Central Coordination Council at the Planning Commission and the Coordinated Research, Planning and Evaluation Committee located at the Hill Universities and the Government Research and Development agencies.

3.10.3 Besides, at the inter-University level the general prevailing culture of departmental casteism and narrow personal loyalties are to be given up for the sake of overall broad objectives. It would demand that adding a new set of values and quantification that without compromising the specialist knowledge base, the individual administrator, scientist

or even a research student develops the most needed generalist view of the problem. This quality will immensly help in appreciating that an eco-development objectives only be realised by developing coordination i.e. a sense of 'organised cooperation' as Dr. M.S. Swaminathan has put it.

3.10.4 Therefore, it will be necessary to begin with identifying individuals to provide a superior purposeful leadership at the higher levels of the institutions as well as in the government, to which these institutions are ultimately accountable. A first-rate leadership is of the essence of this aspect of institutional involvement, as so well demonstrated by the success stories of the institutions builders, Dr. Homi J. Bhabha and Dr. Vikram Sarabhai, that good institutions can be built around good people. In contrast, the reverse effort of building an institution and then find bodies to fill them, has often met with dismal failure.

3.10.5 The involvement of senior active university men in the governing councils of official research institutions and vice-versa can pave the way to inter-institutional involvement for mutual learning of the complex problems for eco-development.

3.10.6 Involvement of Teachers and Students

The teacher-student community is a growing social force which no longer quiet residents of an ivory tower, need to be involved in the eco-development problems of their environment. It is a large special investment in them, therefore, the academic abilities of the academic staff and the youthful vigour, zeal and enthusiasm of the students should be harnessed to make the entire process of education socially productive. The students participation could be at following levels:

a) Post-graduate Research - The young scholar may be assigned research problems of relevance to the local environment.

b) The graduate and undergraduate students should be involved in mass social programme like afforestation, soil conservation, environmental awareness, health, hygiene and sanitation etc.

These tasks may be performed through NSS and also by organising special eco-development camps during short and long vacations under the guidance of enthusiastic and dedicated teachers. The test of their performance in the field should be assessed by the impact made by the operational programme.

3.11 The process of building capabilities of the Universities

3.11.1 To make education more relevant to the local environment and to functional job needs in the problems of hill development. This should include forestry, water management, hill farming, electricity, road construction and agro-industries with appropriate technologies underlying all of these. This subject merits separate enquiry in depth to make it more specific and authoritative.

3.11.2 The role of non-formal education should be stressed as an important eco-development need, therefore, strong capabilities to impart it should be developed in the universities.

3.11.3 Each University should pay special attention for the conservation and development of local art and folk culture and their possible

impact on regional development. This would be an apt subject for social science research and each hill university may also house local museums of culture and crafts.

3.11.4 Special attention needs to be paid to strengthen social science participation for higher contribution of social scientists to Himalayan Eco-development Problems. Some ways are suggested below:

i) Policy direction should clearly identify significant social sciences areas calling for more knowledge for solutions e.g.

- community participation factors, complimentary roles of men and women in hill farming, impact of environment on health and family planning implication (with public health specialists);
- relevant education (cultural) needs for hill eco-development;
- micro economic studies of projects and programmes;
- evaluation studies;
- the socio-economic impact of in-migration in the eastern region, and out-migration in the western and central Himalayan regions; and
- most relevantly, in extension work, public health and family welfare/planning programmes;
- the implications of man/woman roles in the context of advancing education.

ii) Better research input and evaluation linkages with regional planning and operational departments, especially in forestry, water resources & health.

iii) A more relevant micro and regional orientation to all social science studies in Economics, Sociology, Anthropology, and Environmental Sciences in course curricula and in research. There is need for more indigenous contexts of social service work.

iv) The involvement of social scientists (as also physical scientists) in consultancy work in the planning or even pre-planning and evaluation phases of Himalayan eco-development projects by official agencies.

3.12 <u>The planning and organising research for eco-development in hill universities</u>.

3.12.1 Since, like other general universities, the hill universities are at present organised in single discipline to teach, research and examine, it would be an essential step to create a new dimension in the form of more advanced form of inter-disciplinary studies. The individual discipline need to be organised for eco-development research purposes into following larger groups, each under a group leader:

1) Earth & Physical Science Group - Geology, Limnology, Geography, Meteorology Environmental Science & Physics.

2) Life Science Group - Botany, Zoology & Chemistry.

3) Social Science Group - Economics, Sociology, Anthropology, Demography, Archeology, Linguistic.

3.12.2 The public health and nutrition has so far been a major gap in life science group. It is a bare need area in eco-development. This deficiency should be rectified. This aspect was earlier left to a few medical institutions, while none existed in the whole Himalayan region.

3.12.3 The aspect of regional biological resource inventory should be strengthened. It is regretted that hardly any uptodate documentation of plants and animals in the Himalayan region exist. This aspect needs attention of the University Grants Commission for creating academic posts and provide funding and infrastructural support to strengthen this basic aspect. The Thrust Area Programme Committee of Department of Science & Technology could assist in fulfilling this major gap and the imperative need.

3.12.4 Data banks may be set up on intra/inter-University basis for each region. These should be planned on a comprehensive basis with a view to serve the eco-development planning needs. The cataloguing should be based on minimum and relevant data planning. In this context the UGC has already made suggestions for eco-system analysis and Resource Documentation by the regional University.

3.12.5 In brief, the eco-development purposes, the Earth and Physical Sciences can cover the major development areas of soil, climate, water aspects of the eco-systems. The Life Sciences can cover plants, animals, fishes, birds, insects and micro-organisms. The Social Sciences can cover all human aspects. The whole approach may be visualised in a syndrome: Nature, man and the inter-relationship studies to make universities more relevant to their physical and social environments. This has to followed up by the most significant attitudinal change and proper opportunities to bring about more 'Organised Cooperation' among the interacting disciplines.

3.12.6 To make coordination and speedy implementation of the research projects, it is suggested that each Research Project Team should - hold monthly meetings

-design internal peer group evaluations, to ensure progress and time-targeted results

-report results and expenditure against budgets.

In addition, inter-institutional linkages may be established with BSI, ZSI, FRI, ICAR and its local units, Soil and Water Conservation Unit and others.

3.13. Suggestions for broad regional approaches for Himalayan Eco-development Research despite narrower diversities and common over-riding problems.

3.13.1 1. The Western Region i.e. J&K & H.P. - Despite the large area and population (8 m in 1971), they share some major common problems;

-having large temperate fruit resource potentials,
-having large temperate forestry potentials;

-sharing similar mountain desert regions in Lahaul, Spiti and Ladakh.

-sharing the upper reaches of what used to be called the five Punjab rivers.

Hence the approach to eco-development problems may admit of much common ground, and efforts may be pooled in this region.

2. The Central Region i.e. U.P. - This too is a fairly composite region - (having the advantage of coming under a single state administration);

-sharing the upper reaches of the Jamuna-Ganga water systems;
-sharing similar agro-climatic conditions;
-sharing similar out-migration problems;
-sharing similar development potentials, constraints, and cultures.

3. Eastern (A): Darjeeling Distt, and Sikkim

-both having similar agro-climatic conditions;
-both sharing the upper reaches of the Teesta river;
-both having similar in-migration problems in terms of man's impact on the environment;
-both sharing similar development potentials and constraints in agriculture, horticulture, forestry and agro-industries.

4. Eastern(B) i.e. Arunachal - We think it advisable in the long run to treat Arunachal Pradesh as a separate region, detached from the N.E. States for the following regions:

-being a part of the main Himalayan chain, its physical, agro-climatic conditions, and social conditions are qualitatively different from therest of the NE States

-in due course, it must develop its own institutions and capabilities to deal with its qualitatively different problems and the developmental lag;

-it is a sufficiently sizeable and composite area, sharing a common administration.

5. Eastern(C) i.e. the remaining N.E. States - Strictly speaking this is not a part of the Himalayan region proper, but as a sizeable hill extension of it, its eco-development problems are very important and merit the attention of the Task Force.

-they have similar tropical and semi-tropical agro-climatic conditions;

-flowing from agro-climatic conditions, their eco-development problems are similar, sharing major local problems like jhooming, rodents and citrus fruits;

-together they are sizeable in area and population, and could share research overheads and costs for greater economics, as well as a better regional focus.

3.13.2 The organised research groups, as suggested earlier, may preferrably initiate investigations for eco-development in a suitable watershed; depending upon their capabilities in terms of academic expertise, equipment and infrastructure back up. The focus of attention should be directed towards eco-system analysis and resource documentation. This research and educational experience should then be incorporated in the action programme as a pilot project in a micro/sub-catchment.

3.13.3 For each given eco-system, it is appropriate to generate and document accurate information relating to biotic and abiotic factors and their interaction and prepare maps as well. Based on documentation of such resources and interacting patterns, it should be possible to suggest appropriate measures for resource enrichment, resource management and utilisation. A sub-catchment/micro watershed could be considered as a unit of eco-systems:

1. Land - Land form - land use patterns for agriculture, Human settlement, forest, grassland, roads and communcating, industrial use etc.

2. Water Resources and their use - Rivers, tanks, ponds, water table, ground water, rainfall, drainage pattern etc. Water use for agriculture, human needs, industrial needs, waste-water disposal patterns.

3. Flora and Fauna - Systematic documentation of plants, plant communities, agriculture crops and crops and cropping patterns; important trees; growth pattern of trees and their productivity patterns; animals and animal populations; their ecology and feeding habits; endangered species of plants and animals, if any.

4. Mineral Resources - Minerals; mines, metals, related industries.

5. Demographic Data - Population; birth rate, family size; age structure of population, literacy; educational attainments; occupations; social and economic profiles.

6. Energy Resources and their use - Sources of energy; levels and patterns of consumption; alternate energy sources; wind and water energy sources, geo-thermal resources.

7. Productivity patterns - Sources and levels of biological productivity, biomass production and biomass utilisation; wastes and waste utilisation; production potential and yields. Biotechnology potential.

8. Environmental degradation patterns - Land, forest grassland, through erosion, grazing, felling, cultural practices etc.

9. Source of pollution and levels of pollution in land, water and air.

10. Plan for eco-system enrichment and development activities (Development without destruction).

3.13.4 The Coordinated Action Research Project teams would initiate action, on all or some of the above aspects. It is necessary for educational institutions to continue these activities by participation of students and teachers drawn from different subject areas in Science, Social Sciences and Humanities by organising eco-development camps during short/long vacation.

3.14 Organisational Linkages for State/North-East Region Coordination.

3.14.1 Between the Planning Commission at the Centre and the Hill University/Research Institutions in the major Himalayan regions defined earlier of this report, the possibilities of regional coordination in the four major regions (Arunachal Pradesh will be a category of its own) have been examined. It was felt that the most difficult area for coordination was in the State or States. We examined the possibility of the ICAR regional committees, which also deal with problems very basic to Himalayan eco-development e.g. soil water, forests, crops etc. It was felt that these were already large bodies; that some aspects of eco-development are excluded from the purview e.g. minerals, roads, public health; and that if the general universities were to be incorporated they may play a very subsidiary role. An alternative proposal was for appropriate members of the ICAR regional committee to be invited to be members of an Inter-University State Committee for Himalayan Eco-development. Both proposals have merits and demerits.

3.14.2 One way out of the dilemma is to ask: what is the best focal point in a state or states? It was felt that the Hill Development Commissioner - or some such corresponding official - might be the best focal point; and also be a useful link between the hill universities and the state development departments. In the case of U.P. the problem is simplest as there is a separate Hill Development Department. If H.P. is lumped together with UP or J&K, two may serve as the focal point. But in the eastern region the problem becomes very acute. The realities and pluralities of the situation may call for pragmatic responses in each case.

3.14.3 The Task Force agreed:

a) that to try and evolve practical regional coordinating agencies may be very difficult;

b) that we should let the universities develop and 'grow' their own interrelationships and cooperative' processes with other agencies.

It may also be left to the Vice-Chancellors of the hill universities to evolve their own local coordination machinery, depending on the circumstances of each region.

3.15 III. THIRD-TIER ORGANISATIONAL SET UP -

A Central Coordination Cell

3.15.1 To ensure the continuity and the outcome of the projects within the framework of time and available funding, the mechanism of setting up a main coordinating centre for the participating hill university is recommended.

It is essential at this crucial stage, of attempting to translate and induct this new vital concept of eco-development into the University

functioning, the Planning Commission continues to directly fund the scheme; and during the current Sixth Plan period the Cell may function in the Planning Commission. Subsequently, its location may be transferred to a central location in the Himalayan region. A suitable funding mechanism should also be developed and financial allocations may be earmarked for the remaining plan period.

3.15.2 The functioning of the Central Coordination Cell should be looked after by a whole-time senior level Chief Project Coordinator, 4 to 5 in-service personnel representing the geo-physical, biological and social sciences and a core technical staff of a statistician, cartographer, photographer and other essential supporting administrative staff.

3.15.3 Following tasks are visualised for this crucial function of coordination:

1. Coordinate the Action Research Project in the 14 Himalayan and Hill Region Universities in N.E. India and built a network of coordination.

2. Assist the universities in generating new projects in the National and Regional priority areas, which may provide the necessary background scientific, technical information/ data, urgently needed to speedily implement the plan targets of regional resource utilization for human development.

3. Visit the actual Action Research Project sites to review the progress of work, and advice and assist the research teams, in solving the problems impeding the progress of work.

4. Collate and assist in transferring the knowledge, experience of different university project teams for mutual gains, in particular the research groups working on related problems of national priorities like snowmelt, glacier retreat, soil erosion, silting and eutrophication of Himalayan lakes, drying of natural springs, afforestation problems and others.

5. Organise workshops for research teams for training to improve the quality of work and to disseminate the knowledge and experience gained by different university teams in their respective regions for mutual sharing - as a process to develop 'organised cooperation'.

6. Assist in developing appropriate linkages between University Action Research Teams and the national and state research and development agencies and also voluntary organisations.

7. (i) Publish an annual report of the progress of the Action Research Project for hill region development in the 14 Himalayan Universities.

   (ii) Assist in preparing the annual budget for the Action Research Project Schemes.

3.15.4 The significant and potential Himalayan Eco-Development Institutions and the Indicative list of priorities for research studies are given at Annexure XVIII & Annexure XIX respectively.

CHAPTER IV

POST HARVEST OPERATIONS

4.1. INTRODUCTION

4.1.1. Post harvest handling of the product of horticulture, animal husbandry, forestry, etc. assume crucial importance in the context of the development of the Himalayan Region. Post harvest handling is of particular interest in the case of persihable commodities such as fruits and vegetables which account for a major share of the produce of the region. Unfortunately, in the hill region, over-exploitation of natural resources has created imbalances in the ecological system. One of the major causes of the alarming situation is the indiscriminate felling of forest trees to meet various needs including the ever increasing packaging needs of fruits. Immediate attention is, therefore, needed to find suitable substitute based on alternate resources to meet the packaging needs of the horticulture industry.

4.1.2 The research needs and development of infra-structural facilities for post harvest handling of major produce such as quality control, packaging, transport, storage facilities, processing on scientific lines and marketing are essential to avoid any set-back to the developing industry. This report while taking into consideration the recommendations of the 'National Committee on Development of Backward Hill Areas' and Expert Group on 'Perishable Agriculture Commodities' has concentrated mainly on post harvest operations in respect of fruits, vegetables and flowers.

4.2 NATURE OF PROBLEMS

4.2.1 The varying altitudes and the widely different soil and climate of the Himalayan region make these areas eminently suitable for growing a wide variety of temperate and subtropical fruits, winter and summer vegetables and an array of flowers with high potential for use as cut flowers. The western Himalayan region is particularly suitable for growing temperate fruits, such as apples, pears, plums, peach, etc. which are in great demand in the plains of India and have also a good potential for export provided the products can compete in the quality conscious international market. In the eastern part of the Himalayan region, there is scope for raising subtropical/tropical fruits such as organes, other citrus species, pineapple, bananas etc. The importance of these fruit crops can be judged from Annexure XX in which the area and production of apple in some apple growing States are given and Annexure XXI where the area and production of some substropical/tropical fruits in the north-eastern zone are given. Development of floriculture with the possibilities of export of cut flowers not only to other parts of the

country but also to the West Asian and European market also holds great potentialities.

4.2.2 Among the temperate fruits, the apple has the pride of place and often been referred to as the harbinger of a'golden revolution'. In the last two decades, considerable effort has been put into increasing the area under apple cultivation. These efforts have by and large succeeded because of the high returns and in some States, such as Himachal Pradesh and Jammu & Kashmir it has become the backbone of the economy. Indeed, more and more orchards are coming up and projections (Annexure XXII) envisage doubling or even trebling of present production by the end of the century. If the people of the region, particularly the growers, are to reap the full benefits of this bounteous production of fruits, there is a need to ensure optimal post-harvest handling. Because of several bottlenecks, even at the current levels of average production, an appreciable portion of the produce has to be left behind, ungathered and unutilised. In years of bumper production the lack of adequate infrastructure such as transport facilities, packing cases, etc, has forced the grower to sell apples as low as 85 paise per kilo while the consumer has been paying about five to six rupees per kg., a margin of over 500 per cent. Therefore, "the one who grows has not reaped" but middleman that has benefited. The situation is likely to get worse if the projected increase in production is realised unless there is a corresponding improvement in the infrastructure needed for post-harvest handling operations.

4.3 PACKAGING

4.3.1 Timber-Traditionally, timber has been in use for making packing cases for the transport of apples in the States of Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh. An Indian Standard Specification* formulated in 1966 deals with suitable timber species, different sizes, designs and other general requirements of packing crates for apple. But unfortunately this is not being enforced and the different States are using varying sizes. In Himachal Pradesh, wood of fir and spruce are mostly in use for this purpose and in Jammu & Kashmir wood of poplar and willow are in use. In U.P., a variety of timber are utilised for this purpose. The performance requirements of boxes used for packing apples are (i) the boxes should be sufficiently strong to withstand handling during loading and unloading operations in the course of transportation and they should also be capable of resisting a load of upto two quintals (10 boxes of 20 kg. weight each) when stacked one over the other in trucks from the interior of hilly areas to the distant marketing places; (ii) the boxes should be rigid enough to retain the shape when filled with fruits during transportation by man and mules from orchards located in the interior to the areas of loading in trucks; (iii) the boxes should be waterproof and moisture resistant both from inside and outside and fit for keeping in the cold storage for a few months; (iv) the boxes should provide adequate ventilation as required; (v) boxes should not emit any smell or odour of their own and should not have any toxic effects which may contaminate the fruits; and (vi) the boxes should provide protection against pilferage during the transportation. According to experience in Himachal Pradesh about 50 boxes and according to J & K about 70 boxes can be made from 1 cubic meter of wood. To pack one ton of apple about 52 boxes each holding 18 kg. of fruits are required. It has been estimated that the requirement of wood for packing apples alone by the year 2000 will be of about 13 lakh m^3. It is obvious that the demand of wood for packing of apples

*I.S. Specification for wooden boxes for packaging apples I.s.3728: 1966 Indian Standard Institution, New Delhi.

will outstrip the total production of suitable timber in the concerned area in the immediate future. Use of timber for packaging apples and other fruits has several implications which merit careful consideration.

4.3.2. The magnitude and importance of the problem has come to be well appreciated even earlier. For instance, the National Committee on the Development of Backward Areas (Sivaraman Committee) in its report on "Development of Backward Hill Areas" has observed as under"

> "Horticulture (Himachal Pradesh is an example) is becoming very popular in this region. Care will have to be taken that this important economy for the development of hill areas does not result in degradation of environment and deforestation due to increasing demand of boxes for packing cases.....Alternative packing would have to be introduced. Steps would also have to be taken to ensure that it is made obligatory to replant the forest areas from where trees have been felled to pack fruits. While it is doubtful if orchard owners would genuinely take steps to replant the forest areas from where trees have been felled to pack the fruits, yet efforts should continue to be made in that direction, the more important steps to eliminate the deforestation to meet the demand of packing would be the introduction of alternative packing material like hard-board. The Forest Research Institute has carried out a number of experiment by using forest produce like pine needles etc., for the manufacture of hard board. Alternative packing material would have to be persuaded vigourously if the expanding demand of boxes for packing is to be met, without large scale deforestation".

4.3.3 Finding alternative source for packing fruits would be particularly important since timber is also needed for packaging other low volume high value products involved in the country's export effort, where substitute packaging will not be acceptable. From the point of national interest, therefore, there appears to be a very strong case for reducing the quantum of wood used for apple packaging and for funding substitute material for this purpose.

4.3.4 Pine Needle Hard Board - Packing boxes made out of pine needle hard boards appear to hold good promise. This needs to be given a fair trial and encouragement. A complete technology for the production of suitable fibre board from pine needles for conversion into packing boxes has been successfully developed in our country by RRL, Jammu and Forest Research Institute, Dehradun. This process can be exploited to full advantage. A portion of the fallen needles (say 20-30 percent) could be collected and utilised. How much of the fallen needles from a hectare could be safely removed without leading to site deterioration, needs to be critically looked into by appropriate research investigations. It is expected that the State Forest Departments concerned should give positive encouragement to the utilisation of pine needles for making fibre boards, because in the ultimate analysis, this would help to cut down on the demand of wood for making fruit boxes. Presently, fallen pine needles (it is estimated that about 3 tons will be available in a hectare) does not serve as a raw material for any industry. The price of a box made out of pine needle hard board capable of holding about 20 kg. of fruits has been worked out to be Rs. 8.50 and this compares favourably with that of wooden crates of same capacity which could cost about Rs. 12/- if the subsidy that is presently available in some States is taken into account. It would, therefore, appear desirable this compares favourably with that of wooden crates of same capacity which would cost about Rs. 12/- if the subsidy that is presently available in some States is taken into account. It would, therefore, appear desirable

that in the first instance the State Horticulture Department of Jammu & Kashmir or Himachal Pradesh in collaboration with the State Forest Department and the Regional Research Laboratory, Jammu, should set up a 3-ton unit in the J & K State to manufacture boxes with pine needle hard boards and bring them into use. Similarly in the State of Himachal Pradesh also the Horticultural Department or HPMC in collaboration with the Forest Department and RRL Jammu should set up a 3-ton unit. Later a network of such units can come up if and when the use of these boxes becomes widely acceptable.

4.3.5 It may be mentioned in this context that the machinery needed and the technology involved in the manufacture of pine needle hard board are fairly simple. An earlier attempt made by the Himachal Pradesh Forest Department in collaboration with RRL, Jammu, to set up a unit in Himachal Pradesh was found not quite successful presumably because of operational/logistic constraints. But the fact that good quality boxes of pine needle hard board have been produced by the Forest Research Institute, Dehradun, and the Regional Research Laboratory, Jammu, gives us the confidence that efforts in this direction should be successful if pursued with vigour. What seems necessary or crucial is careful planning and management, both technical and financial.

4.3.6 Corrugated Fibre Board Cartons - One other alternative that can be explored profitably is the possible use of corrugated fibre board cartons. The advantage claimed for this type of carton are lighter weight, lesser bruising on the fruits, controlled ventilation, pilfer proof nature, easier handling and the possibilities of reaycling. By using these, the demand for timber for packing cases perhaps, could be reduced to one third or half the quantity needed by traditional wooden crates. However, these are more expensive than the wooden crates particularly when the latter is subsidised by the Government as in H.P. It has been already recommended by the Expert Group on Perishable Agricultural Commodities that these boxes can be made comparable in cost to wooden boxes if the State and Central Excise duties levied on them which accounts for more than 50% of the cost, are waived. Another aspect to be considered in this connection is the level of sophistication in technology that is required, i.e. whether it has to be imported and also whether it is possible to set up these corrugated fibre board factories (one or more) in the apple growing States so that the local people can benefit from the enhanced employment opportunities.

4.3.7. The Group on Perishable Agricultural Commodities has suggested that the institutional arrangement for promoting research on post harvest horticulture should include the following objectives:

"(i) Screen varieties of fruits, vegetables and flowers showing different maturity periods and having better shelf life under ambient conditions.

(ii) Evolve basic package of practices oriented to producer's level.

(iii) Establish Central Packing Houses for purposes of operational research.

(iv) Develop cheaper and durable substitutes for packaging to minimise damage during transit, storage and marketing.

(v) Evolve energy saving storage structure based on evaporative of desert cooling system and find optimum storage period for different commodities.

(vi) Develop suitable post-harvest treatments of perishables with existing and new fungicides, wax coatings etc. to minimise wastage and retain freshness.

(vii) Find out efficacy of rail and road transport for individual crops and recommend suitable modifications to minimise losses and retain better quality.

(viii) Standardise techniques for bulk storage and transit of fruit juices/concentrates. Use cheaper preservation techniques based on solar dehydration, pickling and chemical preservation for use at home and farms.

(ix) Utilise horticultural and processing wastes into value-added by-products viz. animal and poultry feeds.

(x) Develop appropriate technology/infrastructure for washing, pre-cooling, grading, packing, loading and unloading of perishables from nodal points in areas of production to terminal points in areas of distribution by available transport truck, rail or air

(xi) Provide demonstration and training to group of field workers/ villages communities on basic principles of fruit and vegetables management.

(xii) Provide suitable type of audio-visual aids, published material in simple language, for quick transfer of cheap technologies for management of fresh produce and its preservation."

4.3.8. As regards packaging, the Group on Perishable Agricultural Commodities has suggested as under:

"Packaging practices should be modified for different commodities with regard to size or structural design, mode of their stacking during transit and storage, providing proper cushioning to minimise

bruising damage..... Rationalisation of packages based on the biological requirement of the produce can go a long way to ensure better quality in perishables.

Rationalisation of packaging of fruit and vegetables can also be achieved by introducing 36 and 18 litre plastic returnable crates with collapsible modular sides. Research on different aspects like optimum ventilation, cushioning material, resistance to rough handling, etc. needs to be thoroughly studied."

4.4. FLOWERS

4.4.1 Another resource for which this area is deservedly famous but has been little exploited for economic purposes are flowers. Several lines of study need to be initiated. The most immediately relevant are listed below:

(a) Study on the storage life of locally available cut-flowers. This study will include flowers cut at different stages of their growth.

(b) The storage life of those flowers kept under different climatic conditions namely;

i) local conditions.
ii) tropical conditions.
iii) cool temperature and high humidity conditions.

(c) storage life under different gaseous atmosphere namely;

i) Nitrogen
ii) Carbon Dioxide in different concentration
iii) Oxygen

(d) Studies on the use of chemical preservatives and correlation on their influence on storage life.

(e) Study on the influence of packaging in locally available corrugated board packages which are exposed to the different climatic conditions indicated in (b) and (c) above.

(f) Study on the influence of transport conditions by the quickest mode of transport to the nearest major market.

The components of the study would involve obviously,

(a) Survey of world literature on research on the subject.

(b) Study of present trade practices.

(c) Study of marketing practices.

(d) Laboratory evaluation.

(e) Field experiments involving the kind of instrumentation necessary for transport simulation are not contemplated in the initial stages by the universities. Priorities in the research programmes may, therefore, take up the initial items of study which may not involve heavy investment of scientific and laboratory equipment.

4.5. RECOMMENDATIONS

4.5.1. Transportation of the produce, in time and in good condition, to the marketing/processing area forms a major bottleneck in the efficient exploitation of horticultural products in the Himalayan region. Many of the existing areas are poorly served by roads and the produce has to be often brought on mule back over long stratches (10 kms. or more) of hilly terrain. With more and more areas coming under these crops the position is likely to become worse. Careful consideration should, therefore, be given to the question as to how far further increases in the area under such crops should be encouraged if the produce cannot be brought to the market in an acceptable condition. With better management, it should be possible to increase the productivity of the plantations in the more accessible areas, it might then be advantageous to divert less accessible areas now under fuirt-trees to valuable forest species. Care would, however, be needed against indiscriminately extending a particular species (forests) or using limited number of genotypes of particular species (forest) into new areas. Such narrow genetic base could well result in the development of epidemics of diseases and pests, which could be difficult to control in an area of poor accessibility.

Research efforts need to be initiated in such areas as (1) orchard management for increased production, (2) development of a number of acceptable genotypes, and (3) identification of valuable tree species, which can be used to replant inaccessible fruit orchards etc.

4.5.2. Suitable Packaging - A major problem in the transportation of horticulture products is their bulk in relation to their value and the packing to be used assumes great importance. Care has to be taken that the fruits are not crushed, bruised or damaged in any way. Traditionally, timber species (such as poplar and willow in J & K, fir and spruce in Himachal Pradesh) have provided the material needed for such packaging. The increasing use of timber for packing cases has raised problems of availability as well as of possible irreversible ecological degradation. Timber is also needed for packaging low-value, high value material which are important for the export performance of the country. Every effort must be made to avoid as far as possible the use of valuable and scarce timber for packing fruits. Research is, therefore, needed to develop alternative packaging material. Some pioneering research has been initiated on this aspect by the Forest Research Institute, Dehradun and the Regional Research Laboratory, Jammu. Some applied research has also been made by the Indian Institute of Packaging. A number of alternatives appear to be available, such as corrugated card board, hard board made from pine needles, chip boards made from wood waste or from agricultural by-products such as straw (Annexure XXIII). Studies are urgently needed to examine the scope of utilising these alternative materials for packaging fruits, so that the demand for timber can be reduced, the available supply extended for longer period of time and its availability, for other purposes where its use cannot be avoided, ensured. While it may not be possible to switch over to one or more of the alternatives immediately or completely, the proper mix of packing crates made from wood and the other alternative materials needs to be encouraged.

4.5.3 Alternative Packaging Material - In deciding the most suitable alternative material for such packing, feasibility studies would have to be undertaken on various aspects of the problems such as suitability acceptability and economics of such substitution. Other important aspects of such substitution, such as shortterm as well as the long-term effects on the eco-system of the region, on the employment opportunities available to the people of the region as well as such factors as the need for installing sophisticated machinery or using scarce and expensive oil-based adhesives or other scarce material should be carefully looked into. The suitability of these alternatives from the point of view of meeting the standards laid down for safe transportation and maintenance of acceptable quality must be carefully assessed. Necessary administrative action or fiscal measures may be needed in some cases to make their substitution for wood competitive. Wood for packing apples is often available at subsidised rates while some of the substitutes are subjected to State and Central Excise duties which add substantially to their cost. For instance, corrugated fibre board cartons can become competitive vis-a-vis their wood based counterparts only after a waiver of duties currently levied.

4.5.4. Technology & Production of Packaging - From the point of view of increased employment opportunities for the people in the region, there would be obvious advantages if a network of small factories for the production of substitutes can be set up in the region itself. Here paper based corrugated boards, hard board made from processed pine needles, a raw material abundantly available in the region. etc. appear to have several advantages. Initial probing done by some research institutes/

agencies existing in the country has led to the development of a technology, appropriate in scale and sophistication. This technology will allow the establishment of a number of such production centres scattered throughout the area. It is recommended that feasibility studies should be taken up immediately by the Development Corporations of the concerned States in collaboration with the Universities in the region and other agencies to set up pilot plants of appropriate size. Little definite information appears to be available regarding the possible ecological effects of removing the pine needle from the forest floor or as to the quantum of the material which can be removed without adversely affecting the ecosystem. Market acceptability of such material also would have to be researched into. There is great need for assessing these and related aspects by appropriate research by the universities and other institutions in the region.

4.5.5. Quality Factors in Transit - This report has concerned itself mainly with the transport of fruits to the primary marketing centres from production areas. Even here, considerable research is still needed on different aspects of transport of fruits to the marketing centres from production areas such as optimum ventilation, cushioning material to reduce bruising, bursting of package and load bearing strength and resistance to rough handling etc., pertaining to various systems of packaging of fruits. Physiological changes occurring in the different types of packs also need to be studied in depth and understood thoroughly. There are possibilities of differential response of varieties to such stresses and these differences need to be carefully evaluated.

4.5.6. Once the fruits have reached the main assembling marketing centres with access to rail transport, the requirements of these products will be the same as for other perishable commodities. These requirements, particularly conccerning transportation by rail and storage has been examined in depth by the Expert Group on Perishable Agricultural Commodities, headed by Dr. M.S. Swaminathan. We endorse the recommendations (extracts of which are at Annexure (XXIV) made by this Expert Group and urge their full implementation.

4.5.7. Grading - Equally important as packing is the careful grading of the produce for quality, if the grower expects to receive the highest returns for his produce. Some information is already available on the grading requirements of apples. Some of the States like Himachal Pradesh and J & K have already introduced grading to some extent. Proper training, particularly training rural women, can contribute to better grading and handling of the produce, besides enhancing the employment opportunities. Much is still to be learnt about the proper methods of harvesting and grading the produce before it can be packed. It is recommended that studies should be initiated on these aspects as early as possible.

4.5.8. Shelf Life - Greater attention is also needed to study the possibilities of increasing the shelf-life of the harvested produce. Varietal differences are known to exist in respect of 'keeping quality'. It may be feasible to breed in better 'keeping quality' into popular high yielding varieties which presently lack it. It should also be possible to develop simple but effective pre-treatment methods which could slow down the ripening process thereby lengthening the shelf life (Annexure XXV). It is recommended that research efforts needed in these directions be initiated in the universities in the region.

4.5.9 Utilisation of Non-marketable Fruit - Methods for utilising profitably as much as possible of the total production need to be given

full consideration. As has been discussed earlier, an appreciable portion of the production does not often reach even the primary centres of assembling. With the implementation of the recommendations for strict grading of produce to be exported outside the producing States, additional quantities of fruit will be left unutilised.

4.5.10 Even with the current production, it has been estimated that 30-50% of the horticultural produce is left ungathered in the orchards because the return obtained is so low that the growers do not care to collect the produce. Attempts could be made to use such fruit for animal feed. The departments of animal husbandry and horticulture in the States should develop a suitable action programme for this. Research may be needed to develop simple methods of processing which would permit such feeding either immediately or after storage in the lean period.

4.5.11 Processing Technology - Fruits of sound quality which have reached the assembly centres but do not fully satisfy the grading criteria for use as whole fruits should be processed as pulp, concentrates, juices and squashes, jams, jellies, etc. Preliminary steps seem to have already been initiated both by private and public enterprises in this behalf. Problems particularly relating to packaging and transporting of such products appear to need solution if such practices are to become more widely adopted.

4.5.12 Established methods such as canning, freezing or dehydration used for preservation of perishable commodities would appear to hold little promise in view of the high costs and energy - intensive nature. It may be possible to improve the cost effectiveness of such processes by integrating biomass, solar and other renewable energy sources available in the area with micro hydro systems. There is a felt need for further research into such integrated energy producing systems in the region. Establishment of pilot projects are reported to be under consideration in some parts of the Himalayan region. Several indigenous techniques are known traditionally, however, these need to be upgraded and developed. For instance, many fruits and vegetables can be preserved by using heat derived directly or indirectly from the sun. Studies are needed to maximise the efficiency of such processes. In depth studies for low-cost drying and selection of cheap packaging material for dried products should be carried out to facilitate marketing quality produce. For drying of fruit/vegetables on a large scale, use of black surface or black polythene can be encouraged for maximum absorption of heat radiation. Simple methods of keeping the articles free from dust, insects and other contaminants during processing have to be worked out. Pre-treatment may help considerably in reducing the time taken as well as in improving the quality of the end product. It may also be possible to develop effective but cheap method of packing which can increase the shelf-life and acceptability of such processed foods. All these possibilities should be looked into and appropriate research initiated.

4.5.13 In the eastern parts of this region fruits such as pine-apples, citrus, bananas, constitute the major horticultural products. In recent times, apple has been reportedly added to this list. There appears to be tremendous potential for increasing the productivity of all these crops. But the major problem that has to be faced and indeed is already being felt is that of marketing the produce. The loss in transit of pineapple has, for example, been estimated to be about 30 per cent of the harvest. Little information seems to be available as to how the marketability of this product can be enhanced. Studies into such methods as well as newer techniques of processing suitable for this region needs to be taken up.

4.5.14 The following recommendations of the "Expert Group on Perishable Agricultural Commodities" in this context are significant:

> "Most of the States in the North-Eastern India have rich potential for production of fruits and vegetables. Pineapple is produced in abundance in these areas. But of total production of about 2 lakh tonnes in these States only 13 per cent is exported and 1 per cent consumed by processing industry in the region while the rest of 86 per cent has to be absorbed within the region which is not possible. Hence much goes to waste. It is reported that one village in Tripura had to send down the river 2 lakh pineapple which becomes a gift to the 'fish of Bangladesh'. Due to the lack of transport arrangements the cost of marketing and processing becomes uneconomical. In order to enable the farmers to obtain remunerative prices as well as to develop integrated system of production, processing and marketing, a proposal has been mooted to set up an Apex agency called North-Eastern Regional Agricultural Marketing Corporation with its headquarters at Shillong. Early steps should be taken to set up this Corporation. The recommendation of the Central Task Force on Horticultural Development in Assam should be fully implemented. Also a detailed project for setting up a processing complex in the North-East Region proposed already should be implemented early. It was reported that the Government had already requested the Modern Bakeries, a Public Sector Undertaking, to set up a fruit and vegetable processing unit in the North-Eastern Region. Adequate funds should be provided to the Modern Bakeries for setting up this unit as well as additional unit in a phased manner to take care of the marketable surpluses."

4.5.15 Pending the development of such techniques and suitable infrastructure for efficient processing and marketing, the advisability of further extending the area under such crops should be carefully evaluated. In the alternative, it should be investigated whether it is possible to introduce in this region some perennials whose end products are less bulky and easier to transport and/or need less processing. Practices such as planting extensive contigous areas to one or two genotypes could prove risky becauseof possible epidemics. Introduction of new crops into any area should be preceded by careful research of the effects of such introduction on the ecology of the area as well as on the life style of the local people, particularly in respect of nutrition. Research on such aspects should be taken up by the universities and other research institutions in the area.

4.5.16 Flowers - Flowers (as cut flowers) have good export possibilities and need consideration. The major bottleneck in exploiting these is the lack of suitable packaging technology. Not much work has been done in this direction. The universities in this region may take up the responsibility of identifying varieties of flowers suitable for use as cut flowers, maximising their storage life and the development of packaging methods. These institutions can initiate research investigations in collaboration with the Indian Institute of Packaging, Bombay. Regional field stations could be set up at different places in the region for field testing such packaging procedures. This would help in imparting training to the local people and at the same time help to develop packaging technology suited to local conditions.

4.5.17 Forest Wealth - The constraints on the exploitation of forest wealth based on considerations of eco-system preservation have been recognised and generally implemented by the Forest Departments. Post

harvest handling of timber needs more attention by Forest Department. In the interest of long-term planning for conservation, it would appear desirable to look into the possibility of developing post harvest handling procedures (such as for instance seasoning) which may ensure efficient utilisation and also increase the sale value of the product. Different species may need different handling methods. Such treatment may also help to extend the period over which the material can be used and contribute to lessening of the demand for such timber.

During the process of conversion of timber into various products considerable quantity of by-products such as saw dust accumulates. These are generally used as fuel as such. It has been shown that its efficiency as fuel could be enhanced by the process of briquetting. Development of suitable mobile briquetting machines should be given high priority so that this helps in the efficient utilisation of saw dust and other by-products.

It is known that there are some timber species that are widely sought after but are of relatively low occurrence. In the Western Himalayas Betula alnodes Carpinus species, Juglans regia and Cornus species belong to this category. Similarly we have in the eastern Himalayas Betula cylindrostachys, Acer Campbellii, Michelia doltsopa. All these species would appear to warrant special attention. Research should be undertaken to obtain further information on the extent of their occurrence, possible management needed to increase their availability, determination of wood properties of these species harvested from different environments and developing appropriate post harvest handling procedures so as to ensure that deterioration in quality does not set in.

CHAPTER V

TRANSPORT PLANNING

5.1 INTRODUCTION

5.1.1 Transportation net-work represents the life-line for the socio-economic development of any country, region or town. With the rapid increase in population and socio-economic activities in the country, the role of the transportation system has assumed added significance. Several modes of transport are available, but in hilly areas, because of the topography and other physical features, roads remain the only mode of transport in most of the situations.

5.1.2 During the past 20 years or so, large scale construction of roads has been taken up in the Himalayan region both by the Border Roads Organisation and other road construction agencies like the State PWDs etc. While significant progress has been achieved in providing an extensive net-work of roads, serious ecological disturbances have also been caused by the road construction activities. The major negative effects have been the destabilisation of hill slopes due to earth cutting and rock blasting triggering off massive landslides and soil erosion due to denudation and leaving the denuded slopes untreated. Clogging and blockage of natural streams, reservoirs, lakes and consequent damage to agricultural fields, orchards, forest resources etc. have been caused by landslides and the debris thrown down valley slopes.

5.1.3 Several agencies like Border Roads Organisation, Director General Roads Development (MOT), Central Roads Research Institute (CRRI), Geological Survey of India (GSI) have examined the various aspects of the problem during the past many years. Seminars and conferences have been organised and useful exchange of information and ideas have taken place. This has enabled the executives on the ground to identify the problems connected with ecological imbalance and provide guidelines for tackling the problem. Director General Roads Development, MOT, has issued guidelines and check-list to all State Chief Engineers for combating the problem of soil erosion. The road construction agencies have also been seeking the advice of specialist organisations like C.R.R.I., G.S.I.etc. for implementing measures for correction of unstable slopes, landslide/erosion prone areas etc.

5.1.4 However, the present procedure and existing arrangements for tackling the problems have not been found to be quite effective and have not always afforded statisfactory solution. There is need for a coordinated approach in tackling the complex problem of ecological imbalance by Engineers, Geologists and Soil Conservation/Forest Scientists and other research bodies with the backing of suitable infrastructure for evolving an integrated solution.

5.1.5 This report aims at examining the problems involved and suggesting the mathodology for minimising ecological disturbances caused by road construction activity in the Himalayan Region.

5.1.6 The main thrust of the recommendations of this Report is basically on the measures required to be taken to minimise the ecological disturbances while taking up road construction in the Himalayan Region. The Report also considered the recommendations of the National Committee on Backward Areas pertaining to the hill areas.

5.2 NATURE AND EXTENT OF THE PROBLEM

5.2.1 As is usual for a developing country and for strategical reasons, speed of construction has been one of the main considerations in road construction activity in the Himalayan Region. Due to this concern for speed in the completion of the roads, quite often, the most important and intricate problem of selection of road alignment through reconnaissance and survey has not received the attention it deserves. This has resulted at times in the alignment having been routed through unstable strata, fault/slip zones and also over unconsolidated mass of maraine deposits. Frequent landslides have been occuring on the hill roads every monsoon and sometimes stretches of road get washed away and new alignments have to be chosen.

5.2.2 During the process of road construction, often large scale blasting in hard rock formation has been resorted to. This has weakened and destabilised the rock formation by opening up cleavage planes and fissures and joints in rock faces over long distances. The blasted rock when pushed down the slope with heavy machines, forms gullies on the slopes and destroys the vegetative cover and often damages the cultivated land below.

5.2.3 Heavy earth cutting in steep slopes by machines and pushing down the spoil and debris, not only create unstable denuded slopes above the road, but also destroy the plant cover of the valley slopes leaving scars, damage the cultivated lands, orchards etc. and ultimately adds to the blockage of natural streams, causing the siltation of reservoirs, lakes etc. and thus interfering with natural drainage.

5.2.4 Large scale cutting of trees and denuding vegetative cover coupled with inadequate stabilising measures after cutting the road formation, causes extensive erosion and seepage of soil during the rains which not noly create destabilising effect in the environs, but also add to the silting up of natural streams and channels. This is a major factor causing ecological imbalance.

5.2.5 Due to considerations of economy and concern for speedy completion of the road, the ground engineers of the road construction organisations have a tendency to restrict stabilisation measures, drainage and protective structures to meet the immediate requirement of completion of the road and tend to overlook the importance of providing such measures extensively for the stability of the affected area as a whole which is necessary for ensuring ecological balance.

5.2.6 Another important factor has been the large-scale cutting of trees and uprooting the same for construction of road structures, roadside accommodation and fuel for conservancy purposes and heating of bitumen for black topping works. To reduce the effects of such deforestation, use of alternative prefabricated structures for camps should be resorted to. Similarly, utilising bitumen emulsion for cold mix carpet, should be encouraged.

5.2.7 Apart from these technical problems set in motion by the process of road construction, certain socio-economic and political problems have also to be contended with. Indiscriminate felling of trees by local villagers/forest contractors and hurtling down huge tree-logs down the hill slopes cause considerable disturbance to the hill slopes, dislocating natural water channels and damaging the road structures. Another factor which disturbs the environ causing erosion of slopes and denudation of grass plant cover is cattle grazing. Shifting Jhoom cultivation in the hill areas by tribal population by cutting trees, plants and shrubs, often near the road side, also creates significant disturbance to the natural state of equilibrium of the hill-slopes. In many cases, the local population practise terraced paddy cultivation or fish farming by impounding rain water above the road formation, which is a potential factor for creating imbalance/instability of hill slopes in the lower regions.

5.2.8 There are instances when the road construction engineer/contractor is subject to pressures from interested influential quarters for changing the road alignment or compromising the geometrics to connect a particular village or location. Such demands are often made for local considerations without regard to the eco-development or the ultimate utility of the area as a whole.

5.2.9 The problems highlighted above have been associated with every phase of road construction activity and by their very nature are not susceptible to measurement in many cases. In certain other cases, adequate statistical data have not been available for assessing the quantum of the problem involved. However, C.R.R.I. has estimated that landslides and soil erosion associated with road construction activities may contribute 22 to 45 million Cu.ft. of silt annually to the Himalayan rivers.

5.3 TECHNOLOGY AVAILABLE FOR CONSTRUCTION OF ROADS IN THE HILL AREAS.

5.2.1 The road building organisations like Border Roads Organisation and State PWDs have been engaged in road construction in the hills for the past few decades and have gained adequate experience and expertise in the field. They have also been consulting specialist organisations and research bodies like Central Roads Research Institute, Geological Survey or India, etc. for finding solutions to major or intricate problems faced by them e.g. corrective measures for unstable strata, control measures for landslides etc.

5.3.2 As early as in March 1969, a National Seminar had been organised under the aeigies of the Boarder Roads Organisation at New Delhi, to study in depth, the problem of soil erosion and stabilisation of hill slopes and evolve solutions. Eminent engineers and scientists from premier road construction organisations and Research Institutions, Universities, Technical Institutes and Forest Departments participated in the Seminar. Exchange of information and ideas based on experience gained on ground proved very useful. The recommendations of the Seminar are enclosed at Annexure XXVI Broadly the Seminar recommended:

(i) Prevention of soil erosion and stabilisation of hill slopes called for coordinated approach, integrated solutions and agreed arrangements for implementation between Engineers, Geologists, Forest/Soil Conservation Scientists. This coordinated approach should be incorporated in a hill road project right from its inception.

(ii) A 3-tier infrastructure at the level of road construction organisation, specialist/research bodies and at National level for ensuring such coordinated approach was envisaged.

(iii) Augmentation of photogrammetric facilities, particularly with regard to the interpretation of air photos for selection of alignments and the need for the setting up of a photogrammetry study cell at the Centre.

(iv) Coordinated research should be organised to develop further, soil mechanics/rock mechanics to analyse instability and failure of slopes, study on the control of combined phenomenon of slides and avalanches and the suitability of various plants, shrubs, grasses etc. for various terrain conditions, climate and altitude.

5.3.3. A symposium on landslides and Erosion problems with special reference to the Himalayan Region was organised by the Indian Society of Engineering Geology in February 1975 in Sikkim, Border Roads Organisation and Central Water Commission were Co-sponsors. The recommendations of the Seminar are enclosed at Annexure XXVII.

5.3.4 Broadly, the seminar recommended:-

(i) Temporary and permanent measures to solve the landslide problems should be identified. Temporary measures would be limited to opening of the traffic for communication, while for permanent measures, detailed investigations should be undertaken to evolve permanent solutions. Long term studies to control the landslides effectively are needed.

(ii) The type of failure of slope and occurrence of landslides and toe erosion should be diagnosed, codified and published.

(iii) A joint land slide authority should be established at the Centre consisting of scientists from Forest, Soil Conservation, Horticulture and Agriculture, Irrigation and Hydel, Geological Survey of India, CRRI, Border Roads Organisation, CPWD, CWC, etc. The agency should take up studies of the most vulnerable areas in a concerted manner with all specialists in different connected disciplines of knowledge.

5.3.5 An International Symposium on landslides was organised in New Delhi in April 1980 by the Central Road Research Institute under the co-sponsorship of Ministry of Shipping & Transport, Department of Science & Technology, Indian Roads, Congress, Institution of Engineers, Border Roads Organisation, Central Building Research Institute etc. The recommendations of the symposium are enclosed at Annexure XXVIII.

5.3.6 These seminars provided forum for inter-disciplinary interchange of ideas/information and stressed the need for cooperative endeavour between research bodies and practising highway engineers in solving the complex problem of landslides and other mass movements, to correct the ecological imbalance in the Hill regions.

5.3.7 From an analysis of the main factors contributing to ecological disturbance resulting from road construction activities, it would be evident that the technique of selection of road alignment needs proper care and monitoring. Adequate guidelines and instructions have been issued by road construction organisations to the executives on ground regarding the technique and the drill to be followed in selecting the most suitable and technically sound alignment.

5.3.8 The guidelines for selection of alignment are:

(i) "Lay of the land" be followed as far as possible.

(ii) Heavy cutting/filling be avoided. As far as possible the technology of "cut and fill" method is to be adopted. Steep hill slopes to be also avoided.

(iii) Unstable/slide-prone areas to be avoided. For identifying such areas the advice of geotechnical engineers and geologists to be taken during the survey for selection of alignment.

(iv) A comparison of various possible alignments with reference to erosion potential be made and the alignment involving minimum erosion risks be preferred.

5.3.9 Apart from the stage of planning the road alignment, effective steps are also required to be taken by ground engineers, during the process of road construction for minimising ecological disturbance to the hill roads. Broadly the measures to be taken have been identified as:

(i) 'Cut and fill' method to be adopted while excavating for road formation and heavy earth cutting is to be avoided. Box cutting is to be avoided to the extent possible.

(ii) Blasting by explosives is to be restricted to the minimum. Lay-out of holes to be drilled for blasting is to be planned keeping in view the line of least resistance and the existence of joints Controlled blasting should be resorted to by using low charge and care be taken to avoid activating slide zones or widening fissures and cracks in rock. Use of delay detonators in large scale blasting work is to be made for enabling dispersion of shock waves, so that minimum disturbance is caused to the rock stratum as a result of the blasting process.

(iii) All cut slopes, unstable hill slopes and slide prone/erosion prone areas are to be provided with suitable correction measure by using one or the other of the techniques developed by CRRI. Several techniques have been sponsored by CRRI like simple vegetative turfing, bitumen mulch treatment and slope treatment by jute netting/coir netting. Of these, simple vegetative turfing seems to be the most appropriate preventive measures in many situations. This should be established on the denuded slopes immediately after the excavation is made. Summary of the recommendations of CRRI."Practical Lessons in Landslide Conversion" are enclosed at Annexure XXIX. The detailed specification of Bitumen mulch treatment and slope treatment by jute netting/coir netting are enclosed at Annexure XXX.

(iv) Adequate drainage measures and protective structures like intercepting catch water drains, longitudinal drains, cross drains/culverts, breast Walls, Retaining Walls and toe Walls are provided for purposes of stabilising the slopes. Growth of vegetative cover is stimulated in the disturbed hill slopes above the road level by planting suitable fast-growing shrubs and plants. In certain selected unstable areas, terraced afforestation has also been practised as a stabilsing measure,with good results.

5.3.10 Over the past few years the Roads Wing of the Ministry of Shipping and Transport has issued instructions laying down broad guidelines and check-list of the preparation of road construction projects, which provide an inbuilt mechanism for tackling landslides/erosion control for the gui-

dance and follow up action by engineers of State PWDs, Border Roads Organisation and others engaged on construction of hill roads. Instructions issued by DG Roads Development MOT are enclosed at Annexure XXXI.

5.3.11 The concerned road construction organisations have developed effective know how and expertise for solving most of the problems discussed in the preceeding paragraphs and adequate technology and technical capabilities are available in the country. Technical instructions and specification have been laid down by IRC,MOT (Roads Wing) and DGBR regarding selection of alignment, geometrics, standards and other specifications keeping in view economical and technical considerations. For tackling complex problems, the advice of specialist organisations especially, the CRRI and GSI have been obtained and implemented with satisfactory results. Another sphere where extensive use of available technology has not been made is in the treatment of cut/denuded slopes with vegetative cover and afforestation measures by the road-side. Inspite of the Instructions it is felt that the ground Engineers are not adequately aware of these important aspects. Training & refresher courses at all levels in the field is therefore very necessary. Non-availability of expert advice about the most suitable type of plants/ shrubs for particular terrain, climate and altitude conditions and the non-existence of a nursery of such plants nearby is another contributory factor. The financial implication involved has also been an inhibiting factor.

5.4 SUGGESTIONS FOR SOLVING THE PROBLEMS

5.4.1 Technical

5.4.2 The technical considerations to be kept in view in order to minimise ecological disturbances on account of road construction activities in the Himalayan regions are:

(i) Transportation planning.

(ii) Environmental considerations.

(iii) Route selection and location of road.

(iv) Design and specification of road.

(v) Drainage and afforestation and conservation measures during road construction.

(vi) Road maintenance activities.

5.4.3 Transportation planning.

Road construction in the hills invariably affects the natural setting, and the environment. The adverse effects could be limited to the minimum through proper planning and by integrating suitable remedial measures into the project itself. Considering this together with the fact that hill roads are rather expensive to construct, the road communication net work should be kept at an optimum extent only. All road construction in the hills should therefore be coordinated on the basis of a Master Plan of the district concerned which should indicate the population centres, the existing road net work, the pockets of present and proposed further economic activity etc. It should be one of the positive aims of road construction in the districts to provide feeder roads from the present and potential areas of production to the main roads. If these feeder roads are not provided, an important potential will remain undeveloped. These feeder roads will be

adequate if they provide for jeeps and metadors which will carry produce to the main transport links. Properly conceived, these feeder roads can be constructed at comparatively low cost. Construction of ropeways may also be considered wherever found feasible. New roads should be fully integrated with the existing road network and should connect the maximum number of villages as well as the present and proposed centres of economic activity. All road construction activities in a particular district should be coordinated through one agency which should be established both at the State level and at the Centre.

It is not possible to give road connection to all villages. The concept of giving connection to a cluster of villages through an all-weather motorable road is more practicable. The other villages could be connected to the roadhead through bridle paths, bridle bridges, foot tracks, feeder roads or jeepable roads as feasible.

5.4.4 Environmental considerations:

Highway planning should not only take into account consideration of economy and technical advances but should pay due regard to environmental considerations. What is required is an integrated approach at the planning, design and implementing stages of the highway projects which should ensure that environmental deterioration does not occur. Unless this aspect is given due attention during the planning and the construction of a road network, environmental degradation such as noise, air pollution, safety hazards, aesthetic deterioration and ecological disturbances are apt to continue.

5.4.5 Selection of route and road location:

The main consideration should be that the road should cause the least disturbance to the natural setting while at the same time satisfying the requirements of the obligatory and control points. This would require the road to be as direct as possible and follow the lie of the land, avoid geological unstable areas such as dipping or faulted rocky faces or areas prone to landslides. Areas requiring large scale destruction of vegetation and forestry should also be avoided. Least disturbance should be caused to local settlements and property/agricultural lands, orchards, etc. The IRC Manual for Survey, investigation and preparation of road projects lays down guiding principles governing route selection and highway location. Relevant extract enclosed at Annexure XXXII. This should be followed as far as possible while selecting the routes and location of hill road.

It would be preferable to consult geological maps of the area or to associate a geologist in alignment selection so that problematic areas are avoided. It would also be advisable to associate the Forest Department in alignment selection and in the formulation of afforestation measures.

5.4.6 Design and specifications.

Guidelines on the alignment survey and geometric design of hill roads are contained in the IRC Standard No.52:1981 "Recommendations about the alignment Survey and Geometric Design of Hill Roads" (under revision). This standard describes the road location and alignment survey procedures besides laying down the geometric design standards such as roadway/carriageway widths, design speeds, sight distance, curvature, gradients etc. for different classes of roads from National Highways to village roads. The design and specifications to be adopted by construction agencies other than Border Roads Organisation, PWDs etc. should be coordinated by one single agency at State level and also at Centre level. Such roads should generally conform to the standards laid down by IRC so that part of the

road developed by such agencies, can be integrated with new roads under construction by Border Roads Organisation/PWD, if considered expedient.

For hill roads, stage construction may be practised in respect of the width or thickness of pavement or the type of cross-drainage/protection structures; but all activities pertaining to control of soil erosion or drainage must be taken up in the first stage itself. The practice of making formation cuts and leaving these for years together without any erosion control measures is deprecated.

When a road is approved for construction, there should be a commitment to provide the required funds year to year till its completion according to the schedule. This will avoid the problem of leaving a work half-way without providing the necessary protection works. Similarly, funds should be provided for maintenance.

5.4.7 Drainage and afforestation measures during road construction.

The following important considerations should be kept in mind for implementation during the construction of a hill road:

(i) Cut and fill technology should be adopted as this involves the least disturbance to the natural ground.

(ii) Heavy blasting of rock should be avoided but controlled blasting using a low charge should be resorted to. Holes for blasting should be chosen keeping in view the line of least resistance taking care not to open up cleavage planes, joints and fissures of rock mass.

(iii) Cut slope should be rendered stable in the construction stage itself by resorting to cutting at correct angle and "benching" etc. including slope-stabilising structures like breast walls, pitching etc. Funds should be provided in the project estimates for the treatment of unstable areas say 50 mm above and 30 mm below the road formation depending on site conditions. This may be in the form of a certain percentage of the total cost based on some assessment of treatment works possibly needed.

iv) Excavated material should not be thrown haphazardly but dumped duly dressed up in a suitable form at selected places so that it may not be washed away by rain. Such spoil deposits may be allowed to be turfed if necessary.

(v) Road formation after excavation should be provided with adequate protective works without delay.

(vi) The location and alignment of culverts should be so chosen as to avoid severe erosion at the outlet and siltation at the inlet. The cross drainage structures should discharge safely on the valley side and to safeguard against discharging water causing erosion, necessary channel-training and erosion-control works like pitching/paving of the channel at outfall points, drop walls, apron etc. should be provided.

(vii) Drainage of water from the road side be given top attention and necessary system of drains constructed to lead the run off of the natural water courses. In particular, suitable intercepting and catchwater drains be provided above the cut slopes for speedy and safe disposal of rain water. These

drains should have gentle gradients and side slopes to carry flow without erosion.

(viii) Vegetative cover should be immediately established on all cut/fill slopes. The activity of establishing vegetation on barren slopes be treated as part of the construction/maintenance operations on all hill roads. Strip forests, suitable for the site conditions, for a minimum distance of 30m on either side of the road be created. This should be raised and maintained by Forest authorities. No felling except dead or dying trees be permitted in this area. Afforestation of road side land be carried out to a sufficient distance on either side of road. "Plant species" be selected depending upon climate, altitude and soil condition with the advice of soil conservation department or forest department officials.

5.4.8 Road Maintenance activities:

Besides normal maintenance of the road pavement, attention should be paid to the following aspects:-

(i) Prompt removal of debris blocking the road because of landslides or other reason.

(ii) Eroded areas should be promptly made up and provided with vegetative cover.

(iii) Drains, catch pits etc. should be cleared of all debris and repaired where necessary before the onset of the rainy season.

(iv) Adequate funds for maintenance activities and construction works should be provided for.

5.4.9 Funds must be provided for complete and full jobs including maintenance.

5.5 Infrastructural facilities:

5.5.1 For combating the highly complex problem of prevention of soil erosion and stabilising hill slopes, a coordinated approach for evolving integrated solution on the part of Engineers, Geologists and Forest Soil Conservation Scientists is necessary. For this a 3-tier infrastructure as under, is recommended:

(i) A premier Road Construction organisation should have its own set up of geotechnical specialists, forest/soil conservation scientists to facilitate evolving integrated solutions to normal problems at the various stages i.e. recce survey for selection of alignment, protection measures and treatment of unstable areas/slide prone or sinking areas and for afforestation measures. Such experts would also be helpful in maintaining proper liaison with specialist Research bodies. These specialists may be taken from the Specialist Organisations.

(ii) Collaboration with specialist research bodies like CRRI, GSI, Forest Survey Institute, Forest and Soil Conservation Research Institute etc. should be available for solving special and complex problems like damages caused by major landslides, soil erosion etc. They should be helpful in involving new techniques for resolving such complex problems. A speedy arrangement should

be worked out so that the specialists can undertake the study of a problem referred to them by the road construction organization without having to wait for completing formalities of acceptance of cost etc. The coordination of such activities should be organised by a cell to be established at CRRI, where all such problems can be referred to by the concerned Road Construction agencies.

The major functions of this Cell will be to identify common recurring problems and develop solutions for them in collaboration with other research organisations.

It may be clarified that this mechanism does not preclude the implementing agencies from referring problems directly to specialised institutions/universities.

(iii) A Standing Committee should be set up at the National Level for laying down policy and guidelines for ensuring eco-development of hill regions. The Committee is recommended to be established at the Planning Commission level with representatives drawn from the Ministries of Transport, Education, Energy, Steel & Mines, Agriculture & Irrigation and experts/specialists from IRC, DGBR, CRRI, FRI, GSI, CWC, Department of Environment. Forest Development Corporation, National Environmental Engineering Research Institute, Vice Chancellors of Hill Universities and Forest Survey Institute, Central Soil Conservation Institute, E-in-C's, concerned PWDs. Charter of duties for this committee should include:

(a) Laying down policy regarding transport planning both at Centre and State levels;

(b) Measures required for coordination of road construction activities at National level;

(c) Identifying urgent and complex problem areas creating ecological disturbances and sponsoring research schemes and projects for tackling such problems. Funding of such research schemes and projects should also come within the purview of this committee;

(d) Laying down guidelines for ensuring an integrated approach for preventing environmental deterioration and pollution and preserving the aesthetic balance of the surroundings and laying down policies for the implementation of eco-development measures;

(e) Creating an awareness for ecology by having suitable seminars, training programmes etc. organised by the Central Road Research Institute with the association of FRI, Soil Conservation Institute, Road Construction agencies etc.;

(f) Laying down a policy relating to the syllabus to be introduced for academic studies in Universities/Training Institutes for generating consciousness and interest amongst students about eco-development;

(g) Deciding inter-departmental/inter-state issues and problems, apportioning of responsibility and sharing of expenditure for comprehensive and elaborate projects concerning eco-development.

(iv) A standing committee should also be set up at the State level for coordinating the activities with regard to eco-development at the State level and to liaise with the standing committee set

up at the national level. It should be the function of the standing committee at the state level to coordinate all road construction and other development activities in the hill region at the State level.

5.6 Socio-political aspects.

5.6.1 Roads constitute one of the most basic amenities for difficult hilly terrain and have a telling impact on the socio-economic conditions of the area both during and subsequent to the construction. There are instances of pressures brought to bear on decision pertaining to the choice of location or the selection of alignment for roads by interested quarters. Such situation can be avoided if a master plan for road development of the area is prepared on scientific lines based on an in-depth study of the actual needs of the villages, points of activity and resources potential etc.

5.6.2 Indiscriminate felling of trees by locals/contractors above the roads and hurtling down large tree logs along the water channels/re-entrants cause disturbing effect and interfere with the drainage of the area, apart from causing heavy damage to the road surface and structures like culverts, parapet walls, retaining walls etc. Such felling must be curbed through arrangements between local State Government Forest officials, SDO's and village chiefs.

5.6.3 Another disturbing effect on the stability of hill slopes is caused by cattle-grazing. Proper check on this must be organised by enforcing no grazing or the practice of rotational grazing with the co-operation of village authority. In areas prone to high degree of erosion, as a last choice, solution may lie in growing non=edible grass along the hill slopes for which attention is required to be paid by the Forest Departments of the State Governments. Other destabilising activities resorted to by local people are: (a) 'Jhoom' cultivation, where a huge belt of forest is burnt for shifting cultivation, year after year, (b) impounding water on the hill slopes immediately above the road level for terraced p-addy cultivation. It is necessary that these activities are stopped through intervention of agriculturists and by making people aware of the ill effects of such activities on the maintenance of the stability of the hill slopes. Livestock reform measures have not so far received the attention they deserve. Both livestock reform and habitat planning are essential for promoting development without destruction in the hills.

5.7 Coordination:

5.7.1 Technical, road construction activities by various agencies in a hill area should be based on a master plan of the district and should be coordinated through a single agency. Coordination with Forest/Soil Conservation Scientists and forest department of State Governments regarding unavoidable deforestation, further afforestation measures and creating suitable flora is essential. Similar coordination with CRRI and GSI for obtaining advice on complex problems of land slides and erosion control measures is to be ensured. As the hills form the catchment area for the river·valley projects, coordination with the Central Water Commission and river valley project authorities, as also the Irrigation and Flood Control departments of State Government, which may be operating in the area, while constructing a road net work, is also essential.

5.7.2 It is necessary to organise further detailed studies on complex landslide problems on some of the important roads. Selection of suitable plant species for different climate, terrain and altitude conditions and establishing nurseries in the various regions where such plant species

should be available for propagation, is also very necessary. For this coordination between road builders, CRRI, Forest authorities and soil conservation department is involved. CRRI has also identified further problems which need to be tackled urgently in coordination with road building organisations for ensuring minimum ecological disturbances due to road construction. These are set out in Annexure XXXIII.

5.8 Recommendations:

5.8.1 The important points where more attention is required to be paid during planning and construction of hill roads are:

(i) (a) Any road construction activity in the Himalayan region should be based on a master plan of the district and should be integrated with existing roads as far as possible.

(b) It is not possible to give road connection to all villages. The concept of giving connection to a cluster of villages through an all-weather motorable road is more practicable. The other villages could be connected to the roadhead through bridle paths, bridle-bridges, foot tracks or jeepable roads as feasible.

(ii) All road construction activities should be coordinated through a single agency both at the Central and the State level.

(iii) Roads to be constructed by agencies other than Border Roads Organisations/PWD should generally conform to the design standards and specifications laid down by IRC for a similar category of roads.

(iv) While deciding route selection and location of hill roads adequate attention should be paid for ensuring that environmental degradation does not take place.

(v) Adequate attention must be paid while selecting road alignment, that landslide/erosion prone areas are avoided as far as possible . While selecting the road alignment the advice of geotechnical engineers and geologists, forest and soil conservation experts should be taken right from the start.

(vi) During the process of road construction, cut and fill method should be resorted to in order to cause minimum disturbance.

(vii) Heavy rock blasting should be avoided and controlled blasting should be resorted to by using a low explosive charge. Blasting should be adequately supervised by technical personnel. Selection of blasting holes should be so done as to avoid large scale disturbance to the rock face, developing cleavage planes/ cracks and opening up fissures etc.

(viii) Spoil from cut blasted rock should not be thrown haphazardly along the valley slopes as these are likely to cause heavy siltation/chokage of water channel/streams and damage agricultural lands. These should be preserved by stocking at selected locations along road side for future use.

(ix) Cut slopes should be rendered stable in the construction stage itself by cutting at the correct angle and benching etc. including slope stabilising structures like drains, breast walls, pitching etc. Wherever considered appropriate on the basis of a

technical study conducted for the purpose, funds should be provided in the project estimates for the treatment of the unstable areas both above road level and below road formation. This may be in the form of a percentage of total cost. Steps should be taken to stabilise the existing roads within a fixed time frame.

(x) All cut/denuded slopes should be treated with vegetative turfing by using one of the techniques developed by CRRI as appropriate.

(xi) Deforestation during the construction of road should be kept to the minimum and should be done only in consultation with Forest Authorities. Any cutting of trees must be replaced by planting an equivalent number of trees.

(xii) Drainage of water from road side should be given adequate attention and an effective system of drainage should be constructed to lead the run off to natural water courses. In particular, suitable intercepting and catch water drains should be provided above the cut slopes for the speedy and safe disposal of water. It should be ensured that water is not drained into the hamlet & cultivated land. Location of cross drains and culverts should be so chosen as to avoid erosion of the outlet. Adequate erosion control works like drop walls apron etc. at out fall points alongwith pitching/paving of the channel should be undertaken.

(xiii) To minimise the adverse effects of cattle grazing proper check should be exercised and the concept of rotational grazing should be implemented. 'Jhoom' cultivation impounding water very near & above the hill roads for terraced paddy cultivation and fish rearing must be avoided.

(xiv) IRC Manual for rural roads has focus on roads in plains. This needs to be focussed on hill roads also.

5.8.2 There is need to organise further intensive field studies of major and complex landslide problems on some of the important roads. Selection of suitable plant species under varying climate, terrain and altitude conditions and creation of nurseries in selected regions also need further examination by CRRI and other concerned soil conservation authorities. Problems on which immediate research is required, as identified by CRRI has been enclosed at Annexure XXXIII.

5.8.3 It is necessary that suitable infrastructure is established for providing effective measures against ecological disturbances and for coordinating the activities of various departments. The following recommendations are made:

Firstly, in order to ensure better cooperation and collaboration between construction engineers, geotechnical engineers, geologists and soil conservation and Forest Scientists from the very inception of the project, itself, such specialists should be made available in the establishment of a premier road building organisation like the Border Roads Organisation, State PWDs etc. Specialists should be brought on deputation so that they continue to maintain links with their parent departments.

Secondly, for tackling complex problems of unstable strata/major landslide area etc. research/detailed study should be organised through CRRI, GSI, Forest Research Institute etc. under the

coordination of a special cell to be established under CRRI. This cell will also coordinate all research activities with regard to restoration of ecological balance and disseminate information about significant measures developed and provided successfully for tackling complex problems. Reorientation courses & periodical Refresher's Course to all categories of field staff is extremely necessary and immediate steps in this direction are called for.

Thirdly, a Standing Committee should be set up at the level of Planning Commission for laying down policies at the National level in connection with maintaining ecological balance.

CHPATER VI

INSTITUTIONAL FRAMEWORK

6.1 The Task Force viewed with concern the absence of a high level institutional infrastructure to oversee the problems of the Himalayan range in a coordinated manner and give broad policy guidance and directions. National and State level arrangements and interventions required in respect of plan formulation, funding, legislative enforcement and administrative machinery for coordinated action were also considered necessary. Identification of interstate dimensions involved in eco-development and measures to suggest remedies were required. The Prime Minister, Smt. Indira Gandhi has stressed the need for attending to the following dimensions of eco-destruction problems with a sense of urgency:

> "The need of the poor for a livelihood, the greed of middlemen for quick profits, the demands of nature and short sightedness of the administration have created ecological problems".

6.2 Indiscriminate destruction of forests and man made "ecological catastrophes" have created problems of unprecedented magnitude and unless the land and forests in the country are put back in order, India would turn into a "vast and inhospitable wasteland".

6.3 Reports and recommendations of the "Expert Committees" in the past have unfortunately not found their way in guiding the formulation of plans and programmes in the field. Ensuring effective implementation of the policies and programmes in the Himalayan Region is, therefore, of paramount importance.

With the above objective in view, the Task Force recommends that -

(1) a "Himalayan Eco-Development Commission" be set up at the apex level under the chairmanship of the Prime Minister with the Depty Chairman, Planning Commission as its Vice-Chairman. Union Finance Minister, Minister in charge of the Department of Environment, Chief Ministers of the concerned States, and Member (in charge of Hill Areas) Planning Commission, will also be Members of this Commission. The Commission, which will be an apex level policy body, may meet once a year to consider a report on "the state of the Himalayas" presented by the Planning Commission and for broad evaluation and policy directions; and

(2) an "Executive Committee", which will function as 'Eco-Development Cell' under the chairmanship of Member (in charge of Hill Areas), Planning Commission may also be set up. Secretary (Plan Finance), Ministry of Finance, Secretary, Department of Environment and Development Commissioners/Secretaries in charge of Planning/Hill Areas of the concerned States will be the other Members of this Committee. This Committee will give advice and directives for the long-term and short-term strategy for development of the Himalayan Region, initiate, direct and follow up surveys and studies of problems. Ensure that plans and programmes are being effectively implemented.

This Committee, which will assist the "Himalayan Eco-Development Commission", will be notified as a "Standing Committee" for the duration of the Sixth Plan period and meet thrice in a year. Apart from its Members, the Committee will call independent experts of various disciplines, namely, Forest, Mining, Post Harvest Operations, Research Organisations etc. for deliberations as and when necessary. "Standing Sub-Committees", wherever required, should also be set up.

6.4 Similar institutional infrastructures need to be set up by the States/UTs concerned.

6.5 The Task Force hopes that the institutional framework recommended would be able to provide the much needed structural mechanism for ensuring that accelerated economic development takes place without destruction of basic life support systems in the hills.

CHAPTER VII

SYNTHESIS

7. 1 INTRODUCTION

7.1.1 The reasons for setting up the Task Force on Eco-Development of the Himalayan Region are two fold, namely the unmistakable signs of ecological damage occurring with increasing intensity in the total Himalayan environment, and the deprivation and poverty of the people who have to depend on a depleted resouce base. The Task Force accordingly set up a Group on Socio-Economic Development to make proposals for the economic and social parameters of development, and also set up Groups on 'Coordinated Research on Action Oriented Basis', 'Post Harvest Technology' and 'Transport Planning'.

7.2 SOCIO-ECONOMIC DEVELOPMENT

7.2.1 Faulty use of the principal resources, namely, soil, forests and water, has been primarily responsible for the widespread degradation evident in the Himalaya. The evidence of disturbing depletion of resources is briefly summarised below.

7.2.2 Soil

Owing to the sharp increase in population in recent decades, cultivation has been greatly extended, even in marginal land. Slopes of very high gradients are also being cultivated. Inadequate attention has been paid to correct agricultural practices, with the result widespread erosion is being caused. It has been established that there are hardly any class 1 and 2 soils left for agricultural use. Most agricultural land is in the lower categories of fertility. Since it takes 500 to 1000 years to replace one inch of topsoil, the loss in large areas may soon become irreversible. Protective measures have, therefore, become a matter of the utmost urgency.

As things stand, the Himalaya is a deficit area in the food requirements of the people,and the gap between needs and local production is becoming progressively wider. Various adverse sociological effects flow from the conditions of life in the Himalaya. The most noticeable is widespread poverty. People of the region are by and large below the poverty line, and an increasing number of able-bodied males are migrating to other parts of the country in search of a livelihood to support their families at home. Though the manpower drain has been compensated by a sizeable flow of remittances, the loss has been felt in family farming

operations in the hills. The women and children are left to fend for themselves in difficult conditions, with no capital for investment in agriculture. The picture is one of undiluted misery.

7.2.3 Forests

In the middle Himalayan belt, which is the main population region in the Himalaya, the area of forest, which was originally estimated at 33% of the total areas, has diminished to between 6 and 8 per cent. The main reasons for the fall in forest cover area: extension of cultivation, extraction of wood for fuel and commercial purposes and uncontrolled grazing. The rate at which forests have been disappearing, even in the other two belts, namely the foothills and the Great Himalaya, have aggravated the dangers arising from loss of soil cover. This, for the most part, is evident in the increasing rate of erosion and siltation. It has been estimated that at the present rate of use, the forests are likely to become a barren area by the year 2041 AD*.

Apart from the effect on erosion, the depletion of the forests is making it difficult for the people of the Himalaya to find fuel necessary for the bearest subsistence. Since bio-fuel provides atleast 90 per cent of the present energy use, the degradation of the forests will create a major difficulty for the people in their day to day life. The effects lower down are equally serious. Erosion silts up river beds and causes floods which have been increasing in extent and damage, particularly in the last decade. The effect of siltation has also been observed in multi-purpose projects. In 21 cases studied, the siltation rate has increased by 182 per cent. The life of the Ram Ganga Project, originally estimated at 150 years, is expected to be reduced to 45 years. No authentic measurement of siltation loads in the main river basins appears to have been made so far, but the evidence cited above shows how grave the problem has become in the last few years. Forest depletion is amongst the most urgent problems of the Himalaya that call for immediate remedial measures.

7.2.4 WATER

Loss of forest cover, particularly in strategic areas such as crests, water-sheds and acquifier recharge areas, is resulting in the drying up of drinking water springs. The erosion effect, which is wearing away the soil has already been noticed. Irrigation systems, if any, are undeveloped. The water picture in the Himalayan region is one of concentrated run-off in the high-water months from June to October, with maximum erosion followed by a prolonged period of relative drought. The problem of water management is, therefore, extremely acute.

7.2.5 CORE STRATEGY

It is clear from the resource picture painted above that radical and immediate measures are necessary both to check the environmental degradation that has gripped the Himalaya and to regenerate the resource base, so as to give the people of the Himalaya the means for a better and happier life.

In considering how to proceed, regard has to be had to the physical nature of the terrain. The Sivaraman Committee and a number of experts

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* Dr S L Shah; Presidential Address, Fortyfirst all-India Agricultural Economics Conference.

have advocated that the unit of development must be the resource unit, namely, the catchment or the mini-catchment. The Task Force fully shares this view. These eco-units, as they may be called, are considered to be natural collectivities of the principal Himalayan resources and the communities inhabiting them.

The pattern imposed by nature enables the Task Force to outline a blue-print for the Himalaya, which may be called the core strategy with three fold objectives: (a) protection, (b) regeneration and (c) productivity. This strategy visualises the following essentials:

i) Protection of the resource base in all its aspects, namely soil, forests, water and other natural resources present in the eco-units.

ii) Regeneration of resources: This involves restoration of forest cover, realisation of agricultural potential by intensive means in soil suitable for the purpose, effective use of water resources and the development of human knowledge and skills.

iii) Productivity: The third process involves deployment of the natural resources, along with human skills, so as to maximise the productivity of the eco unit.

It should be emphasised that these are processes and not stages. There is no temporal phasing; indeed, in most cases it will be found possible to combine these processes and undertake them simultaneously.

7.2.6 PRIORITIES

The most acute problem in the Himalaya at present is the depletion of resources. Clearly, therefore, the highest priority has to be given to protection and regeneration of the resource base. In doing so, the worst affected areas should be given immediate attention.

It is equally important that the basic requirements of the people of the Himalaya should be met. Unless this is done, they will continue to make further inroads into the slender resource base. These needs are for food, fuel and fodder and the minimum needs programme for the human welfare.

7.2.7 METHODOLOGY

The three stages of eco-development visualised above will be put into effect on the principle of determination of correct land use and intensification of those forms of use to maximise yields and economic benefit. The modalities are summarised as follows:

i) Determination of correct land use.

ii) Intensification of agriculture in suitable land, along with provision of irrigation and inputs necessary for high yields.

iii) Unirrigated areas to be put under tree and high value cash crops.

iv) Crests, watersheds, acquifer recharges to be put under trees.

v) A massive programme of afforestation to cover unculativated village land, in a prescribed rotation, combined with grazing regulations.

vi) Limitation of herds and improvement of stock, which should be progressively stall fed.

Energy use hold the key to the success of afforestation and preservation of forest cover. The strategy suggested for this purpose is a coordinated scheme for bio-fuel plantations, combined with saturation by micro hydel supply and other alternate forms of energy.

7.2.8 The main emphasis throughout is on current resource use and development. For this purpose, technical and administrative staff teams, along with the sabhapatis and sarpanches of each unit, will together constitute the catchment development boards. Mobilisation of popular participation in such a way that the interests of women and the underprivileged are ensured is of vital importance. As far as possible the execution of development schemes will be dovetailed into existing community organisations so that the people are dynamically involved.

7.2.9 ADMINISTRATIVE PATTERN

The administration has to be given new orientations if Himalayan development is to make headway before time runs out. Administration with the character of a genuine field organisation must be effectively coordinated by the district officer, or officer of equivalent level. The single line administrative pattern, that has proved its worth in border areas, has been suggested so that departmental approaches are substituted by fully integrated planning and development for each eco-unit (catchment).

7.2.10 EDUCATION

The link between education and development is of vital importance in the hills. A vocation oriented education should be designed, specifically related to acceptance of the development programme in which women are destined to play an increasingly important part.

7.3 COORDINATED RESEARCH

7.3.1 The Indian universities have a creditable record of agricultural research, mostly in the plants. A start has been made with agricultural research specially relevant to condition in the Himalaya, but much remains to be done. New directions have to be given by involving the universities in the main stream of planning and development. The process of re-search, extension and feed back is considered essential for a well modulated policy with practical relevance.

7.3.2 At present there are 14 universities in the Himalayan region. The intention is that the universities should be involved both in research and also actively in extension. A suitable mechanism has been suggested to involve the academic community in a coordinated and continuing manner in the task of eco-development.

The strategy envisaged is (a) each University should prepare a total plan indicating all the research and educational programmes under way in the different faculties and colleges of the University in studies relating to the conservation and enrichment of basic life support system; (b) each university should establish a suitable coordinating mechanism under the Chairmanship of the Vice-Chancellor with representatives from all the participating faculties and student groups interested in ecology in order to ensure the success of the totality of the eco-development programmes of the University; (c) linkage between the university eco-development group and appropriate agencies of the State Government should be established. The Planning Commission should extend its assistance in ensuring a close

tie-up between the universities and the State Governments; (d) student involvement in the university eco-development programmes should be made by integrating the related activities in the curriculum, assigning the research projects, participation in field oriented studies, and organising the eco-development camps for graduate and undergraduate students; (e) universities should prepare radio and T.V. programmes and audiovisual aids for the purpose of generating an awareness of environmental problems; (f) inter-university coordination should be looked after by a project coordinator assisted by 3-4 in-service personnel established at a suitable university preferably in the Central Himalaya region. This coordinating centre should compile annual reports, maintain the research project files and organise annual workshop etc.; and (g) at the apex level there should be a Policy Guidance Committee to be constituted by the Planning Commission. The funds for the programme should be provided by the Planning Commission.

7.4 POST HARVEST OPERATIONS

7.4.1 The principal forms of land use in the Himalaya are agriculture, horticulture and forestry. The harvested products of these activities, especially horticulture and forestry, require to be processed before they can be used. In most cases the end-product is consumed in the plains. Consequently, several processes are involved in post-harvest operations. Apart from the primary question of increasing productivity, dealt with in the core strategy, post harvest operations are aimed at getting the maximum benefit to the grower out of the horticulture and forest products grown in the hills.

7.4.2 Post harvest operations have assumed great importance in consequence of the core strategy for production suggested. The aim is to intensify agricultural production in small areas favourable for the purpose and to concentrate on horticulture, flori-culture, sericulture and similar occupations in other areas suitable for these purposes. Since the products in this category are mostly cash crops, which, properly utilised, can increase the economic well-being of the grower, it is clear that post harvest operations will acquire greater importance as time goes on. These include grading, packaging, processing and storage and finally marketing of Himalayan produce. The special importance of marketing must be highlighted. It is at this stage in the producer to consumer chain that the grower is deprived of the full benefit of his produce. Even a small margin of improvement in marketing operations is, therefore, of vital importance, but the aim must be to cut down intermediate costs to the maximum extent possible.

7.5 TRANSPORT PLANNING

7.5.1 Broadly speaking, the objectives of communication in the Himalaya are two fold, namely strategic and economic development. In this Report, the Task Force is concerned primarily with the latter, but it has taken note of the econological effect of strategic communications. A number of proposals have been made to minimise the adverse ecological effects both of strategic communication as well as those necessary for economic development of the region.

7.5.2 It is recognised that the valleys must be provided with arterial roads. Since the main thrust of the proposals made is the economic uplift of the people, the Task Force has advocated that positive plans be made for extension of feeder roads to the areas of production so that the crops on which the people's well-being so vitally depends can be moved to markets of destination. This apart, reliable communication, with minimum ecological damage, are necessary for the ordinary coming and going of the

people. The Himalaya, which for centuries has been isolated, are undergoing a communication transformation. It is imperative that the technology used for this purpose should be specially suited for operations in the fragile Himalayan environment.

7.6 INTER LINKAGES

7.6.1 Widespread concern is evident both in the country and even in some international organisations regarding the adverse trends noticed in the Himalayan environment. This interest has been expressed in a number of development plans formulated in the States at a national level and also by international bodies. While this upsurge is extremely gratifying, it is felt that some sort of inter-linkages between these various efforts should be established at the national level in the interest of Himalayan development. This, it is essential, should be done in such a way as to encourage rather than dampen the widespread interest in the subject.

A N N E X U R E S

Annexure I

Area and Population - Himalayan Region

State/U.T./Sub-region	Area Km^2	Population	
		1971	1981 (Provl.)
Western Himalayas			
Jammu & Kashmir	2,22,236.0**	4,616,632	5,981,600*
Himachal Pradesh	55,673.0	3,460,434	4,237,569
Central Himalayas			
Eight hill districts of Uttar Pradesh	51,112.0	3,821,960	4,780,000
North Eastern Himalayas			
Sikkim	7,299.0	209,843	315,682
Darjeeling district of West Bengal	3,075.0	781,777	1,016,177*
Assam	78,523.0	14,625,152	19,902,826*
Arunachal Pradesh	83,573.0	467,511	628,000
Nagaland	16,527.0	516,449	773,281
Manipur	22,356.0	1,072,753	1,433,691
Mizoram	21,087.0	332,390	487,774
Meghalaya	22,489.0	1,011,699	1,327,874
Tripura	10,477.0	1,556,342	2,060,189
Total	594,427.0	32,472,942	42,944,663

*Projected

**Includes area under illegal occupation of Pakistan and China.

Annexure II

LAND USE PATTERN - IN HIMALAYAN REGION

Area - '000 ha.

State/Union Territories/ sub-regions	Geogra-phical area	Report-ing area	Percentage distribution of reporting area				
			Forest	Area not available for cul-tivation	Other than cultivated area exclu-ding fallow	Fallow includ-ing current fallows	Net area sown
1.	2.	3.	4.	5.	6.	7.	8.
Western Himalayas							
Jammu & Kashmir	22224	4523	61.4	11.7	9.1	2.2	15.6
Himachal Pradesh	5567	5076	54.8	5.7	27.5	1.2	10.8
Central Himalayas							
U.P. Hill Districts	5144	4880	46.7	30.6	4.6	1.0	17.1
N.E. Himalayas							
Manipur	2236	2211	27.2	65.4	1.1	Nil	6.3
Arunachal Pradesh	8358	5644	91.31	0.7	3.0	3.0	2.0
Darjeeling Distt. of West Bengal	308	311	38.1	23.5	5.1	1.2	32.1
Sikkim	729	NA	36.0	NA	NA	NA	NA
Assam	7853	1522	22.1	74.4	Nil	Nil	3.5
Meghalaya	2248	2249	8.3	84.5	Nil	Nil	7.2
Nagaland	1655	1351	19.7	75.9	Nil	Nil	4.4
Mizoram	2109	2092	62.0	36.1	Nil	Nil	1.9
Tripura	1068	1048	60.1	4.9	11.6	0.5	22.9
Total		30907	53.2	28.2	7.6	1.3	9.7

Source: Report of Study Group A of Sub-Group on Socio-Economic Development of Task Force on the study of Eco development of Himalayan Region.

Annexure - III

Plan outlays - States/Areas of Himalayan Region

(Rs. in crores)

State/UTs/Areas	Fourth Plan	Fifth Plan Outlay 1974-79	Five Year Plan 1978-83	Sixth Five Year Plan (1980-85)
I. Hill States/UTs				
1. Himachal Pradesh	113.43	238.95	442.00	560.00
2. Hammu & Kashmir	162.22	362.64	694-50	900.00
3. Manipur	31.15	92.86	173.20	240.00
4. Meghalaya	36.24	89.53	191.00	235.00
5. Nagaland	38.52	83.63	163.20	210.00
6. Tripura	34.66	69.68	168.00	245.00
7. Sikkim	@	39.64	94.00	122.00
8. Arunachal Pradesh	21.12	63.30	115.00	212.00
9. Mizoram	9.30	46.59	95.09	130.00
10. NEC	-	90.00	212.00	340.00
Sub-Total	446.64	1176.82	2347.99	3194.00
II. Hill Areas				
1. U.P.Hill Areas (8 Distts.)	-	204.00	-	570.00
2. Assam Hill Areas (2 Distts.)	-	60.13	-	151.28
3. West Bengal Hill Area (3 Sub-Divisions of Darjeeling Distts.)	-	34.05		29.71 *
Sub Total		298.18		750.99
Grand Total	446.64	1475.00	2347.99	3944.99

* Central Assistance only. Proposals about State Plan funds are yet to be received

@ Was not a State then.

Annexure - IV

State/Union Territory-wise

PER CAPITA NET STATE DOMESTIC PRODUCT(AT CURRENT PRICES)

(Rs.

State/Union Territories	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
1.	2	3	4	5	6	7	8	9	10	11
1. Assam	539	550	578	645	820	781	846	912	953	960
2. Himachal Pradesh	678	716	769	936	1048	1078	1029	1178	1295	1317
3. Jammu & Kashmir	524	572	601	721	835	883	897	986	1145	-
4. Manipur	396	466	571	688	781	807	765	808	814	822
5. Meghalaya	-	-	-	598	-	-	-	-	-	-
6. Tripura	502	563	534	649	789	813	831	862	861	-
All India	633	660	712	871	1006	1029	1094	1210	1267	1379

- Not available

Note: Information for Nagaland, Arunachal Pradesh, Mizoram and U.P. Hill Areas is not available.

Source: Central Statistical Organisation

Annexure V

Percentage of population below the povery line by States separately for rural and urban areas in 1972-73 & 1977-78.

Sl. No.	State/U.T.	1972-73*	1977-78**
1.	Assam	46.95	51.10
2.	Himachal Pradesh	15.13	27.23
3.	Jammu & Kashmir	39.00	34.06
4.	Manipur	24.70	29.71
5.	Meghalaya	19.05	48.03
6.	Nagaland	3.33	4.11
7.	Tripura	39.88	59.73
8.	All Union Territories@	30.24	21.69
	All India (weighted)	51.49	48.13

Note: The above estimates are derived on the following basis:

*) A daily minimum per caput caloric intake of 2400 in rural areas and 2100 in urban areas assumed for 1978-83 draft plan period has been considered for estimating the poverty line. In 1977-78 prices, this works out to Rs. 65 per capita per month in rural areas and Rs. 75 in urban areas. The corresponding per capital monthly expenditure in 1972-73 prices is Rs. 41 in rural areas and Rs. 47 in urban areas. For estimating the percentage of people below poverty line in each State, these cut-off points in the National Sample Survey data on household consumer expenditure of 27th Round (October, 1972 to Sept. 1973) have been used.

**) The above estimates are derived by using the povery line of Rs. 65 per capita per month in 1977-78 prices corresponding to minimum daily calorie requirement of 2400 per person in rural areas and the poverty line of Rs. 75 corresponding to calorie requirements of 2100 in urban areas.

@ relates to all the UTs of the country.

Annexure VI

No. PC(P)19/1/HIM/80-MLP
Government of India
Planning Commission

Yojana Bhavan, Parliament Street,
New Delhi.

Dated the 3rd June, 1981.

OFFICE MEMORANDUM

The Government has been seized of the need to incorporate environmental and ecological consideration into the developmental activities going on in the Himalayan Region so as to ensure that short-term gains are not followed by long-term impairment of the health of the eco-systems that sustain these activities. There is an urgent need to balance economic development with the imperatives of environmental conservation and to formulate realistic and manageable programmes for tackling the inter-linked problems involved in eco-development of the Himalayan Region. The Planning Commission have therefore decided to set up a "Task Force for the study of eco-development in the Himalayan Region" with the following composition:

1.	Dr. M.S.Swaminathan, Member, Planning Commission.	Chairman
2.	Shri Madhava Asish, P .O. Mirtola, District Almora U.P.	Member
3.	Shri S.K. Bhatnagar, Additional Secretary to the Government of India, Ministry of Defence, New Delhi.	Member
4.	Vice-Chairman University Grants Commission, UGC Building, Bahadurshah Zafar Marg, New Delhi110002.	Member
5.	Secretary, Department of Environment Ministry of Science & Technology, New Delhi.	Member
6.	Dr. S. Kedarnath, Head of Department of Forest Genetics, Forest Research Institute , Dehra Dun.	Member
7.	Dr. Virender Kumar Department of Botany, Zakir Hussain College, Ajmeri State, Delhi.	Member

8.	Mr. K.M.Tiwari, President, Forest Research Institute, Dehra Dun (UP)	Member
9.	Dr. D.N. Borthakur, Director, ICAR Research Complex for N.E. Hill Region, Shillong (Meghalaya)	Member
10.	Dr. C.K.Atal, Director, Regional Research Laboratory, Canal Road, Jammu - Tawi.	Mamber
11.	Shri J.S.Lal, (Retired ICS), 83, Jorbagh, New Delhi-110003.	Mamber
12.	Shri A.D.Moddie, F.10/12, Vasant Vihar, New Delhi-11005-.	Member
13.	Dr. K.G.Tejwani, Director, Central Soil Conservation Research & Training Institute, Dehra Dun (UP)	Mamber
14.	Smt. P.P. Trivedi Adviser (State Plans) Planning Commission, New Delhi.	Member
15.	Shri D.D.Joshi, Consultant, Planning Commission, New Delhi.	Member-Secretary
16.	Dr. Vidya Joshi	Mamber
17.	Shri Mukul Sanwal	Mamber

The Task Force may constitute Sub-Groups to consider any specific issues and to co-opt members, as necessary.

The terms of reference of the Task Force are as follows:

(1) To consider the proposal for a Centre for Himalayan Regional Studies to be established with the participation of the Universities of the region and to make suitable recommendations in this regard.

(2) To identify the ecological/environmental problems that require study on a priority basis, recommend the University departments and research institutions for undertaking these studies, and to draw up the guidelines for such studies;

(3) To take note of the major developmental activities going on in the States falling in the Himalayan Region, to assess the extent of their impact on the hill eco-system and to suggest suitable modifications:

(4) To recommend the national and State level arrangements and interventions necessary in respect of plan formulation, funding, legislative enforcement and administrative machinery needed to overcome the ecological/ environmental problems of the Himalayan region; and

(5) To identify any inter-State dimensions involved in eco-development and to suggest measures for dealing with such issues.

The Task Force will submit its report on item 1 of the terms of reference by 31st August, 1981, and on the remaining terms of reference by 31st December, 1981.

The T.A./D.A. of the official Members of the Task Force will be met by the respective departments/organisations to which they belong. T.A./D.A. of non-official members will be met by the Planning Commission.

Sd/-
(R.S. Saksena)
Director(Administration)

Annexure VII

No. PC(P)19/1/HIM/80-MLP
Government of India
PLANNING COMMISSION
(M.L.P.Unit)

Yojana Bhavan, Sansad Marg,
New Delhi, July 21, 1981.

OFFICE MEMORANDUM

The Task Force for the study of Eco-Development in the Himalayan Region set up vide Planning Commission O.M.No.PC(P)/19/1/HIM/80-MLP dated 3rd June, 1981 under the chairmanship of Dr. M.S. Swaminathan,Mamber, Planning Commission in its first meeting held on 15th July, 1981 at New Delhi has constituted a Sub-group on"Coordinated Research on Action Oriented Basis". The Chairman of this Sub-Group would be Shri A.D. Moddie, F-10/12, Vasant Vihar, New Delhi-110057. The other members of the Sub-Group are:-

i) A nomineee of the Department of Environment, Minsitry of Science & Technology, Technology Bhavan, New Delhi.

ii) A nominee of the University Grants Commission, UGC Building, Bahadurshah Zafar Marg, New Delhi-110002.

iii) Dr. Virendar Kumar, Consultant (Hills Areas), Planning Commission, New Delhi.... Mamber-Secretary

2. The Sub-Group may associate with its deliberations such other experts as are considered necessary.

3. The terms of reference of Sub-Group would be:

i) to examine the setting up of a cooperative net work of eco-development centres in Universities in the Himalayan Region with a Centre for coordination and to suggest an action plan thereof; and

ii) to develop cooperative links with other organisations like ICAR, CSIR, F.R.I., Defence Science Laboratory, Department of Environment, Department of Science & Technology and other Social Organisations.

4. TA/DA of the official members will be met by the respective Departments/Organisations to which they belong. TA/DA of non-official members will be met by the Planning Commission.

5. The Sub-Group may complete their deliberations and place their findings before the Task Force within two months from the date of this O.M. The meetings of the Sub-Group may be held at New Delhi or at any such place in the Himalayan Region as is considered necessary.

Sd/-R.S.Saksena
Director(Administration)

To

1. All members of the Sub-Group.
2. S.A. to Deputy Chairman, Planning Commission, New Delhi.
3. P.S. to Member(S), Planning Commission, New Delhi.
4. P.S. to Member-Secretary, Planning Commission, New Delhi.
5. Secretary to Chief Minister of the respective States/ UTs in the Himalayan Region.
6. Chief Secretary of the respective States/UTs in the Himalayan Region.
7. All mambers of the Task Force on Eco-Development of Himalayan Region.
8. Mamber-Secretary of the Task Force on Eco-Development of Himalayan Region.

Sd/- R.S. Saksena
Director (Administration)

Annexure VIII

No. PC(P)19/1/HIM/80-MLP
Government of India
Planning Commission
(M.L.P. Unit)

Yojana Bhavan, Sansad Marg,
New Delhi, July 21, 1981.

OFFICE MEMORANDUM

The Task Force for the study of Eco-Development in the Himalayan Region set up vide Planning Commission O.M.No.PC(P)/19/1/HIM/80-MLP dated 3rd June, 1981 under the chairmanship of Dr. M.S.Swaminathan, Mamber, Planning Commission in its first meeting held on 15th July, 1981 at New Delhi has constituted a Sub-Group on "Post Harvest Technology." The Chairman of this Sub-Group would be Dr. S. Kedarnath, Director, Biological Research (Retired), Forest Research Institute, Dehra Dun.The other members of the Sub-Group are :-

i) Shri P.H.Vaishnav, Joint Secretary(State Plans), Planning Commission, New Delhi.

ii) Shri M.R. Subramanian, Acting Director, Indian Institute of Packaging, E-2 MIDC Area, Chakala, Andheri (East),Bombay-400093.

iii) Dr. J.C. Anand, Project Coordinator, Post Harvest Technology, Horticulture Crops - IARI, New Delhi.

iv) Shri T.R. Parmeshwaran, Director(Food), Ministry of Agriculture Krishi Bhavan, New Delhi.

v) Shri S.K. Alok, Managing Director, Agro Industries Corporation, Himachal Pradesh, Simla.

vi) Shri G.L. Kaul, Professor of Horticulture, Agriculture University, Pant Nagar, District Nainital.

vii) Shri M.A. DAr, Director(Horticulture), Government of Jammu & Kashmir, Srinagar.

viii) Dr. C.K.Atal, Director, Regional Research Laboratory, Canal Road, Jammu Tawi.

ix) Prof. S. Ramanujam, Head of Department of Genetics, Indian Agriculture Research Institute, New Delhi.

x) Shri N.L. Meena, Dy. Adviser(NEC), Planning Commission, New Delhi Member Secretary

2. The Sub-Group may associate with its deleberations such other experts as are considered necessary.

3. The terms of reference of Sub-Group would be:

i) to study the post harvest technologies already developed and to identify the ecological problems arising from the existing practices of resource use particularly in respect of fruits and vegetables, flowers, silvi-culture and dairy products;

ii) to suggest suitable strategies for development of the resources as at item (i) above in the context of the primacy of environmental conservation; and

iii) to suggest appropriate technologies for harvesting, processing, storage, preservation, alternate packaging, movement and marketing of the products as at item (i) above consistent with ecological conservation and developmental needs.

4. TA/DA of the official members will be met by the respective Departments/Organizations to which they belong. TA/DA of non-official members will be met by the Planning Commission.

5. The Sub-Group may complete their deliberations and place their findings before the Task Force within two months from the date of this O.M. The meetings of the Sub-Group may be held at New Delhi or at any such place in the Himalayan Region as is considered necessary.

Sd/-
(R.S. Saksena)
Director (Administration)

To

1. All members of the Sub-Group.
2. S.A. to Deputy Chairman, Planning Commission, New Delhi.
3. P.S. to Mamber(S), Planning Commission, New Delhi.
4. P.S. to Member-Secretary, Planning Commission, New Delhi.
5. Secretary to Chief Minister of the respective States/UTs in the Himalayan Region.
6. Chief Secretary of the respective States/UTs in the Himalayan Region.
7. All Members of the Task Force on Eco-Development of Himalayan Region.
8. Mamber-Secretary of the Task Force on Eco-Development of Himalayan Region.

Sd/-
(R.S.Saksena)
Director (Administration)

Annexure IX

No. PC(P)19/1/HIM/80-MLP

GOVERNMENT OF INDIA
PLANNING COMMISSION
(M.L.P. Unit)

Yojana Bhavan, Sansad Marg,
New Delhi, July 21,1981.

OFFICE MEMORANDUM

The Task Force for the study of Eco-Development in the Himalayan Region set up vide Planning Commission O.M.No.PC(P)/19/1/HIM/80-MLP dated 3rd June, 1981 under the chairmanship of Dr. M.S.Swaminathan, Member, Planning Commission in its first meeting held on 15th July, 1981, at New Delhi has constituted a Sub-Group on "Transport Planning". The Chairman of this Sub-Group would be Dr. K.G. Tejawani, 25/31, Old Rajinder Nagar, New Delhi-110060. The other members of the Sub-Group are:

1.	Brig.Gobinder Singh, Director-General, Road Development, Ministry of Shipping and Transport, New Delhi.	Member
2.	Maj.-Gen.S.S. Ahluwalia, AVSM, Director-General, Border Roads, New Delhi.	Member
3.	Prof. C.G. Swaminathan, Director, Central Road Research Institute, New Delhi.	Member
4.	Shri G. Pant Senior Geologist (On behalf of Shri V.S.Krishnaswamy, Director-General, Geological Survey of India)	Member
5.	Shri P.N.Misra, Engineer-in-Chief, Public Works Department, Uttar Pradesh, Lucknow.	Member
6.	Shri P.Krishnan, Advisor (T&C) North Eastern Council, Shillong.	Member
7.	Dr. Anil Berry, Transport Economist, Forest Survey of India, Dehra Dun.	Member

8. Shri K.M.Balasubramanian, Member-Secretary
Deputy Adviser (Transport)
Planning Commission,
New Delhi.

2. The Sub-Group may associate with its deleberations such other experts as are considered necessary.

3. The terms of reference of Sub-Group would be:

i) to examine the existing net-work of the means of transport and to assess the optimal minimum requirements of transport consistent with ecological conservation and developmental needs; and

ii) to suggest appropriate technology for construction of roads and development of other communication systems.

4. TA/DA of the official members will be met by the respective Departments/Organisations to which they belong. TA/DA of non-official members will be met by the Planning Commission.

5. The Sub-Group may complete their deliberations and place their findings before the Task Force within two months from the date of this O.M. The meetings of the Sub-Group may be held at New Delhi or at any such place in the Himalayan Region as is considered necessary.

Sd/-

(R.S.Saksena)
Director (Administration)

To

1. All members of the Sub-Group
2. S.A. to Deputy Chairman, Planning Commission, New Delhi.
3. P.S. to Member(S), Planning Commission, New Delhi.
4. P.S. to Member-Secretary, Planning Commission, New Delhi.
5. Secretary to Chief Minister of the respective States/U.Ts. in the Himalayan Region.
6. Chief Secretary of the respective States/UTs in the Himalayan Region.
7. All members of the Task Force on Eco-Development of Himalayan Region.
8. Member-Secretary of the Task Force on Eco-Development of Himalayan Region.

Sd/-

(R.S.Saksena)
Director(Administration)

Annexure X

No.PC(P)19/1/HIM/80-MLP

Government of India
Planning Commission
(M.L.P. Unit)

Yojana Bhavan, Sansad Marg,
New Delhi, July 21, 1981.

OFFICE MEMORANDUM

The Task Force for the study of Eco-Development in the Himalayan Region set up vide Planning Commission O.M.No. PC(P)/19/1/HIM/80-MLP dated 3rd June, 1981 under the chairmanship of Dr. M.S. Swaminathan, Member, Planning Commission in its first meeting held on 15th July, 1981 at New Delhi has constituted a Sub-Group on "Socio-Economic Development." The Chairman of this Sub-Group would be Shri J.S. Lal, ICS(Retd.), 83,Jorbagh, New Delhi-110003. The other members of the Sub-Group are:-

i) Shri S.K.Bhatnagar, Additional Secretary, Ministry of Defence, New Delhi.

ii) Shri Madhava Asish, P.O. Mirtola, District Almora (U.P.).

iii) Shri K.M.Tiwari, President, Forest Research Institute, Govt. of India, Dehra Dun.

iv) Dr.(Smt.) Vidya Joshi, President, Hill Women's Welfare Society, Tilokpur, Almora (U.P.)

v) Shri Mukul Sanwal, Managing Director, U.P.State Spinning Mills Company, Kanpur.

vi) Shri D.D. Joshi, Consultant(Hill Areas) Planning Commission, New Delhi. ... Member-Secretary.

2. The Sub-Group may associate with its deleberations such other experts as are considered necessary.

3. The terms of reference of Sub-Group would be :

i) to study the socio-economic and cultural characteristics of population and the interrelationship between these sectors with main emphasis on institutional factors and settlement pattern with reference to physical environment;

ii) to suggest suitable strategies/action plans for development of horticulture, forestry, pasture land on an integrated watershed management basis, development of animal husbandry, industires and minimum level of social services, namely, education, health, drinking water supply and other infrastructural facilities consistent with ecological preservation and developmental needs;

iii) to examine the existing facilities of public distribution system and to suggest measures for its improvement;

iv) role of women in the socio-economic development and community leadership; and

v) to examine the planning and promotion of tourism and to integrate it with socio-economic and cultural development.

4. TA/DA of the official members will be met by the respective Departments/Organizations to which they belong. TA/DA of non-official members will be met by the Planning Commission.

5. The Sub-Group may complete their deliberations and place their findings before the Task Force within two months from the date of this O.M. The meetings of the Sub-Group may be held at New Delhi or at any such place in the Himalayan Region as is considered necessary.

Sd/-
(R.S. Saksena)
Director(Administration)

To

1. All mambers of the Sub-Group.
2. S.A. to Deputy Chairman, Planning Commission, New Delhi.
3. P.S. to Member(S), Planning Commission, New Delhi.
4. P.S. to Member-Secretary, Planning Commission, New Delhi.
5. Secretary to Chief Minister of the respective States/UTs in the Himalayan Region.
6. Chief Secretary of the respective States/UTs in the Himalayan Region.
7. All members of the Task Force on Eco-Development of Himalayan Region.
8. Member-Secretary of the Task Force on Eco-Development of Himalayan Region.

Sd/-
(R.S. Saksena)
Director(Administration)

ANNEXURE-XI

Classification of Land-use

(Thousand Hectares)

State/ Year	Geographical Area	Reporting area for land utilisation statistics	Forest	%age under Forest	Not available for Cultivation		Total Col. 6&7	Permanent pasture & other grazing land	Land under misc. trees crops & grasses not included in net area	Cultivable waste lands.	Total 9,10 & 11	Fallow land other than current fallow	Current fallow	Total 13 and 14
					Area put to non-agriculture	Barran & Cultivable land								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Sikkim (1978-79)	730	714	260	36.3	70	209	279	103	4	1	108	1	-	1
2. Himachal Pradesh (1977-78)	5567	3002	2172	38.9	198	156	354	1024	47	136	1207	4	51	55
3. Jammu & Kashmir (1977-78)	22224	4674	2189	15.2	333	230	563	124	102	149	375	8	86	94
4* Uttar Pradesh	29441	29809	3404	40.0	2218	1146	3364	298	679	1338	2315	607	932	1539
5. Arunachal Pradesh	8358	5550	5154	1.7	-	19	19	-	50	85	135	105	25	130
Total:	66320	43749	14888		2819	1760	4579	1549	882	1709	4140	725	1094	1019

*Figures for U.P. in Cols 2 & 3 are for the whole State.
Figures in Col. 5, taken from Report of Study Group A, P 41.

ANNEXURE-XII

Irrigated Area

(Thousand/Hectares)

State/Union Territory	Net Area Sown	Total Gropped Area	Area Sown more than once	Net Irrigated Area	Gross Area Irrigated	% of gross area irrigated to total cropped area
1	2	3	4	5	6	7
1. Himachal Pradesh 1978-79	561	935	374	89	156	16.68
2. Jammu and Kashmir 1978-79	724	990	266	305	405	40.91
3. Sikkim	61	65	4	10	10	15.38
4. Uttar Pradesh	17482	24300	6818	8892	10575	43.52
5. Arunachal Pradesh	112	128	16	24	24	18.75
Total	18940	26418	7478	9320	11170	42.28

ANNEXURE-XIII

SOCIAL FORESTRY IN THE EIGHT HILL DISTRICTS OF U.P.

It has been calculated that at the present rate of population increase in the hills, and at the present rate of increase in cattle numbers, the carrying capacity of fuel and timber forests will be exceeded in the year 2031, and the carrying capacity of pastures and fodder forests, even supposing that pastures are protected and grazing controlled, will be exceeded in the year 1986.1/

It is therefore a matter of extreme urgency to regenerate pastures and fodder forests, to establish fuelwood plantations, to improve the stands of timber forests, to check the increase in human population, and to reduce cattle numbers. The consequences of failing to do so will be disastrous both to the people of the hills and to the people of the adjoining plains. Damage to the national economy will be enormous.

The primary aim of social forestry must be to provide the hill population with sustainable supplies of their basic needs of fuel and fodder. The cash economy of commercial forestry, private or public, should be subservient to the population's basic needs. Interference with the population's life style should be kept to the minimum consistent with the urgency of the situation so as to diminish the risk of social disturbance. Acceptance of unavoidable changes can be prepared for by educational and public relations programmes.

It has been estimated that approximately 10,000 km^2 of land needs to be afforested with fuel and fodder plantations, in the proportion of 2 : 1 in order to provide the resident hill village population with substainable supplies of fuel and fodder. 2/ About 9,500 km^2 of this is available as Civil & Soyam Land (mostly bare of trees, except where recently planted under programmes of the Civil Forest Deptt.) and as Panchayati Forest (usually badly managed and degenerate). The balance may need to be made up by reclassification of Reserved Forests.

This available land is unequally distributed over the populated area as allocations to over 15,000 villages of varying sizes. To be effective, plantation sizes must be adjusted to the per capita requirements in each village or group of villages. Programme implementation on the ground must therefore be given great flexibility.

Pasture improvement and fodder forest plantation

Great stress needs to be laid on the importance of fodder trees, because they are the main and, perhaps, the only source of green fodder in the winter and summer months, because the total yields of leaf plus grass are considerably greater than those of grass alone, and because the economic interests of village power groups lead them to stress the value (to them) of pine and other timber species. Totally unafforested grassland is appropriate only to alpine pastures above the tree line and to a few areas of low gradient pasture, with the exeception of areas totally closed to grazing. Species and varieties of fodder trees need to be chosen with regard to altitude, aspect, soil, and village preferences.

1/ Dr.S.L. Shah, Presidential address to the forty first All-India Agricultural Economics Conference, December 25th, 1981.

2/ Shri Madhava Ashish associated with J.C. Nautiyal and M.G. Jackwon, Papers presented to the Task Force sub-group on Socio-Economic development.

Fuelwood forests

The forester's ingrained habit of thinking of forests in terms of mature timber trees must be abandoned in the context of fuelwood plantations The purpose of a fuelwood plantation is to produce the maximum biomass per hectare which can be used as fuel within the shortest possible time at sustainable rates. Very close planting of quick growing species is recommended, preferably of coppicing varieties and preferably by hand seeding, which should be ready for their first thinning in four to five years. Multi-purpose trees may be tried in some locations (fodder-fuel-timber) but it must be clearly understood that their multi-purpose nature in no way reduces the total area of forest needed to supply a village with fodder, fuel and timber. Similarly, though inclusion of nut, fruit, and flowering trees is highly desirable, any area needed for them must be added to and not substracted from the area needed for fuel and fodder trees.

General Plan (First Alternative)

Social considerations demand a medium to long term afforestation programme, spread over fifteen to twenty years, which will permit the population to adjust gradually to changing circumstances, permit time for reduction in cattle numbers, and time for upgrading cattle breeds. The urgency of the situation prohibits a longer plan period.

For the purpose of the afforestation programme only, it is proposed that the eight hill districts of U.P. should be divided into four zones (A.B.C.D.) of approximately equal population numbers. These will be afforested on a rotational schedule, spread over a total period ofsixteen years.

By dividing the areas populationwise, it is expected that the required fuel and fodder forest areas, calculated on a per capita basis, will be approximately equal in each zone, i.e. about 250,000 ha. This includes Panchayati forests, where established, and existing social forestry plantations, so that the actual area to be planted may be considerably less. The average area per village should be around 66 ha. divided into 6.6 ha in year 1, 13.2 ha. in year 5, 19.8 ha in year 9, and 26.4 ha. in year 13. Actual variations between villages will be considerable.

Planting Schedule

Year 0. Education, Public Relations, preparation of nurseries, and preliminary survey in zone A.

Year 1. Walling and planting of ONE TENTH of the required area in every village in zone A.

Preliminary survey and nurseries in Zone B.

Year 2. Walling and planting of ONE TENTH OF the required area in every village in Zone B.

Preliminary survey in Zone C. etc.

Year 3. As above for Zone C (Planting) and Zone D (Survey etc.).

Year 4. As above for Zone D. (Planting).

Year 5.6. 7&8 Walling and planting of TWO TENTHS of the required areas in Zones A.B.C.&D. respectively.

Years 9,10 Walling and planting of THREE TENTHS OF the required areas
11& in Zones A,B,C, & D respectively.
12

Years 13. Walling and planting of the final FOUR TENTHS of the required
14.15&16 areas in Zones A.B.C. & D. respectively.

This Planting schedule aims to provide a gap of three years betweet the enclosure and planting of an area in any one village and the next planting in the same village. This is sufficient time for regeneration of grasses within the enclosure. Increased grass yields, which may be two to six times the original, insure the farmers against loss due to enclosures, while permitting progressively larger areas to be enclosed. Thus the programme may be completed within sixteen years without materially reducing fodder supplies at any time, even though large areas are removed from grazing.

The complexity of the planting schedule is organisational and is the concern of the administrator. The villager needs only to know that the programme will affect him every fourth year, that the area to be planted will be larger each time without loss to himself, and that he will have twelve years to adjust himself to new forms of cattle management.

Afforestation of the whole areas required in any one village in only one year is definitely not recommended. The purpose of staggering the planting is:

(a) The impact of interference with traditional cattle management systems is softened.

(b) Natural increase in yields of grass from small enclosed plots afforested in the first years of the programme will offset reduction in grazing areas due to later enclosures.

(c) Every village within each zone can be treated simultaneously, thus reducing inter-village rivalry over scarce resources. ('If we don't cut it, our neighbours will steal it.')

Allocation of fuel and fodder resources

In order to obtain cooperation from the village populations in maintaining the programme, it is absolutely essential that fuel and fodder resources to fairly distributed. Since the collection of fuel and fodder is predominatly, if not entirely, in the hands of the women, distribution of these resources should be handled by the women themselves. Women's Panchayats may be established for this purpose. The manner in which they make fair division may be left to them subject to post facto review by the Civil Forest Department and/or the District Magistrate. However, it is suggested that lopping rights on fodder trees may be allocated to individual families/landholders in respect of identified trees. Only thus can fodder trees be saved from destructive lopping. Destruction occurs because all fodder trees being common property, what one individual does not cut will be taken by another. On the other hand, personal rights which will be exercised year after year on the same trees engender an interest in maintaining sustainable yields. One had only to compare conditions of fodder trees in community forests with those standing on private land to appreciate the truth of this statement.

Programme interdependence

Implementation of several other programmes is indissolubly linked with the success of fuel and fodder plantations.

(a) Reduction in cattle numbers and their replacement with improved breeds whose yields will more than compensate for lesser number.

(b) Action against uncontrolled grazing by goats (preferably prohibition) which can be excluded from plantations only with great difficulty. Goats cause high mortality in fodder tree seedlings.

(c) Encouragement of stalk feeding of cattle with properly designed non-waste mangers, preferably associated with chaff-cutters.

(d) Introduction of a metal ploughshare to replace the short-lived wooden share.

(e) Reduction in bullock numbers. This may follow:

i) Improved bullock utilisation, as a consequence to consolidation of land holdings.

ii) Encouragement of horticulture, which requires no bullocks.

iii) Improvement in bullock maintenance leading to stronger animals which do more work more quickly. F.G. one well maintained cross-bred bullock with proper harness can do the work of two ordinary hill bullocks.

(f) Long term and persistent educational courses and public relations programmes, designed to create an atmosphere of thought in which stall feeding and/or controlled grazing practices will be accepted by village people.

(g) Planned provision for watering of cattle in village water supply schemes.

(h) Cooperation between the Forest Department and Municipal bodies to set aside and replant Reserve forests and Municipal Forests for town fuel supplies.

(i) Special arrangements may be required to supply fuel to roadside bazaars whose shops have a high fuel consumption and which often carry an appreciable number of government employees with no local rights.

(j) Steps are required to check the excessively high fuelwood consumption by turpentine factories (reported to use 2 kg pinewood for every kilo of turpentine retrieved). This could be checked by relegating all turpentine factories to the plains where coal can be used. Such a step would simultaneously check the widespread corruption associated with these factories in the hills.

ANNEXURE-XIV

ECONOMICS OF PRINCIPAL CROPS IN HILL AREAS, EVALUATION OF TRADITIONAL AND NEW TECHNOLOGY

(Irrigated Valleys and unirrigated up-lands) 1979-80 (Rs./hectares)

Name of the crop		Total valuable cost	Yield (Quintals)		Gross revenue	Not returns	Benefit-cost ratio
			Grain	Crop- Residues			
1		2	3	4	5	6	7
Kharif (rainy season)							
1. Paddy (Irrigated)	Local	2,944.83	17.44	26.16	3,043.28	98.45	1.03
	Improved	3,280.39	25.84	38.76	4,509.08	1,228.69	1.37
2. Soybean	Local (Bhatt)	1,830.55	7.55	9.21	1,648.15	(-)182.40	0.90
	Improved (Bragg)	2,240.82	19.50	24.00	4,260.00	2,019.18	1.90
3. Maize	Local	1,865.00	17.09	-	1,879.90	14.90	1.00
	Improved	2,137.28	28.58	-	3,143.80	1,006.52	1.47
4. Wheat	Local	2,345.52	10.48	15.72	1,545.80	(-)799.72	0.66
	Improved	2,746.40	24.15	36.23	3,562.20	815.80	1.30
5. Pea	Local	2,263.70	7.56	11.34	2,712.34	448.64	1.20
	Improved	2,674.96	19.66	29.49	7,053.52	4,378.56	2.64

Source: Forty-First All India Agricultural Economics Conference, December 25, 1981.

ANNEXURE XV

ECONOMICS ON FRUIT PRODUCTION AND BENEFIT COST RATIOS: 1979-80

(Rs./hectare)

Name of the fruit	Plant population (Nos.)	Total yield (quintals)	Total returns	PVUS* of returns	Total costs	PVUS* of total costs	Gross benefit-cost ratio
1	2	3	4	5	6	7	8
1. Apple	400	2,620	2,62,000	37,336.60	59,175.00	16,239.00	2.30
2. Plum	400	2,215	1,10,750	23,925.55	25,200.00	10,779.75	2.22
3. Walnut	100	2,564	7,69,200	45,817.50	47,437.00	9,296.05	4.93

*PVUS - Present value of uniform series.

Source: Forty-First All-India Agricultural Economic Conference, December 25,1981

COSTS OF AND RETURNS FROM VEGETABLE PRODUCTION: 1979-80

(Rs./hectares)

Name of the vegetable	Costs				Returns				
	Operational cost	Material cost	Interest in working capital @12%	Total valuable cost	Yield (quintals)	Price/ quintal	Total returns	Net returns	Benefit cost ratio
1	2	3	4	5 (2+3+4)	6	7	8	9 (8-5)	10 (8-5)
1. Potato (rabi)	1,688.00	5,566.06	333.90	7,587.96	140.80	100.00	14,000.00	6,412.04	1.85
2. Capsicum	1,441.60	1,341.98	80.52	2,864.10	35.00	250.00	8,750.00	5,885.90	3.06
3. Pea	1,201.55	1,669.50	100.25	2,971.30	62.50	150.00	9,374.00	6,403.70	3.16
4. Cauliflower	1,504.45	1,463.51	87.84	3,055.80	48.25	180.00	8,685.00	5,629.20	2.84

(*Source: Forty-First All-India Agricultural Economics Conference, December 25, 1981.

ANNEXURE XVII

Comparative Analysis table of Research Institutions

	Organizational	Objectives	Funding	Results
I.C.A.R.	Centralised, with field units, coordinated and with good inter-disciplinary work.	Linked to Agriculture Policies and Operations - Clear Crop-wise and regional objectives.	Central and Single source	Good in wheat HYV, more limited in rice. Very limited for Himalayan region.
I.C.S.S.R.	Centralised	Unrelated to specific development policy objectives and operations Largely ad-hoc though recently leaning towards rural development.	Central and Single source	Insignificant for development planning and operational purposes. No relevance to Himalayan region.
Himalayan Region Universities.	Decentralised, but links with UGC, State Governments and Central Funding Agencies.	Not yet related to regional development problems and planning in practical terms, despite desires. No specific manpower training or development objectives.	Diffused between Central and State Agencies Research funding largely ad-hoc for Ph.D theses unrelated to sustained eco-development policy objectives.	With some exceptions insignificant, and not yet functionally related to eco-development policy objective of the region.
Research Institute having a relation to Himalayan region problems e.g. FRI, Wadia Institute, Central Soil and Water Conservation, Vivekananda Krishi Anusandhan Shala, Almora.	Central and State Govt. bodies. -Each in a specific sectoral sphere, with little inter-disciplinary work.	Not effectively related to regional inter-disciplinary eco-development problems	Centre and State, but largely Central.	Limited in most cases.

ANNEXURE XVIII

The Significant & Potential Himalayan Eco-Development Institutions

I. EASTERN HIMALAYA

A. Sikkim & Darjeeling

1. Botanical Survey of India, Gangtok
2. Zoological Survey of India
3. Geological Survey of India, Gangtok
4. Sikkim Mining Corporation, Gangtok
5. Sikkim Aromatics and Distillaries, Gangtok
6. Government Cottage Industries Production-cum-Training Institute, Gangtok.
7. Industrial Training Institute, Rangoo
8. Oentres for SISI and KVIC, Gangtok
9. Sikkim Industrial Development and Investment Corporation, Gangtok
10. Land Use Board, Government of Sikkim, Gangtok
11. ITDC Centre for Tourism, Gangtok
12. Sikkim Research Institute of Tibetology, Gangtok
13. ICAR Complex for North-East Region, Tadong, Gangtok
14. Cardamom Research Centre, Pangthang, Head Office at Tadong, Gangtok, Sikkim (Cardamom Board).
15. Department of Agriculture, Government of Sikkim, Gangtok.

15A. Department of Animal Husbandry, Government of Sikkim, Gangtok.

16. Survey of India - Ranjit Project, Gangtok.
17. Government Horticulture Centre, Kalimpong
18. Lloyd Botanic Garden, Darjeeling
19. Padamaja Naidu Himalayan Zoological Park (NHZP), Darjeeling
20. Hill Development Council - a statutory body set up by the Government of West Bengal (Secretary: Shri A.K. Deb, Deputy Commissioner Darjeeling, West Bengal).
21. Small Farmers' Development Agency, Darjeeling (West Bengal) under the Planning and Development Department, Government of West Bengal.
22. Comprehensive Area Development Corporation, (6-A, Raja Subodh Mallick Square, 9th Floor, Calcutta-13) - an autonomous corporation set up by the Government of West Bengal.
23. Directorate of Cinchona and Other Medicinal Plants, Mungpoo (District Darjeeling) - Government of West Bengal.
24. Indian Agricultural Research Institute - Research Centre, 8th Mile, Kalimpong (District Darjeeling)
25. Potato Seeds Multiplication Centre, Rongbull, Darjeeling (West Bengal).
26. Forest and Environmental Research Institute Sonada (District Darjeeling)

27. Central Sericulture Research Station (Government of India) 7th Mile, Kalimpong, Distt. Darjeeling.

28 Rural Industries Project, Darjeeling - Cottage and Small Industries Department, Government of West Bengal.

29. West Bengal Forest Development Corporation Ltd., Divisional Office, Kalimpong (Distt. Darjeeling).

30. Dairy and Poultry Development Corporation Ltd., Darjeeling (West Bengal)

31. Indian Council of Agricultural Research - Research Centre, Gangtok, Sikkim.

32. Indian Institute of Hill Economy, Hayden Hall, Laden Lal Road, Darjeeling - A voluntary agency.

B. Arunachal

1. Survey of India.
   i) Ranganadi Hydro-electric Project
   ii) Dihang Dam Project
   iii) Subansiri Dam Project (DST Sponsored Projects).

2. Geological Survey of India, Itanagar.
3. Botanical Survey of India, Itanagar
4. Orchid Research & Development Centre, Tipi, Subansiri District.
5. Nature Loving Society, Itanagar. (Supported by World Wild Life Fund).
6. Forest Resource Survey - FRI sponsored programme in Kameng and Subansiri District.
7. Social Welfare Advisory Board, Itanagar.
8. Health & Education -
   i) Ramakrishna Mission Ashrams
   ii) Vivekananda Kendra
   iii) Sharda Mission
   iv) Shankara Mission Centres at Tawang (Mameng), Along, Senua (Tirap) and Pasighat (Siang) for Leprosy Eradication Programme.
9. Adim Jati Seva Singh, Itanagar.
10. Mahila Imdad, Itanagar.

(Note: The development activities are mainly being conducted through the State Government Department).

II. NORTH EAST INDIA

1. The Geological Survey of India, Shillong
2. The anthropological Survey of India, Shillong
3. The Botanical Survey of India, Shillong
4. The Zoological Survey of India, Shillong
5. The Survey of India, Shillong

6. The Central Ground Water Board, Shillong/Gauhati
7. The Atomic Minerals Division, Shillong
8. The Indian Council of Social Welfare, Shillong
9. The Tribal Research Institute, Shillong
10. Central Plantation Crop Research Institute - Sub-Station, Gauhati.
11. Jute Agricultural Research Institute, Sub-Station, Sarbhog, Assam.
12. Central Potato Research Institute, Sub-Station, Uppre, Assam.
13. Regional Research Laboratory of CSIR, Jorhat (with units in other States and Union Territories of N.B. Region).
14. Toklai Tea Experimental Research Station, Jorhat.
15. Indian Tea Board Centre, Gauhati
16. Indian Coffee Board Centre, Gauhati
17. Sericulture Research Station of Central Silk Board, Titabar, Jorhat.
18. Coordinated Project Centre of Composite Fish Culture and Air Breathing Fishes, Gauhati.
19. Forest Survice College and Research Institute, Burnihat, Meghalaya.
20. ICAR Complex, Shillong
21. ICAR Complex, Imphal.
22. National Bureau of Soil Survey and Land Use Planning, Jorhat
23. ICAR Krishi Vigyan Kendra, Jorhat
24. ICAR Krishi Vigyan Kendra, Shillong
25. Institute of Peoples' Action, Wanglahul, Manipur
26. Manipur State Kala Academy, Imphal
27. Jawaharlal Nehru Manipuri Dance Academy, Imphal
28. Manipur State Museum, Imphal
29. Loktak Down-Stream Hydel Project (DST Project) Imphal
30. Flood Management Survey (DST Survey Project)
31. Brahmaputra River Board, Gauhati
32. ICAR Complex, Aizhal (Mizoram)
33. Assam Science Society, Gauhati
34. Institute of Advanced Studies in Science, Gauhati
35. Himalaya Seva Sangh, Manipur Branch, Imphal
36. Directorate of Tribal Welfare, Government of Manipur, Imphal
37. Directorate of Economics and Statistics, Government of Manipur, Imphal
38. Directorate of Industries, Government of Manipur, Imphal
39. Directorate of Agriculture, Govt. of Manipur, Imphal
40. Nagaland Gandhi Ashram PO Chuchu Yimlang, District Mokokchung-798614 Nagaland.

III. CENTRAL HIMALAYA

1. Botanical Survey Regional Centre, Dehradun
2. Zoological Survey of India, Dehradun
3. Geological Survey of India, Dehradun
4. Survey of India, Dehradun
5. Wadia Institute of Himalayan Geology, Dehradun
6. Petroleum Institute of India, Dehradun
7. Central Soil and Water Conservation Research Training and Demonstration Institute, Dehradun.
8. Indian Photo-Interpretation Institute (IPI) Dehradun (National Remote Sensing Agency).
9. Forest Research Institute & Colleges, Dehradun
10. Vivekananda Parvatiya Krishi Anusandhan Shala, Almorah
11. Appropriate Technology and Development Academy (ATDA) Lucknow
12. Planning Research & Action Division (PARI) Lucknow
13 Hill Development Board, Lucknow
14. DST Survey Project:-
    i) Flood Control Survey, Lucknow
    ii) Surju Nahar Project, Lucknow
15. National Botanic Research Institute, Lucknow
16. Central Drug Research Institute, Lucknow
17. School of Hydrology, University of Roorkee
18. Water Resources Development Training Centre, University of Roorkee.
19. Indian Veterinary Research Institute, Muktesar.
20. Central Potato Research Institute, Sub-Station, Muktesar.
21. Dasholi Gram Swarajaya Mandal, Gopeshwar, Chamoli
22. Oil & Natural Gas Commission, Dehradun
23. Central Institute of Agricultural Implements (Bhopal)
24. Pre-Investment Survey of Forest Resources, Dehradun
25. Logging Training Centre, Dehradun
26. State Council of Science & Technology, Lucknow
27. Defence Science Laboratory, Regional Station (Agri) Joshi Math, Garhwal.

IV. WESTERN HIMALAYA

1. Central Potato Research Institute, Simla
2. Genetic Resource & Horticulture Research Centre, Mashobra (Simla).
3. Wheat Breeding Station (IARI) Simla
4. Centre for Conifer Research (FRI) Simla

5. Institute for Advanced Studies, Simla
6. Agriculture Economic Research Centre, Simla (Attached to Himachal Pradesh University).
7. State Institute of Public Administration, Fair Lawns, Simla
8. Central Research Institute, (Ministry of Health and Family Welfare) Kasauli
9. Biological Control Laboratory (Department of Plant Protection and Storage. Solan.
10. Regional Centre of the Zoological Survey of India, Solan
11. Pre-Investment Survey of Forest Resources (Department of Forests) Ministry of Agriculture, Simla
12. Labour Bureau (Ministry of Labour) Simla
13. Plant Pathological Research Station of the Indian Agricultural Research Institute, Simla.
14. Wheat Breeding Research Station of the Indian Agricultural Research Institute, Simla.
15. Research Station of the National Bureau of Plant Genetic Resources (NBPGR) Simla.
16. Flood Control Survey in J&K (DST) Srinagar
17. Thein Project (DST Survey) Srinagar
18. Dul Hasti Hydro-Electric Project (DST Survey) Srinagar
19. Shahpur Kandi Project (DST Project)
20. Sutlej Basin Survey (DST Project)
21. Regional Research Laboratory, Jammu
22. State Council of Science & Technology (DST) Srinagar
23. Defence Science Laboratory Station (Glaciology) Manali, H.P.
24. Defence Science Laboratory Station (Agri) Leh, Ladakh, J&K.

Indicative List of Priorities for Research Studies

Priorities for Western/Central Himalayan Region

1. (a) Drying up of hill springs and the geomorphological/ hydrological studies of springs for their preservation, a basic priority for the hillman's future water needs.

   (b) Survey utility and costs/benefits of irrigation water storage tanks lined with black polythene sheet, with sufficient capacity for irrigation of 1/5th hectare, (i) fed from perennial springs, (ii) filled by collection of surface rainwater. Study evaporation rates of stored water.

   (c) Techniques of water harnessing and harvesting.

   (d) Additional economic returns from irrigation from water harvesting.

2. The inter-related problems of grazing, animal husbandry, deforestation, soil conservation, fuel/fodder needs:

   (1) Study inter-dependence of Livestock and Agriculture in the context of hill soils, particularly in unirrigated areas. Determine desirable application crops, to improve moisture retention, and to keep cultivated land in health. Compare quantities of FYM/ha. required under different systems of land management/crops/orchards. Try to establish figures for numbers of livestock which should be maintained to supply the required FYM/ha. with reference to alternative systems of livestock/pasture management.

   (2) Establish maximum grazing incidence of all types of livestock which would permit recovery of degraded pastures under uncontrolled grazing, as currently practised.

   (3) Establish number of livestock/ha. maintainable under alternative systems of pasture management.

   (4) Produce formulae for estimating desirable proportions between (a) fodder production from a fixed area of land under grass and fodder trees, (b) numbers of livestock that can be properly maintained, (c) area of cultivation that can be supported from that area, for alternative systems of fodder management, livestock management, and crops/cultivation practices.

   (5) With respect to these proportions, produce estimates for the entire region of surplus/deficit of livestock and excess/deficit of cultivated land. Suggest remedial measures.

   (6) Study social/cultural constraints on introduction of remedies, with particular attention to politicised vested interests and their effects on panchayat decisions.

(7) Study alternative systems of ownership/management of commonly held pasture and fodder forest - institutional, cooperative, private - in relation to desirable social/ psychological incentives. Suggest legislative measures that may be required.

(8) Survey proposal for distribution village fodder/forest resource areas as individually controlled plots or as individually allocated trees to existing village families as a means to overcoming the abuse of land resources over which the village community holds common rights Survey feasibility of forming women's panchayats to manage all fodder resources. Consider combination of fuelwood plots controlled by forest panchayats with individual control of fodder forest lots or trees.

(9) Study and recommend appropriate upgrading of cattle breeds in relation to nutritive levels of locally available fodders, selective upgrading of local non-descripts, introduction of improved Indian breeds, exotic crossbreds or purebreds. Study effects on milk yields and bullock utilisation.

(10) Study problem of bullock under-utilisation and suggest remedies. Study social resistance to reduce bullock numbers with higher utilisation. (Note: the problem varies with altitude. Higher altitude land has longer duration crops, because of lower temperatures, and therefore shorter periods between harvest and sowing).

(11) Determine minimum area of land at different locations and altitudes required to support one cow or buffalo giving 8-10 lts. per day on local fodders: (a) under existing conditions, (b) under stall-fed conditions, (c) under various combinations of stall-feeding and graing for different seasons and with combinations of current and improved methods of agriculture, horticulture, and pasture/forest management.

(12) Determine forest productivity/ha./annum for differing locations, altitudes, and tree species, in terms of timber, firewood, fodder leaves, fodder grasses, and secondary forest products, and with reference to different planting/management.

(13) On the basis of item 12, determine optimum species/ management systems for fuel production (social forestry) for single purpose or multi-purpose forests at different altitudes and locations.

(14) Survey population fuelwood requirements, making allowance for increasing demands and utilisation with increased population, improved availability, and improved standards of living. Determine per capita annual requirements and forest areas needed to maintain sustained yields of these requirements. In the context of oil and power shortages, and of transport costs of coal, this survey should be made on the assumption that alternative fuels are neither available nor desirable. Solar, wind, and biogas resources are as yet unproven and should not be considered, unless the survey shows that it may be impossible to obtain sustained yields of both fuel and fodder from available afforestable areas.

(15) Test fuel efficiency of smokeless chulas, study costs and social acceptability. (Note that traditional open heart with no chimney, though smokey, is an efficient house warmer in a cold climate. A longer than normal stove-pipe for a smokeless chulha kept inside the room and existing through the roof, keep excess heat within the house).

(16) Study methods for improving manurial value of rotted pine needles (these are reputed to cause soil acidity).

(3) Integrated plans for the preservation of lake systems, especially in Kumaon and Kashmir, and their water, fish and tourism resource potentials, maintaining the health of eco-systems for sustainable productivity.

4. Snowmelt, siltation, and more intensive studies of micro-climatic changes, with impact on flora and fauna to test the thesis of "Glacier retreat and the warming of valleys".

5. Socio-economic impact of sizable migration out of the region.

6. (a) Environment impact on human health, mainly water borne diseases and family planning/welfare.

(b) Sociological factors making for better family welfare and family planning results for population control.

7. Mass scale seed collections of trees/shrub species for rearing saplings.

8. Set up a net work of nurseries of plants of economic value - also in collaboration with forest departments, and social action groups.

9. Tree planting programme.

10. Survey for future aerial seed broadcasting programme to reforest degraded/landslide areas.

11. Design, manufacture, test and introduce an iron substitute plough share for the current wood share. (Only the share is required, not the plough body). An acceptable ploughshare would serve thousands of trees annually.

Priorities for Eastern Himalayan Region

1. Shifting cultivation and prospects of zerominimum tillage.

2. The rodent problem.

3. The decline in citrus, a major fruit potential.

4. Prospects for micro and mini-hydel schemes upto 100 KW.

5. Environmental impact on human health and family planning and welfare.

6. Socio-economic and environmental impact of immigration in N.E. India.

7. Studies on tribal culture, languages/dialects.

8. Inter-disciplinary studies to account for the declining acqua-culture and to suggest remedial measures.

9. A survey for scientific analysis on 'malady-remedy' basis for sick cottage/handloom industries.

III. General Priorities

1. soil/water conservation - reliable productive capabilities and economic answers to the problem on scale.
2. The prospects for the implementation of the concept of community management of local resources e.g. forests and water.
3. Case studies of the limitations of forest laws and actualities in the field.
4. remote sensing surveys of priority eroded and land-slide prone areas requiring priority afforestation and soil/water conservation e.g. Alaknanda Valley.
5. Inter-disciplinary studies on watershed eco-system, restoration technology and human development.
6. Collection of germ-plasm before further disappearance.
7. Studies on crop potential of horticulture development of temperate and sub-tropical vegetable and fruit crops for: Crafting, budding, dwarfing and disease resistance for higher yields.
8. Post harves technology for all major fruit, vegetable, and other crops, referring to: storage, standardisation, transport and marketing system and cold/air-conditioned transport of perishables.
9. Research gaps in animal breedings, feeding and management suitable for hill areas.
10. Pilot agro-forestry scheme for sub-tropical and temperature regions, with landuse planning.
11. Carrying capacity studies of human and animals in representative eco-systems, with existing and more developed technologies.
12. Studies of the complimentary role of men and women in hill economics.
13. Women's education/health and welfare.
14. Impact of tourism on local environments and cultures.
15. The building blocks for inter-sectoral work in coherent sub-groups for Himalayan development work in regional hill universities, ICAR hill institutions, and the proposed Centre.
16. Documentation of action programmes for mutual learning processes for the benefit of local people, official agencies and the academic community.
17. Wild-life preservation studies in Game/Wildlife sanctuaries on inter-disciplinary basis: endangered species; preservation of habitat and man-live stock and wild life problems and management
18. Water resources and their use, rivers, tanks, ponds, water table, ground water, rainfall, drainage pattern etc. Water use for agriculture, human needs, industrial needs, waste-water disposal patterns.

19. Human health and diseases -

- Air/water-borne diseases
- Warm infestations
- Cancer
- Leprosy
- Goitre
- Anemia and others.

20. Use of pesticides and their impact on human health, insectbird faune, acqua-culture and apiculture.

21. Infantile mortality and child health care.

22. Studies on high altitude rainshadow area eco-system.

23. Energy resources and their use: sources and levels and patterns of consumption.

24. Survey of natural energy resource potential and development of efficient energy harness technology: Water/Wind/Solar/ Geothermal/Biomass.

25. Survey of mineral resources; minerals, mines, metals and related industries.

26. Environmental degradation patterns: land, forests, grasslands, through erosion, grazing, tree-felling, road construction, cultural practices etc.

27. Sources of pollution and levels of pollution inland. water and air.

28. Plan for eco-system enrichment and development activities.

Annexure XX

Area and production of apples during 1979-80 in some states.

State	Area in 1000 ha.	Percentage of total area	Production in 1000 tonnes	Percentage of total production	Production per ha.
1. J&K	56.00*	40.32	470.00	65.40	8.39
2. H.P.	42.43	30.35	146.41	20.37	3.45
3. U.P.	38.00	27.36	95.00	13.22	2.50
4. Arunachal Pradesh	2.31	1.66	6.72	0.93	2.91
5. Sikkim	0.10	0.07	0.20	0.03	2.00
6. Manipur	0.06	0.04	0.30	0.04	5.00
	138.90	100.00	718/63	100.00	5.17

* According to the representative of the State Govt. J&K area was 52,000 ha. and production was 400,000 tonnes..

Sources:- Deptt. of Agriculture & Cooperation (Horticulture Division), Govt. of India.

Annexure XXI

Area and production of some of major fruits in the North Eastern Region.

A= Area in 1000 hectares

B= Production in 1000 tonnes.

State/UT		Pineapple	Orange	Other citrus	Banana
1		2	3	4	5
1. Arunachal Pradesh	A	0.256	1.667	-	-
	P	2.480	1.719	-	—
2. Assam	A	3.40	2.00	1.10	20.00
	P	34.00	17.00	9.00	260.00
3. Manipur	A	6.02	4.00	1.60	2.875
	P	75.30	28.00	9.40	39.327
4. Mizoram	A	0.21	0.38	-	0.9
	P	1.56.	1.73	-	2.4
5. Meghalaya	A	7.30	4.80	2.00	8.50
	P	43.00	28.00	15.00	7.50
6. Nagaland	A	0.11	0.36	-	-
	P	1.61.	1.20	-	-
7. Tripura	A	2.83	1.21	-	2.8
	P	10.00	8.50	-	16.0
Total:	A	20.126	14.417	4.70	35.075
	P	167.518	86.349	33.40	327.227
Average Yield/ha.		8.32	5.90	7.10	9.33

Source: Basic statistics - 1979
North Eastern Council, Shillong.

Annexure XXII

Projections of Apple Production in the three major apple producing States.

(1000 Tonnes)

	J & K	H.P.	U.P.	TOTAL
1985	569.90 (500.00)	457.84	164.03	1191.47
1990	711.95	578.09	204.78	1494.82
1995	854.30	648.34	245.53	1748.17
2000	996.65	818.59	286.28	2101.52

Figure in bracket was reported by the representative of the States Government of J&K.

STRAW PROMISES RICH HARVEST

(Extracts of News item reported in Hindustan Times dated 17.11.81)

LONDON: Fruit boxes made from waste straw which would other wise have been burned in the fields, will start coming off from production line this week.

It will be the culimination of an idea which came to a young Kent designer and inventor during the 1973 energy crises.Now after seven years of development work and financial difficulties, Mr. Kenneth White, 36, sees h is visison made real in a facotry at Sittingbournes.

The production machinery, was delivered last week and trial production runs are expected to start today or tomorrow.

Mr. White's company Straw Box Systems has secured 3,00,000 in financial backing from a city development capital organisation and an international chemical firm which helped to develop waterproof resins to bond chopped straw to make tough, weather-proof and cheap boxes and trays.

About 100 million non-returnable boxes are used each year in Britain to market fruit and vegetables.

Mr. White's invention was first described in the Daily Telegraph in August last year. And the world has been beating a part to his door ever since.

Last week, two continental visitors turned up unexpectedly at the factory having taken a taxi from London "which must have cost them a fortune and a half", Mr. White said.

There is also interest from South America and Australia as well as European countries.

Although the Sittingbourne factory is intended to be a profit centre in its own right, producing straw boxes and board and eventually employing more than 40 people, a major part of the firm's growth is expected to come from Licencing manufacture overseas.

"The price of non-returnable packaging is high, and it is going up quite a lot now", Mr. White said, 'We are about 20 per cent cheaper than comparable fruit trays'.

Each year, about a quarter of the 10 million tonnes of straw produced in British farms as a by-product of the cereal harvest is burned.

Boxes made from straw have considerable ecological advantages. Apart from reducing the toll of trees they can, at the end of their life, be chopped up or ground and the material spread as mulch on the land.

(By arrangement with the Daily Telegraph London)

Extracts of the summary of recommendations of the Group on Perishable Agricultural Commodities relating to Transportation by rail and storage.

"29. With respect to Railways, the Group recommends that:

i) Covered sheds should be constructed at important rail heads to save losses to perishable due to high temperature, etc.

ii) There should be close liaison between the Railways and the National/regional marketing organisations for the smooth flow of fruit and vegetable traffic.

iii) The rail fare structure for fresh fruit and vegetables should be rationalised.

iv) In peak production season, fruit and vegetables should be given high priority for movement by the railways. National horticulture Board should have an officer to liaise with the Zonal Railways for advance movement planning.

v) Construction of railway sidings at big terminal markets for perishable products should be undertaken.

vi) Adequate number of covered wagons should be ensured at the important stations.

vii) High damages in perishable during rail transit should be minimised by ensuring quick transport, avoiding delays at transhit points and careful handling at loading and unloading stations.

viii) There should be improvement in wagon design. The wagon Climate experiment is being conducted by the MPDG with the help of FAO and the Railways to improve the design of rolling stock and in-transit involvement should be pursued.

ix) The production of dry ice may be encouraged as it can be used for keeping the wagons cool and in the distribution of pershables in the local markets.

x) Lables like "Perishables - Handle with Care" or "Rush-Perishables' can be pasted on the packages contained fresh fruits and vegetables.

xi) The growers should be represented on the railway Consultative Committee.

(3.17.5)

30. Sufficient facilities like storage should be provided at the international terminals so that export of fresh fruit and vegetables is speeded up. It is also necessary that suitable national airports should be put on the international map for export of fresh agricultural products.

(3.18.3)

31. For transportation of fruits from North-Eastern Region, export markets, linked to local air ports, may be developed. The cost of such air transportation from these areas may be neutralised by giving subsidy to make the commodities so transported competitive.

(3.18.4)

32. Inland navigation needs to be developed for the North Eastern States. More and more mechanised boats should be pressed into service for transport of persishables from Tripura, Mehgalaya, Mizoram, Manipur and Arunachal Pradesh to Calcutta.

(3.18.5)

33. Gravity ropeways, which are cheaper than mechanical/electrical ropeways, may be constructed for transport of perishables in hilly/ difficult areas.

(3.18.6)

Annexure XXV

MARKETING FRUIT RIPEN SLOWLY

(Extracts of news item reprinted in Hindustan Times dated 18.9.1981)

NEW DELHI, Sept. 17 (PTI)-

Bananas and other fruits such as apples, pears, plums, avocados and mangoes can now be prevented from over-ripening.

They are simply dipped in a solution that coats them in a thin film and delays the natural ripening process.

Delegates at the annual Conference of the British Association for the Advancement of Science held in York were told that trials had shown the new coating to be effective on these fruits.

With bananas it had allowed them to be transported from the Phillippines to Hong Kong in air temperatures of upto 32 deg. C. Normally they have to be carried in refrigerated ships at a temperature of 13.5 deg. C.

Tests with the coating, called prolong, are being carried out at Cambridge University's department of applied biology.

Two of the department's researchers, Mr. Nigel Banks and Mr. Garry Happer, told the conference that the coating was made up of a mixture of foodstuff molecules dissolved in water. It was cheap, non-toxic,water-soluble and easy to apply.

When fruits were dipped and left to dry, the thin film produced add the effect of reducing the torement of gases to the pores of the fruit.

The oxygen and carbondioxide mixture inside the fruit was thus modified, with the result that respiration was reduced and the rate of ripening slowed from five to about 12 days.

Although much work remained to be done on commercial development of the new coating, yet the Cambridge researchers said preliminary experiments had shown that it could retard the development of ripeness in both the skin and fruit pulp.

RECOMMENDATIONS OF NATIONAL SEMINAR OF SOIL EROSION AND STABILISATION OF HILL SLOPES HELD AT NEW DELHI IN MARCH 1969

The basic recommendations of the seminar were that:-

(a) Prevention of soil erosion and stabilisation of hill slopes calls for a coordinated approach, integrated solutions and agreed arrangements for implementation between Engineers, Geologist and Forest/Soil Conservation Scientists. The coordinated approach should be incorporated in a hill road Project right from its inception. A three tier arrangement was recommended as under:-

(i) A major road building organisation should have its own set up of geologists, forest and soil conversation scientists to progress the project in its various stages i.e. recee survey, construction and maintenance.

(ii) Special and complex problems should be tackled in collaboration with specialist agencies like CRRI/Geological Survey of India, Forest and Soil Conservation Department etc.

(iii) A standing committee comprising experts on various disciplines should be set up at National level to deal with problems on a national policy level and problems which are too intricate and cannot be solved by the above arrangements.

(b) Coordinated research should be organised to develop further soil mechanics and rock mechanics to analyse instability and failure of slopes and actuation and control of combined phenomenon of slides and avalenches and suitability of various plants, shrubs, grasses etc. for various terrain and climatic conditions at high altitudes. Potential of various research bodies regarding these problems be assessed and research coordinated.

(c) A central pool of funds should be created to finance scheme for prevention of soil erosion and stabilisation of hill slopes along road alignment.

(d) A speedy arrangement has to be worked out with specialist Organisation so that they can undertake study of a problem referred to them by road construction organisation, immediately by cutting short some of the formalities like preparation of estimates of cost, acceptance of same by indenting agency, making deposit in advance of the cost etc.

(e) A Cell for collection and maintenance of statistics with regard to experience gained on investigation, observation, prevention and coorective measures by various organisations should be established under the Central Government. This could be called Research Coordination and Statistics Cell.

Annexure XXVII

RECOMMENDATION OF SEMINAR ON LANDSLIDES AND TOE EROSION PROBLEMS WITH SPECIAL REFERENCE TO HIMALAYAN REGION: FEBRUARY 1975 AT GANGTOK (SIKKIM)

1. The type of failure of a slope and occurrence of landslide and toe erosion needs to be diagnosed, codified and published.

2. Long term studies to control the landslides effectively are needed.

3. Joint landslide Authority at the centre should be formed consisting of Forest, Soil conservation, Horticulture and Agriculture, Irrigation and Hydel, Geological Survey of India, Central Road Research Institute, Border Roads Orgsanisation, CPWD, Central Water Commission, Meteorological, Geotechnical and Air Photo Interpretation Departments. This agency should take up studies of the most vulnerable areas in concerted manner with all specialists in connected disciplines of service and Technology.

4. The Geological Survey of India should be requested to prepare landslide and land subsidence map of the Himalayas with special reference to the major slides.

5. Temporary and permanent measures to solve the landslide problems should be identified. Temporary measures will be limited to opening of the traffic for communications while for permanent measures detailed investigations should be undertaken to evolve permanent solutions.

6. Specification for various types of protective measures should be drawn and codified.

7. Data collected by the Joint landslide Authority be fed to the state agencies also.

8. Certain areas, where landslides are prominent, be taken up as project studies.

9. Typical design of various types of protective structures be made available to all concerned.

DELIBERATIONS OF INTERNATIONAL SYMPOSIUM ON LANDSLIDES HELD AT NEW DELHI - APRIL 1980

The highlights of International symposium on Landslides 1980 and major recommendations relating to environmental and ecology aspects of the Himalayan region are as follows:-

(i) Landslide hazard zoning maps should be developed to a degree of high accuracy and on a large enough scale so as to be of use to the site engineer who is applying this information on the ground.

(ii) Detailed study and documentation are required on existing experiences on drainage of hill roads and the control of landslides in the Himalayan region.

(iii) For control of erosion and surficial landslides, vegetative turfying represents one of the most effective corrective measures. Removal of vegetation proves to be one of the predominent causes, as far as surficial earth movements are concerned. The most appropriate preventive measure would seem to be the establishment of vegetative turfying over the soil slope soon after the excavation is made. Establishing such vegetation on denuded soil slopes should in fact be looked upon as part of normal construction and maintenance works on hill roads.

(iv) Several methods have been sponsored by CRRI for stabilisation of slopes such as the Asphalt mulch technique, use of coir and jute netting or simple vegetative turfying. Any of the methods can be restorted to depending on the circumstances of the case. Deep rooted plant species may also be resorted to for stabilising slopes such as Robinia, Pacudoacacia and Kudzu Vine etc.

Annexure XXIX

SUMMARY OF CRRI RECOMMENDATIONS ON LANDSLIDE CORRECTION MEASURES

1. Most of the superficial, landslides are caused mainly by leaving the freshly exposed soil slopes untreated and denuded of vegetation, after a cut has been made. Removal of vegetation, therefore, seems to be the one predominant cause, as far as the surficial earth movements are concerned. The most appropriate preventive measure would seem to be the establishment of vegetative turfying over the soil slope soon after the excavation is made, by one or the other of the methods discussed. Establishing such vegetation on denuded soil slopes should in fact be looked upon as part of normal construction or maintenance work on hill roads.

2. The emphasis in remedial measure for a flow type of slide should be on subdrainage works. The use of retaining walls uphill or downhill of the road for correcting flows should be limited to the minimum if they cannot be avoided altogether.

3. (a) The use of horizontal drains represents the most promising method of correcting flow types of landslides. Efforts should be made expeditiously to instal horizontal drains on selected locations with a view to gaining first-hand experience of their functioning and in order to develop their use in India.

(b) The main approach to the control of rock-falls should be to contain the rock-fall or to deflect the falling rock away from the road pavement and towards the cliff.

4. It is imperative that corrective measures for a particular landslide should be implemented conjointly and in one working season. Implementation of remedial measures in stages should be avoided.

5. Corrective measures formulated on the basis of an analysis of the mechanism of the landslide should be designed to be implemented immediately or soon after the investigations are made. If kept unimplemented long enough, there is a series likelihood of the slide deteriorating further, changing both in character and magnitude, invalidating the original recommendations on correction, necessitating a re-examination of the problem, occationing the need for a new set of recommendations, thereby entailing further loss of time and money.

6. Considering the colossal magnitude of the landslide problems involved in the construction of hill roads and considering the pre-requisties for success, it is recommended that any sizeable programme of landslide correction for big road projects in hill areas, can best be achieved by organising field units manned by competent staff, who can give their undivided attention throughout the year to be various landslide problems and go about implementing the corrective measures in a systematic and intelligent manner. It should be the responsibility of these field units to conduct the needed soil investigations and formulate the remedial measures and maintain observations on trouble-some slopes by means of slope indicators, etc., installed for the purpose. Landslide correction under troublesome terrain conditions calls for a concern for expediency far beyond the requirements of routine construction and a care for detail for beyond the standards of routine design. Indian expertise in this field of applied highway engineering can grow only with the introduction of such field units as part of the highway staff system.

TECHNIQUES OF EROSION CONTROL FOR SURFICIAL LANDSLIDES SPONSORED BY CRRI

Brief details of the techniques are given below:-

ASPHALT MULCH TREATMENT

Firstly, the slope proposed to be treated are demarcated and fenced by local prickly bushes or barbed wiring. The slopes are then prepared into vast seed beds by rounding off the tops, regarding or reshaping and by finally raking the top soil about 2 cm thick. If the slopes are entirely raw and infertile and if the soil happens to be slightly acidic, (as in Northern UP) calcium ammonium nitrate is applied at the rate of 50 Kg per 1000 sq.m. in solution. The root slips of the most promising types of locally available grasses are dibbled, 15 to 20 cm part, root to root, row to row, taking care to see that no turts or clumps are dibbled. An asphalt emulsion (mulch) of a specified grade is then spread by a suitable sprayer, the sprayer should be capable of easy handling, and one that is developed especially for the purpose, enabling quick treatment by undertaken over vast areas. The optimum rate of application of the emulsion shall be 0.90 litre per sq. m. i.e. just a thin film. Thickness of the emulsion coating is to be an optimum because thicker application would tend to retard the growth of plants and seeds whereas applications thinner than optimum would not be effective in controlling erosion.

The advantages resulting from the application of asphalt are (i) susceptibility to erosion is cut down (ii) the moisture content as well as the nutrients in the soil mantle are conserved, (iii) the soil temperature is raised by absorbing the light rays, promoting the emergence of tiny saplings.

The asphaltic film gradually disintegrates, its place being gradually taken by a carpet of green vegetation, the carpet of grass that supplants the asphaltic film, acts as an immediate cover for the slopes till the more deep rooted species of grasses, clovers, shrubs and trees, develop and take root.

The method proves particularly successful if it is so timed that advantage is taken of the increased moisture content in the soil resulting from the first couple of monsoon showers. However, neither a continuous heavy down pour nor a long spell of dry weather occuring immediately after the completed treatment is desirable since in such an eventuality the process might perhaps have to be repeated partially or fully. The cost of asphalt mulch treatment work out to the order of Rs.290/- per 100 sq.m. approximately.

SLOPE TREATMENT BY JUTE NETTING/COIR NETTING

The slopes are initially demarcated, graded, fenced and fertilised as in the case of Asphalt-mulch technique cited before.

The levelling of the area in this case must be ensured so that when netting is laid it may cover the entire area flush to the ground permitting water to flow over the netting. First seeding @ 5 Kg per acre dibbling of the root slips of locally available perennial grasses 15 cm apart row to row and plant to plant is done. The top of the root slips are removed before dibbling. After this operation temping by wooden

hammers is done to attain smooth surface and appropriate compaction of seed and root slips. To ensure even sewing, the area is divided into equal rectangles. Thereafter, Jute or coir netting, (available in rolls) of 2.54 cm to 1.27 cm openings and having width 1.22 m to 1 m is laid on the prepared surface firmly in the direction of water-flow. The different width of netting are secured against displacement by an overlapping of 5 cm to 8 cm and pegged down with staples of 10 gauge steel wire 30 cm to 60 cm apart. The top and bottom ends of the jute netting are fixed in slots of 30 cm deep fully stretched. Afterwards another dose of light of fertiliser and seed broadcasting is done subsequent to the net installation. Again, the netting is finally tamped flush to the soil surface.

The net provides innumerable miniature check dam thus absorbing the impact and kinetic energy of the falling rain drops and water flow. The soil, seed and root slips are kept in situ without being dislodged and keep protected, getting full benefit of moisture. The jute netting sometimes disintegrates soon after the first rainy season and adds to the humus content of soils. The seeded and springged vegetation soon envelopes the entire surface protecting the slopes permanently.

The cost of treatment of vegetative turfing by use of coir/jute netting work out to be Rs.125/- per 100 sq. m. approximately.

POINTS OF GUIDANCE ON PREVENTION OF SOIL EROSION NEEDING ATTENTION IN THE CONSTRUCTION OF ROAD IN HILLY AREAS

(Enclosure to Ministry of Shipping and Transport letter No.PL-30(119)/79 dated 11th October, 1979)

1. GENERAL

1.1 Aspects relating to route selection and highway location Surveys and investigations, preparations and presentation of road projects, etc. are discussed in details in IRC special publication No.19 'Mannual for Survey, Investigation and Preparation of road projects.' For road construction in hilly areas, while the guidelines given in this Mannual apply equally and have to be duly considered, the following points related to prevention of soil erosion should be specially kept in view during different operations.

1.2 Effective erosion prevention and soil conservation measures require careful attention at different stages of a road project, starting right from the stage of project conception. To help the concerned engineers in determining whether all aspects, considerations and items of work with regard to erosion prevention have been duly taken into account and to facilitate review at different stages, a check list has been prepared, vide copy attached. The check list which should be read in conjunction with the points of guidance listed here under should form part of the road project itself for facilitating cross checking of the requirements at different stages.

1. POINTS OF GUIDANCE

i) The road construction project estimates should provide for not only the requisite scale of investigations but also the necessary measures against soil erosion so that these can be built into the project with adequate financial provision.

ii) Before finalising the alignment, erosion potential of each alternative should be carefully examined, and the one involving least disturbance to the natural ground should be preferred.

iii) Road should not be located through Geologically unstable strata if this can be avoided. Study of the geological maps of the area and consultations with the local Geological Department will be helpful in this regard.

iv) Road alignment should avoid large scale cuttings and fillings and follow the lie of lands as far as possible. Use of tunnels to avoid deep cuts should be considered where feasible and economical.

v) To the extent feasible, roads should be aligned away from streams and terrents except where these to be crossed. Since the greatest damage always occurs along water courses, special attention is necessary to create protection belts of forests on both sides.

vi) It will be advisable, at least for important roads, to have consultation with the Officers of the Forest Department at the stages of route/alignment selection, surveys and investigations etc. so as to ensure that the selected alignment has minimum potential for soil erosion and that the project design and estimates provide for the necessary soil erosion control

measures. The idea is that with such joint consultation pursuits practised for some selected roads, the PWD Engineers would get conversant and should be able to take care of such requirements by themselves for other road Projects in general.

vii) Where the road is in cutting, half cut and half fill type of cross section which involves least disturbance to the natural ground should be adopted subject to considerations of economy and road stability being satisfied.

viii) The cut slopes should be made for the type of strata in the initial construction stage itself by resorting to stable cut slopes with beneces etc. including the use of slope stabilising structures like breast walls, pitching etc.

ix) For treatment of unstable areas, 50 m above and 30 m below the road level depending on the site conditions, necessary funds should be provided in the Project estimates. This may even be in the form of certain percentage of total cost but based on some possible assessment of treatment works possibly needed.

x) Area for clearing and grubbing should be kept the minimum subject to the technical requirements of the road. The clearing areas should be properly demarcated to have desirable trees and shrubs and to prevent over clearing.

xi) Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit, otherwise temporary erosion control measures should be provided between successive construction stages. This requirement has already been stressed in the Ministries"Specification for Road and Bridge Works" (Vide Clause No.306.3). Under no circumstances, however, should very large surface area of credible earth material be exposed at any one time by clearing and grubbing.

xii) Location and alignment of culverts should be so chosen as to avoid severe erosion at outlets and siltation at inlets.

xiii) The cross-drainage structures should discharge safely on the valley side, and in this connection all necessary precautions/safeguards should be taken to ensure that the discharging waters do not cause erosion even when they flow for long periods. For this purpose, all necessary channel training and erosion control works like pitching/paving of the channel and outfall points drop walls, flexible apron etc. should be considered and provided for as a part of initial design and construction.

xiv) Drainage of water from the roadside must be given top attention and necessary system of drains constructed to lead the run off the natural water courses. In particular, suitable inter-ceptor and catchwater drains must be provided above the cut slopes for speedy and safe disposal of rain water. The drains should have gentle gradients and side slopes to carry flows safely without erosion.

xv) Excavated material should not be thrown happazardly but dumped duly dressed up in a suitable form at suitable places where it cannot get easily washed away by rain, and such spoil deposits may be duly turfed or provided some vegetative cover toward the same purpose.

xvi) Depending on the availability of land and other resources, afforestation of road side land should be carried out to a sufficient distance on either side of the road. The selection of plant species will depend on climate, altitude and soil conditions, but preference should be given to deep rooted trees and plants. For preparing the detail and some of afforestation persons having knowledge of soil conservation or forestry should desirably be associated.

xvii) Vegetative cover should be established on all cut/fill slopes through any one of the techniques described in IRC. 56-1974 "Recommended practice for Treatment of Embankment slopes for Erosion Control". The activity of establishing vegetation on barren slopes should be treated as part of the regular maintenance operations on all hill roads.

xviii) Strip forests suitable for the site conditions for a minimum distance of 30 m on either side of the road should be provided. These shall be raised and maintained by forest authorities. No felling except of dead or dying trees should be permitted in this area.

xix) Alongwith other road components, due attention should be paid to the maintenance of drainage and soil conservation works. Drains, catchpits etc. should be cleared of all debris and repaired where necessary before the onset of the rainy season. Eroded areas should be promptly made up and provided with vegetative cover.

xx) For any seriously, problematic areas where normal measures are not likely to be successful, specialist organisations like the CRRI, GSI etc. may be consulted for evolving suitable remedial measures.

3 CHECK LIST OF POINTS ABOUT EROSION CONTROL IN THE CONSTRUCTION OF ROADS IN HILLY AREAS

Enclosure to Ministry of Shipping and Transport (Road Wing) letter No. PL-30(119)/79 dt. 11.10.79).

1. Does the road construction project estimate provide for the necessary measures against soil erosion.

2. Have soil maps and aerial photographs studies and investigations been made to locate areas or sections with high erosion potential.

3. Has erosion potential been considered for each alignment.

4. Have geological maps been studied or local geological department consulted to avoid unstable strata.

5. Does the selected alignment follow the lie of the land and avoid large scale cutting.

6. Has use of tunnels to avoid deep cuts been investigated.

7. Is the road alignment susceptible to damage/erosion by streams and torrents.

8. Is consultation/coordination with other departments like forest department necessary. If so, have they been consulted.

9. How will adjacent and nearby streams, ponds and lakes be affected by project construction.

10. Will special erosion control measures be required to protect adjacent propoerties.

11. Does the road cross section involves a lot of disturbance to the natural ground.

12. Are the design cut slopes stable for the type of strata

13. Are slope stabilising structure like breast walls, pitching etc. required.

14. Does the cut hill face require any special treatment to prevent slips.

15. Has the area for clearing and grubbing been clearly demarcated.

16. Has a work schedule been worked out for the different construction operations.

17. What erosion control works are required before clearing and other work is started.

18. Are any temporary erosion control measures required between successive construction stages.

19. Have sediments traps, beneches catch water drains, side drains, sedding, ditch paving, slope protection works and other erosion control items been identified on the plans and provided in the contract.

20. Have the location and alignment of culverts been fixed with due consideration to erosion to out-lets and siltation at inlets.

21. Have the necessary erosion control measures been taken at the out-falls of culverts.

22. Has the proper disposal of surplus excavated material been thought of and provided for.

23. What action has been taken to establish vegetative cover on cut/fill slopes and plantings on the disturbed road sides land.

24. Are the existing drainage facilities maintained in good order.

25. Have any inadequacies in planning, design and construction been identified and reported to higher authorities.

26. Do any of the design measures require modification in the light of field conditions.

27. Do any of the problems require consultation with specialist Organisations like the CRRI, GSI etc.

GUIDING PRINCIPLES OF ROUTE SELECTION AND LOCATION

A. General Consideration:

1. The alignment should be as direct as possible so that there is maximum economy in costs of construction, maintenance and transportation.

2. The grades, curvature and profile should be designed as to be economical, consistent with the service requirements.

3. While improving an existing route, the endeavour should be to utilise the existing facility as much as possible in order to minimise the cost and effort of land acquisition and construction.

4. The alignment should steer of difficult obseructions such as cemetories/graveyards, place of worship, archeological and historical monuments, hospitals, schools, playgrounds etc.

5, As far as possible, the alignment should not interfere at any stage with services like power transmission lines, water supply mains etc.

6. To extent possible, crossings with railway lines should be avoided. When the alignment interesects railway lines, waterways etc. due thought should be given to skew crossings in order to achieve better approach geometrics. In the case of railway crossing railway authorities should be consulted.

7. As a general rule, the alignment on high ground/ridges involves less drainage problems.

8. Embankment and pavement account for a major proportion of the road cost; therefore availability of materials for embankment and pavement construction should be kept in view while finalising the alignment. Similarly, good subgrade conditions mean lower pavement cost and thus subgrade conditions mean lower pavement cost and thus subgrade condition should also effect the choice.

9. While connecting population centres, the alignment should skirt round the population pockets rather than pass through congested areas.

10. Problems and cost of land acquisition should be kept to the minimum. It will be advisable to avoid costly lands of intensive agriculture etc.

B. Special considerations in Mountanous areas:

1. The selected route should be feasible from the point of attaining the ruling gradient.

2. As far as possible steep terrain should be avoided.

3. Unstable hilly features (rock dips, fissured strata slides etc.) can lead to maintenance problems on long-term basis and should therefore, be avoided.

4. As mountanous road, when located along a river valley, has the inherent advantage of gentle gradients, proximity to inhabited villages, and general convenience of construction and operation of the facility. However, this solution has the disadvantage of larger outlay on cross-drainage and protective works. All these factors should be carefully considered before making the final selection.

5. The alignment should involve least number of hair-pin bends. Where unavoidable, these should be located on stable and less steep slopes.

6. While locating roads in high mountain ranges, it may be expedient and economical in some cases to construct tunnels to shorten the length of the alignment.

7. As far as possible, mountain ridges should be crossed at their lower elevation.

8. In hilly country, a location subject to sunlight should get preference over a location in the shade.

9. Areas liable to snow drift should be avoided.

10. Needless rise and fall should be avoided.

C. Special consideration in Sand Dune Areas:

1. The road should be so located that it causes minimum interference to the flow of sand-laden winds. Therefore, the roadway should merge with the lie of the land as much as possible.

2. In areas having longitudinal sand-dunes, a location along the ridge or in the inter-dunal space be preferred. Location along the face of the dunes should be avoided.

3. Locations where sand is loose and unstable should be avoided.

Details of further studies indentified by CRRI for evolving erosion/ landslide correction measures.

The following represent further problems in need of urgent attention to be tackled by the CRRI:-

(i) Indigenous fabrication of equipment for large scale spraying of asphalt emulsion cut-back for applying the technique of asphalt mulch on a large field scale in the Himalayan region.

(ii) Developing, refining, sponsoring and undertaking of demonstration trials on a large scale providing the application of horizental drains for sub-surface drainage with a view to effectively control and correct landslides which are emanable to treatment by sub-surface drainage.

(iii) Evolving techniques for the control of rock falls.

(iv) Developing and sponsoring the indigenous fabrication of foundation instrumentation such as deflection tubes, tilt meters, slope

indicators, for successfully monitoring the behaviour of natural slopes as part of the observational method of design and construction with reference to landslide prevention and correction.

(v) Undertaking a study under with a view to selecting the most promising types of grasses, shrubs, legumes and trees suitable for different climatic, terrain altitude and the establishment of agrostology centres at different locations for the effective dissemination and propogation of plant material.