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Kathmandu, Nepal
February 6-13, 1981

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Jointly sponsored by

His Majesty's Government of Nepal, Department of Soil Conservation and Watershed Management
Nepal National Committee for Man and the Biosphere

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CONTENTS

ACKNOWLEDGMENTS

INTRODUCTION 1

WORKSHOP SUMMARY 3

WORKING GROUP REPORTS
Forest, Rangeland, and Wildlife Management 9
Watershed Management and Irrigation 15
Agriculture and Livestock 27
Energy 33
Human Resources 41

APPENDIXES
A Pokhara Area Field Trip, February 6-8, 1981 57
Donald A. Merserschmidt

B Workshop Agenda 61

C List of Workshop Participants 64

D Introductory Speech 72
M.D. Joshi, Director General
HMG Department of Soil Conservation
and Watershed Management

E Introductory Comments 75
Roland J. Fuchs, Chairman
National Research Council Panel

F Inaugural Speech 78
Makeshwar Prashad Singh, Minister of Forests
His Majesty's Government of Nepal

G Opening Remarks 80
Mohan Man Sainju, Member
HMG National Planning Commission

H Microhydro Projects: An Alternative Source of Energy 83
D. M. Amatya
Department of Soil Conservation
and Watershed Management

I Press Coverage 89

J Background Material 91

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INTRODUCTION

Fffective resource management is vital to any government's attempt to sustain and improve the quality of life of its people. Newspaper and magazine articles describing events in the developing countries center increasingly on the consequences of overpopulation and overutilization of natural resources. Vanishing forests, famine, and floods are reported with such regularity that notice is scarcely taken.

Statistics assembled by His Majesty's Government (HMG) are causing increasing concern. Based on these figures, approximately one-fourth of Nepal's forests have disappeared during the past 25 years--1 million hectares in just the last decade. At this rate, there will be no accessible forests in the hill area in 15 years, and none in the Terai in 25 years.

HMG has given high priority to renewable resource management in its Sixth Five-Year Plan (1980-85), which specifically addresses existing policies for land use, environmental restoration, and conservation of natural resources. As a result of this emphasis, HMG officials and staff of the Board on Science and Technology for International Development (BOSTID) of the National Research Council (NRC) selected renewable resource management as an appropriate topic for an initial joint workshop, held in Kathmandu, February 6-13, 1981.

At the opening plenary session of the workshop, Makeshwar Prashad Singh, Minister of Forests, and Mohan Man Sainju, member of the National Planning Commission, suggested that participants explore, in addition to the agenda items, practical recommendations that would address the following needs:

- Better intra- and interagency coordination by the National Council for the Conservation of Natural Resources, chaired by the Minister of Forests. HMG is supporting a multidisciplinary approach to many activities during the Sixth Plan period. The National Council was organized by HMG to bring about integration and coordination, to provide overall policy direction, and to evaluate performance.

- Communication among and appropriate priority given to natural resource management programs being implemented by various ministries and departments of HMG.

- Identification of areas where suitable technology for intervention in renewable natural resources management is available, fields where further research is required, and informational gaps for which appropriate studies can be carried out.

- How to obtain greater community involvement in the management of natural resources, which is stressed in the Sixth Five-Year Plan.

- A framework to conceptualize long-term management of natural resources beyond the current plan, including ideas for implementing recommendations.

M. D. Joshi, chairman of the Nepal panel; Roland J. Fuchs, chairman of the NRC panel; and U.S. Ambassador Philip Trimble also addressed the opening session. The Panas ceremony (lighting of the oil lamp) was conducted by Minister Singh.

After a morning of plenary discussions and a two-day observation visit to the Phewatal Watershed area in Pokhara, workshop participants reconvened in Kathmandu and divided into five working groups: (1) forest, rangeland, and wildlife management; (2) watershed management and irrigation; (3) agriculture and livestock; (4) energy; and (5) human resources. Each working group chairman read the recommendations that emerged from his group at a plenary session, soliciting comments from the audience. Comments appropriate for recommendations were taken into consideration in the final conclusions and recommendations contained in this report.

WORKSHOP SUMMARY

Each working group met for three sessions over a two-and-a-half-day period, which allowed panelists to participate in more than one group. Groups were asked to address technical options, including human resources, education, and training; and evaluation, including consideration of capital requirements and human resources. Groups were also asked to provide recommendations and conclusions on short- and long-term strategies and activities, institutional framework needs, in-country training and research needs, and policies and legislation.

Detailed recommendations and conclusions are contained in the working group reports that follow. It is evident that a number of the problems identified in this report could be acted upon without a significant expenditure of funds since they are organizational or legislative in nature. The major recommendations that emerged from the workshop are listed below.

GOVERNMENT COOPERATION, INTEGRATION, AND LEGISLATION

1. It is important to move forward with strengthening the newly-created National Council for the Conservation of Natural Resources (NCCNR) which would serve as the main coordinating entity within GMG for the management of natural resources. The NCCNR should be provided with the support staff and funding needed to carry out its activities, such as:

- Formation of a special interagency committee of lawyers and appropriate officials to review existing laws and policies related to land ownership, land registration, and land revenue.

- Creation of mechanisms, both formal and informal, to promote interdepartmental coordination and cooperation and to prevent duplication and overlap of duties.

2. To remove confusion regarding desirable land use in different physiographic regions, legislation outlining criteria for appropriate land use should be enacted and a coordinating agency designated or established. Responsibilities would include:

- Enforcement of existing rules and laws to prevent misuse of forests and other resources

- Implementation of a comprehensive educational program to inform various resource users about good conservation practices

- Development of a national settlement policy, in view of the rural and agricultural character of Nepal's population and the serious regional disparities in population in relation to arable land

3. The basic constraints to the alleviation of Nepal's energy problems appear to be lack of a single, central agency that deals exclusively with energy and related problems and lack of coordination and communication between institutional, private, donor, and government energy entities. Thus establishment of a National Energy Commission should be considered, or, as an alternative, the existing Water and Energy Commission should be strengthened. This commission should have sufficient status to bring the urgency of the energy problem to the attention of both the government and the people, and should have sufficient influence to develop a coordinated plan of action. In addition, the Commission would:

- Prepare a national energy plan that focuses on specific annual energy requirements and targets for each year of the Sixth Five-Year Plan, thus integrating its efforts closely with those of the National Planning Commission

- Systematically implement technologies in rural areas through education, training, and demonstration efforts

- Encourage research and development on alternative sources of energy such as biogas, small-scale hydro, and solar energy

- Establish clear targets or goals for each energy source per year and monitor actual performance as a continuous function

- Establish a clearinghouse to exchange information on each energy technology

EDUCATION AND MANPOWER TRAINING NEEDS

4. To improve general education and public knowledge of resource management and conservation problems and practices, the elementary school curriculum should be modified to emphasize agriculture and renewable resource

management relevant to a rural population. General education in academic secondary schools, colleges, and universities should include a required component on Nepal's resource and environmental management problems.

5. To attract students interested in field- or production-oriented careers rather than administrative positions, selection and admission procedures of agriculture/resource schools, including vocational secondary schools, should be revised to favor those with rural backgrounds and actual farming experience and appropriate incentives should be provided. Efforts should also be made to increase the proportion of women in secondary, vocational, and higher institutions, perhaps through quotas or scholarship programs.

6. To address two current problems--an inadequate number of agricultural resource personnel in field positions and dissatisfaction with the terms of service and career advancement--manpower policies should be reviewed and reformulated as necessary, and improved means of measuring job performance should be devised. In addition, new approaches to overcoming transportation and communications hardships experienced in fieldwork should be developed.

7. Government research and extension efforts are beginning to provide a flow of technologies to hill farmers. However, the speed of this flow is hampered by the large number of diverse hill environments, duplication of extension efforts, poor training and motivation of government workers in contact with hill farmers, and insufficient understanding of local socioeconomic constraints to technology transfer. Priority attention should be given to (1) economic and social research on conditions that facilitate adoption of new practices and encourage higher levels of production from public lands, and (2) a study of government operations in hill areas that concentrates on interagency planning and coordination, especially on research, extension, credit, and marketing arrangements. In addition to an extension service, dissemination of information and appropriate technology could be aided by (1) reinstituting the National Development Service with a substantial emphasis on resource management programs; (2) using individuals skilled in resource management and related technologies and industries, but who lack academic credentials, as consultants in demonstration and training programs; and (3) studying superior resource management techniques on the part of individual ethnic and caste groups to determine the feasibility of wider diffusion and adoption.

8. The capacity of and accessibility to the national network of agriculture/resource training institutions must be improved. Thus highest priority should be placed on establishing the Institute of Renewable Natural Resources (IRNR) at Pokhara which will focus its programs on the underserviced hill areas. Any future training institutions should be carefully located with special consideration given to the Regional Development Zone centers in the hills and should be integrated with other educational institutions.

9. To improve management capabilities in Nepal generally, including those in the resource management sector, and to foster interagency cooperation, establishment of a resident college of organization and management to serve both the public and private sectors should be considered. The college would focus on pre-service management training for selected government administrative officers, and could also provide in-service training.

LOCAL IMPLEMENTATION AND VILLAGE INCENTIVES

10. Agricultural production in the hills is not keeping pace with hill peoples' needs for food and fiber, higher incomes, and more jobs. Thus agricultural productivity must be increased through the use of new or improved agricultural techniques, intensified cropping, and improved animal nutrition, breeding, and disease control. Priority attention should be given to (1) improved varieties and more productive strains of existing hill plants and animals; (2) alternative profitable crop and livestock combinations for densely populated hill environments; and (3) soil nutrient and moisture management, with emphasis on the economic consequences of using organic or inorganic fertilizers and irrigation water.

11. Productivity of public lands must be maintained or increased through substantially enhanced local responsibility for and management of forest and range resources.

12. Behavorial, legal, and administrative constraints impede greater community involvement; however, they can be overcome. For example, it is recommended that additional forms of agricultural land use, such as fodder, tree orchards, and rotational farming, be legally recognized and that traditional forms of resource management be incorporated into a legal resource management framework.

13. Local resource management plans require agreement on strategies and responsibilities which can only be reached through mutual accommodation and compromise. Hence in local planning, manager and planners should go to the people and not expect the people to come to them. Also micro-level planning should be executed through provision of better alternatives and incentives to cover short-term costs, rather than coercive measures based solely on technical grounds.

WORKING GROUP REPORTS

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FOREST, RANGELAND, AND WILDLIFE MANAGEMENT

Although this chapter contains conclusions and recommendations for managing Nepal's forests, rangelands, and wildlife, these resources were examined in relation to other natural resources and in the context of Nepal's overall development.

This working group considered lands managed by HMG Department of Forests and Department of National Parks and Wildlife Conservation. Although land management by the Department of Soil Conservation and Watershed Management (DSCWM) was also considered, the watershed management and irrigation working group took a closer look at this department.

Nepal's land area is about 145,000 square kilometers, of which about 30 percent is considered forest land and is managed by the Department of Forests. However, the designation "forest land" does not necessarily mean a forest exists on the land. Rather, "forest land" is a residual category that contains lands not managed by other agencies. For example, treeless land used primarily for grazing is included along with land containing forests of varying density and quality. The Department of National Parks and Wildlife Conservation presently manages four national parks, three wildlife reserves, and several hunting reserves. Additional parks and hunting reserves have been proposed.

At the risk of oversimplification, two major management objectives can be identified: (1) provision of goods and services from the forest land, particularly fuelwood,* fodder, and commercial timber; and (2) conservation and protection, which are the primary

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*Fuelwood is of great importance as it comprises approximately 95 percent of the wood consumption and 87 percent of the energy production.

objectives of national parks and wildlife reserves. The latter includes preservation of several endangered wildlife species such as the rhinoceros, tiger, and red panda; of plant ecosystems in several areas of heavy tourist use; and of upper slopes to attenuate precipitation run-off and reduce erosion and its ill-effects. National parks and wildlife reserves should also provide recreation and hunting experiences for Nepal's citizens and tourists (since tourism is becoming an important part of Nepal's national income and earner of foreign exchange), as long as it does not conflict with the primary objectives of the reserves.

Clearly, His Majesty's Government has made great strides in a very short time in developing Nepal's capacity to deal with very serious renewable resource problems engendered by vigorous population growth and low national income. Analyses have pointed repeatedly to the need for a massive reforestation program to make up growing deficits in fuelwood and fodder supplies and to assist in mitigating steadily worsening soil erosion. At the same time, protection of existing and replanted forests is required, although the apparent lack of viable alternatives makes this a most difficult action to undertake. In addition, some unique and irreplaceable areas should be preserved in the form of national parks and reserves.

In many respects this report builds upon previous analyses and recommendations by various study groups, including His Majesty's Government, and emphasizes those aspects that seem particularly appropriate to an up-to-date review of both the problems and the progress made to solve them. Recent plans and documents prepared by His Majesty's Government recognize these problems and propose various means to address them, such as the community forest and integrated resource development programs that emphasize local participation in both protection and development. The workshop participants support these programs and encourage rapid implementation.

This report contains three categories of conclusions and recommendations: General, Forests, and Parks. Unfortunately, there was not enough time to collect the detailed information necessary to evaluate capital and human resource requirements. Nevertheless, discussions indicate that professionally trained manpower will have to be increased severalfold with substantial enhancement of mobility and communication.

RECOMMENDATIONS AND CONCLUSIONS

General

These recommendations and conclusions are general and will usually apply to management of both the Department of Forests and Department of National Parks and Wildlife Conservation.

1 Enact land-use legislation that outlines the broad physical characteristics desirable for different land uses and the criteria to be used to determine the primary use that should be made of specific kinds of lands and regions. In addition, legislation should identify or create the specific agency of His Majesty's Government to be assigned responsibility for implementing land-use determinations and time schedules for implementation. This agency should have broad powers cutting across all line organizations.

Confusion exists nationally about the desirable uses of different lands in different physiographic regions. This confusion leads to inconsistent decisions, conflicting objectives, and inefficient resource expenditures.

2 Enforce existing rules and laws to give the resource time to rehabilitate. This requires formally demarcating forests on a permanent basis, and hiring officers and guards to carry out the protection program.

HMG operational staff are well trained, cognizant of problems, and have enough knowledge to begin rehabilitating the resource. However, they are continually frustrated because increasing resource use and the misuse resulting from increasing population pressures, resettlement programs, tourist impacts, poaching, and other causes, destroy the resource before their plans are fully implemented.

3 Identify and provide alternative sources of employment, fuel, fodder, and other goods and services generated by the forests during the period of resource rehabilitation. This may require establishing a special social services arm of HMG to provide basic necessities of life, and even regrouping of villages during rehabilitation in selected regions.

The pressures causing overuse of the resource are real and often necessary to the short-term survival of the people. Because punitive measures alone cannot stop this use, alternatives must be found for the people during resource rehabilitation.

4 Implement an integrated and comprehensive educational program to inform the various resource users about good conservation practices, their results, and the long-term impact of poor practices. More specifically, the program should include (1) conservation education in the school system, particularly in the primary grades; (2) extension activities to facilitate villager participation, such as demonstration plots and conservation centers; (3) sensitization of transient populations, such as tourists and migrants, to the impact of their actions; (4) inclusion of a technology transfer plan as part of any project or research plan; and (5) expansion of radio programming about conservation.

Misuse of resources often occurs because citizens of Nepal and visitors do not fully recognize the impact of their actions collectively and over time.

5 Establish a uniform and consistent data base that will include land capability classes and resource inventory information. Allow for periodic updating so that land and resource use trends can be confidently estimated.

The current weak data base undermines confidence in proposed programs and makes decision making uncertain.

6 Articulate unified resource policies for each functional area, e.g., forests, parks, wildlife reserves, and rangelands. Policies should contain: (1) production objectives, which should include likely net exports and theft; (2) a statement of the general and specific responsibilities of each agency; and (3) policy priorities such as the relative importance of employment, resettlement, and production. Further, personnel positions within an agency should be thoroughly reviewed and position descriptions written outlining specific tasks and responsibilities for each. Performance evaluation should then be instituted to ensure that officers are performing the assigned tasks and responsibilities.

Departmental and ministerial roles are not clearly understood or are overlapping. Many personnel either do not understand the job they are to perform or simply do not perform it. Responsibility for past actions or inaction is hard to establish. All of this results in inefficient resource use and unnecessary delay in program implementation.

Forests

7 Initiate additional research so that the information required to optimize resource use will be available after immediate problems are solved and it is needed. This program should include (1) growth and yield studies so timber production can be better predicted; (2) species studies so trees are optimally matched with Nepal's many different sites and soils; and (3) silvicultural research to better manage forests once they are established.

Existing knowledge is adequate to implement resource management plans that will greatly improve the nation's forests. However, not enough is known to assure optimal use of the nation's resources.

Parks

8 Initiate a carefully planned and limited research program to obtain the unique information needed for management planning. Research should be oriented toward and justified by its management contribution. A survey is needed to identify the current status of fauna and unique geologic and scenic areas for possible future inclusion in parks and reserves.

Each park, reserve, and ecosystem has individual and often unique characteristics that depend on detailed knowledge for their optimal management.

9 Devise a system to compensate persons for loss of livestock, forage, fodder, and other forest products. This might include returning a percentage of park income or a surcharge to the village panchayat, or direct compensation at market value for livestock killed by protected species.

The sudden restrictions resulting from establishment of parks and reserves and their continuing activities have caused negative impacts on persons living inside and outside the area. Resources of the parks and reserves are no longer available to local residents, and park and reserve users and protected animals often have negative impacts on areas surrounding the parks and reserves.

10 License trekking agencies and make it illegal to take tourists on a trek without a license. A condition for maintaining a license should be observation of HMG rules and regulations for resource use, such as fuel self-sufficiency at Sagarmatha National Park. Trekking agencies will thus have an incentive to help implement national policy.

Trekking tourists can have a strong negative impact on protected ecosystems through fuelwood consumption, waste disposal, and other activities in the protected area. Control is difficult because of the large numbers of tourists and their transient nature, and because they are usually foreign nationals.

WATERSHED MANAGEMENT AND IRRIGATION

STATEMENT OF THE PROBLEM

Land disturbance and degradation occur widely in Nepal, particularly in the Middle Hills and the Siwaliks. Problems of water shortage, constraints on land capability, landsliding, soil erosion, declining productivity, sedimentation on valley floors, flooding, and river channel instability have been described in books, journal articles, and consultants' reports. These conditions reduce the quality of life for people who must carry water, fuelwood, and fodder for long distances in steep terrain, and who must cultivate poor soil on steep hillsides to produce a sparse diet and a limited cash income.

The natural environment of Nepal places severe constraints on land use and limits the range of management options. In the naturally unstable and active terrain, degradation of land and water resources results from tree felling, cultivation, and grazing. These practices aggravate soil erosion and in some places appear to have lowered soil fertility and water-holding capacity. The soil eroded from disturbed hillsides augments the naturally high sediment loads of rivers and therefore the tendency for deposition and channel instability in small watersheds. The problem is of most immediate concern in the Middle Hills, where a majority of the population lives. Here one can observe evidence of decreasing land productivity, reduction in the amount of land that retains a soil cover, and declining availability of fodder and fuelwood. These trends directly reduce the quality of life by increasing labor requirements and decreasing food production and opportunities for raising saleable crops and animal products.

On the basis of discussions with Nepalese scientists, consultancy reports, and field examination of the area between Kathmandu and Pokhara, this working group concludes that most of the

doomsday scenarios in the popular press describing the condition of Nepal are overdrawn. The problem of land degradation in the Middle Hills is widespread, and locally acute, but there are equally widespread opportunities for taking advantage of the natural recuperative properties of this land through technologically simple methods. There are also many opportunities for improving the quality of life through provision of an adequate water supply, improvement of trails, and broadening of the mixture of productive plants. Much progress can be made in modest projects within the expertise and resources of the Nepalese people, in addition to the large-scale, integrated watershed management projects funded and managed by foreign donors.

DEFINITION OF WATERSHED MANAGEMENT

Watershed management involves using techniques that, for example, provide adequate water for drinking and irrigation; reduce soil erosion and improve soil fertility and water-holding ability; increase production of crops, tree products, and livestock; stabilize gullies and small river channels; improve access to water; and allow people to generate trade and off-farm employment.

The overall aim of watershed management is to improve quality of life and to effect a permanent increase in the productivity of land. Water management techniques are available and practicable in Nepal. Government policy should be aimed at releasing technical staff from their present constraints and encouraging them to apply their skills to watershed management.

It is not necessary to apply water management techniques simultaneously; they can be introduced singly or several at once, and one improvement may pave the way for another. For example, provision of a spring-fed water supply reduces time required for carrying water and thus may release labor for more intensive cultivation or for collection of fodder for stall-fed livestock. Exclusion of livestock from a grazing area may allow planting fast-growing trees for fuel and fodder, which if pruned systematically and intelligently could supply a permanent source of materials near homes.

Because of the multiplicity of options in watershed management, it is important to choose the geographical areas and mixture of techniques that will produce the greatest benefits to the local people in the shortest possible time. These aims are best attained through an innovative and wide-ranging search for the most appropriate crops and trees, by planning land use on the basis of a

simple land-capability classification, and by wise, consistent, and persistent advice through a motivated, well-supported extension service.

RELATION OF WATERSHED MANAGEMENT TO FLOODING PROBLEMS

It is unwise to expect that watershed management in the Middle Hills and the Siwaliks will solve flooding and channel instability problems in the large and medium-sized rivers in the Terai. The latter problem will require a separate program of river and flood plain management.

Experience and well-established theory indicate that increasing the infiltration capacity of soils and improving vegetation cover reduce run-off and soil loss from hillsides and small watersheds, but do not significantly affect the magnitude of floods or the rates of sediment transport and channel evolution on big rivers. These latter processes are controlled by the size of rainstorms, geologic history, and large-scale landscape features, such as the longitudinal profiles of the rivers, alluvial fans, and slow tilting and uplift of the land surface. To expect or promise mitigation of flooding and sedimentation problems of the Terai through watershed management in the Middle Hills will lead to disappointment and loss of professional credibility on the part of the land management agencies.

CURRENT STATUS OF HYDROLOGICAL AND METEOROLOGICAL SERVICES IN NEPAL

Prior to 1960, very little was done in the field of hydrology in Nepal. The Hydrological Investigations Project began in 1961 as a joint venture between HMG and the USAID Mission to Nepal, and was implemented in 1962 by the Hydrological Survey Section, initially under the Department of Electricity. The project later became the Department of Hydrology and Meteorology, and is now a section in the Department of Irrigation, Hydrology, and Meteorology, under the Ministry of Water Resources. Within this department, hydrological and meteorological services are divided into a hydrology section that deals with surface water, including a sediment analysis laboratory; a meteorological services section; and a ground water section, including a water quality laboratory to furnish chemical analysis of water from ground-water sources.

According to the panelists, under the hydrology section, there are 212 river gauging stations, 50 of which are regular stations equipped with staff gauges. Of these, 33 are equipped with cable cars, and 21 with gauge houses and automatic stage recorders. Stage

observations are made three times a day year-round, and flow measurements from the cable cars or bridges are made several times yearly. Another 162 partial stations are equipped with staff gauges. Flow measurements are made irregularly, mostly during low flow season.

Out of 250 meteorological stations, there are 200 rain gauges, including 12 equipped with recording rain gauges and 11 in remote places equipped with automatic rain gauges; 12 synoptic stations; and 38 climatological and agrometeorological stations.

CURRENT STATUS OF IRRIGATION IN NEPAL

In the national economy, the agricultural sector accounts for approximately 80 percent of export earnings and two-thirds of the gross domestic product. Because of the uncertainty and seasonality of rainfall, irrigation plays an important role in the intensification of agriculture. During the last 25 years, the area under permanent irrigation has increased from 14,530 hectares (ha) to 154,417 ha. By the end of the current 5-year plan, an additional 65,490 ha is expected to come under irrigation. Further, about 140,000 ha of land are expected to be irrigated by small systems built independently by farmers. Thus only about 14 percent of the 1.98 million hectares of cultivated land will be irrigated. After the forthcoming two 5-year plans, it is envisaged that about 40 percent of the agricultural land in the Terai and 25 percent of the agricultural land in the hills will be under irrigation.

Surface water is the chief source of water for irrigation. Rainfall is concentrated within four months and the rest of the year is practically dry. In the Terai, there are no developed ground-water basins. Only gravity schemes fed by surface water are developed because of the power requirement for ground-water supplies and for lift irrigation.

Many projects are under construction and in operation. Projects in the hills range from 100 to 1,000 ha, and a number of projects are being studied, either by the Irrigation Department or by local and foreign consultants.

Four regional directorates under the Department of Irrigation, Hydrology, and Meteorology investigate, execute, and maintain the irrigation projects, and separate boards with representation from various agencies execute the major irrigation schemes, especially projects funded through international loans.

Rs.419,800,000 have been allocated for irrigation, hydrology, and meteorology for fiscal year 1980-81. Most targets for projects have not been achieved as a result of shortages of fuel and construction materials, insufficient data for planning and design, and lack of skilled manpower.

CURRENT STATUS OF WATERSHED MANAGEMENT IN NEPAL

Before HMG established a new department equipped with multidisciplinary expertise to address the issues of watershed management, soil erosion, and flooding, this responsibility was divided among departments and ministries. The Department of Soil onservation and Watershed Management (the old Department of Soil and Water Conservation) was established in 1974 to pursue integrated efforts in the management of renewable natural resources.

Four pilot watersheds were selected in the four development regions of the country to initiate and test the available soil and water conservation technology, and work has now been extended to several other pilot areas. Flood control programs were also initiated in different Terai and hill rivers. A national inventory of the extent of erosion in different ecological zones has been completed, and several studies have been conducted to strengthen the technical options that were tried on an experimental basis. A number of comprehensive integrated watershed management plans have been completed and are ready for implementation in cooperation with international and bilateral agencies.

In 1980, HMG shifted responsibility for flood control from the DSCWM to the Department of Irrigation, Hydrology, and Meteorology because it was believed that resource allocations for upper watersheds were being channeled into flood control works in the lower areas and that flood control and irrigation schemes could be better organized if they remained in the same agency. Given its limited financial and manpower resources, this new department has made satisfactory progress. However, the department is confronting a number of problems in its attempts to address national problems of soil erosion and natural resource degradation rapidly.

Hydrology-related problems include:

- Hydrological and meteorological records are too short for making firm estimates of future rainfall, run-off, and evapotranspiration, and the present network of stations is inadequate for use in most water resource development.

- Accessibility to stations is difficult because of the rugged terrain and sparse road network. Transportation is arduous and slow, and few stations can be maintained. Measurement is particularly difficult during the critical monsoon months when most flow and sediment transport occur.

- Structures (cableways, etc.) are often damaged by people, or by high flows, landslides, and sedimentation.

- Funds and personnel needed to establish a good network of stations and facilities for maintenance of equipment are lacking.

- There is a shortage of trained hydrologists and technicians in Nepal. Although it is easier to send a technician abroad for training than to train him in Nepal, the Hydrology Section, under the sponsorship of UNESCO, will sponsor a 6-month regional hydrology training course for technicians. At the professional level, civil engineers have been recruited as hydrologists but there is a sharp demand for them elsewhere in Nepal. Plans have been made to train physicists, mathematicians, and statisticans for one year in Holland or India, but thus far the response has been poor because of lack of incentives to improve one's training and to apply one's skills in the field. A 2-year masters of science course in hydro-meteorology is now being started at Tribhuvan University.

- Procedures for promoting technicians are inadequate. Many valuable technicians have only a high school education and thus cannot be promoted to professional status. There is a need to give these individuals in-service training and to either promote them as professionals or develop a separate, nonprofessional promotion ladder.

- Personnel need interdisciplinary training in addition to their specializations.

- Progress on hydrological studies needed to support water resources development is impaired by a general lack of data. The problem is compounded by a lack of manpower to process the raw data that are available.

- Lack of communication between agencies and programs results in unnecessary duplications and inefficiencies.

Irrigation cannot be done in isolation. There must be coordination among the agencies involved in the feasibility study and the execution phase of each project. The full benefits of irrigation development cannot be obtained without a coordinated program of agricultural, cooperative, and extension services at the farm level.

Problems afflicting irrigation management include inadequate manpower allocation, work scheduling, budgets, objectives, and coordination. Regarding manpower, apart from their low numbers, civil engineers are often inexperienced in hill agricultural systems. To a certain extent, inadequate technical expertise can be overcome by using local consultants for feasibility studies, but this solution is not recommended for planning and implementation.

Some specific problems constraining watershed management include:

- Land ownership laws and policies are vague, and land ownership claims may be advanced after improvements have been done. Laws made for different purposes often conflict.

- Cooperation of local people is essential but is difficult and time-consuming to obtain.

- Soil and water conservation are the responsibility of everyone, but especially of those whose operations affect natural resources. For this reason, a National Resource Conservation Council has been established and lower tiers are envisaged.

- Coordination between agencies is hard to achieve in practice for reasons discussed in a later section.

- Watershed boundaries have been used for addressing watershed development, but district boundaries have been used in Integrated Rural Development (IRD) projects.

- HMG rules do not adequately address the special needs of multidisciplinary departments, creating staffing problems.

<u>Watershed management efforts should concentrate on areas where erosion is already bad or areas where conservation is relatively easy and where recuperation will be rapid.</u>

TECHNICAL OPTIONS AVAILABLE FOR WATERSHED MANAGEMENT AND IRRIGATION

In Nepal, there is considerable knowledge of the technical options available for watershed management and irrigation. Because few trials and measurements have been made, it is not possible to assert which particular plant species, crop rotation, or agronomic technique represents the optimal alternative. However, with the aid of a small amount of local experience and information disseminated through the U.N. and other agencies, it is possible to make a good first estimate of the techniques and crops that will work well. Vigorous, wide-ranging searches in the published literature and the accumulation and dissemination of local information would rapidly extend the range of options.

The following techniques need to be applied and require no elaboration here:

- Extension and improved maintenance of irrigation systems, including development of adequate water supplies in the Middle Hills.

- Reforestation of parts of the landscape to produce fuelwood and fodder that will reduce storm run-off and stabilize soil.

- Improved terrace construction, involving better grading in some places, drainage and stabilization against landsliding, and more careful conveyance of storm water from the terrace to valley floor.

- Improved agronomy on both dry land and irrigated terraces. Techniques for this include: a wider range of crops and rotations, more intensive manuring (possibly including the use of green manures where a dry-season cover can be grown but where rainfall is inadequate for maturation of a food crop), composting, and crop residue management.

- Development of drinking water supplies for people, livestock, and nurseries, which could reduce labor, allow stall-feeding, and encourage increased production of trees for fuel, fodder, and soil and water conservation. Such development would include: mapping and testing ground-water springs and seeps under dry-season conditions; excavating, developing, and maintaining springs; conveying water from springs to stock tanks and other small holding tanks which would have to be sited

carefully on the steep hillsides; carefully diverting storm water into holding tanks for use in stock watering and nurseries during the dry season.

- Improved trails to facilitate transport of water, fuelwood, fodder, and saleable products, and to reduce soil erosion.

To facilitate implementation of the above options, there is need to accumulate and exchange hard data and technical knowledge, particularly on rainfall intensity and erosivity, as well as on the erodibility of soils and the geotechnical characteristics of rocks and soils. These data are needed for rational soil and water control designs and road designs that will not aggravate landsliding, flooding, and sedimentation problems.

The qualitative aspects of species selection and performance are well known, but some time will be required before growth rates are adequately known. Calculation of water balances is made difficult by lack of data on evapotranspiration, soil characteristics, and the water requirements of crops. Adequate data exist for many regions of Nepal, but in others they are completely lacking. For example, in Mustang it may be necessary to rely on foreign consultants from similar climates. More knowledge of the nutrient status of soils and of nutrient losses from agricultural lands is also needed.

Lack of trained manpower, funding, and transport limit efforts to collect information, but the bottlenecks in exchanging and using information are institutional. Even within a single department such as irrigation, only financial and administrative data are exchanged among heads of projects. Because there is no mechanism for this exchange--such as lectures, seminars, transfer of personnel, or exchange of technical reports between projects--valuable local information is lost. The situation could be remedied by the above methods and if HMG personnel policies encouraged individual officers to undertake independent studies, thereby becoming better qualified. Incentives need to be established for this.

DELIVERY SYSTEMS

Practicable technologies for watershed management and irrigation are readily available, but the challenge in Nepal is applying these technologies through delivery systems and adoption practices by the hill people. Thus, the key to effective watershed management and irrigation is some institutional reforms or refinements, coupled with participation of the hill farmers.

Institution of Delivery Systems

Trained Manpower. In-country training is desirable for all qualified professional personnel and technicians. Training should emphasize interdisciplinary subject matter and should be a coordinated effort between government and university departments to assure efficient use of educational facilities.

Personnel management is not practiced to the fullest extent possible, and career ladders are not well established. In fact, civil service rules inhibit promotion from subprofessional to professional grades but do not compensate the subprofessional for this immobility.

In some instances, the promotion points system encourages people to go overseas for training because it does not recognize in-country training. Persons transferring to Kathmandu are discouraged by limited housing and high costs. Incentives for some officers to engage in fieldwork do not apply to officers in planning cells who are faced with low allowances and per diem. One could conclude that the Administrative Management Department does not understand the problems of technical departments.

Even when an individual becomes qualified to carry out effective watershed management and irrigation, there is no incentive for him to do so. Good work is not rewarded by a promotion or increased salary, and ineptness or indolence are not punished. A reward system is needed.

Other problems relate directly to the project manager, who lacks special training and is faced with outdated HMG rules and regulations pertaining to accounting, tender procedures, and delegation of authority.

The rigidity of HMG organization prevents a good manager from transferring to other departments where his skills may be needed. The current system seems to encourage management by crisis as well as to promote suspicion and lack of trust.

Management science must be put into practice. Incentives for officers to work in the center should be increased but field incentives should not be reduced. Ability must be recognized and rewarded, especially in technicians. Periodic evaluations should be introduced. Cases in which rules and regulations affect management should be compiled, studied, and the rules modified.

Funding. Some areas of HMG are unable to spend their budgets while others cannot function properly for lack of funds. More flexibility in transferring funds between budget heads is needed. Further, planning and budgeting are often not done sufficiently well, and maintenance funds are too low. There is a lack of confidence between the Finance Ministry and other agencies: for instance, a section officer in the Finance Ministry can disburse higher sums than the secretary of a ministry. The Finance Ministry also does not give authority to responsible officers.

A survey should be made of financial problems faced by upper- and middle-level managers as a basis for changing and streamlining rules.

High-priority HMG programs that are impaired by lack of funds should be identified. An equitable mechanism for reallocating surplus funds should be established.

Transportation. Considering Nepal's mountainous nature, it is surprising that greater efforts have not been made to overcome transportation and communication problems. HMG rates for per diem and for porters are too low, which encourages staff to compensate by manipulating expense accounts and time sheets. Problems involving availablility, portability, and maintenance of equipment complicate and inhibit fieldwork.

A study of ways to overcome transportation problems in hilly regions should be made. Consideration should be given to lightweight equipment, decentralized placement, and sharing between departments.

Policy, Laws, and Land Ownership. Different line agencies deal with laws concerning land, but ambiguities and contradictions in the laws lead to conflict. The DSCWM has no law to allow it to operate. HMG has no definite land-use policy (e.g., what land should be under forest) nor a water-use policy.

The recently established National Council for the Conservation of Natural Resources should formulate a national land-use policy, based on a simple scheme for classifying land capability that should be developed. A committee of lawyers and technical officers should then be set up to review laws and the way they operate and to recommend changes, including new legislation and policy.

Coordination of Activities. Whenever several departments are responsible for managing a combination of renewable resources, a deliberate attempt should be made to force these departments to coordinate their activities. Formal coordination will be one

mission of the National Council for the Conservation of Natural Resources. However, it would be expedient to supplement this high-level coordination with interdepartmental project committees, and by encouraging frequent informal contacts between professionals through regular lecturers and seminars. An informal interdisciplinary linkage of agency programs and personnel could result from forming a National Academy of Arts and Sciences for high-level professionals; by establishing a continuous professional seminar program; by producing a regular newsletter; and by naming special subcommittees of the NCCNR.

Local Participation

A farmer is more likely to adopt conservation practices when he can see direct benefits for himself and his family, for example, a closer or better source of drinking water and fuel, more reliable or plentiful irrigation water, or improved crop production. Information about these benefits could reach the farmer through special education efforts such as demonstration projects. There is a direct correlation between level of education and receptivity to change.

It is desirable that the various agents of change, whether local leaders, junior technician assistants, junior technicians, school teachers, or agency personnel, work together, which prevents confusion, contradiction, and fragmentation. Low status and morale of change agents, especially extension personnel, are serious problems that deserve immediate attention.

Local organizations can greatly facilitate adaptation of new technologies, but few exist in hill communities.

Priority should be given to works that improve the quality of people's lives and promise rapid and immediate benefits. Conservation practices should be designed as an integral part of these works or as a direct and obvious adjunct.

Technological change should proceed gradually rather than flood the farmer with a bewildering array of improvements in cropping, livestock management, and other practices. The linkages between a sequence of introduced practices should be simple and easily demonstrable to the farmer.

The status and support of the extension agent must be improved. Better training, higher qualifications, and stronger performance incentives are needed for this potentially valuable agent of change.

AGRICULTURE AND LIVESTOCK

ISSUES AND PROBLEMS

The ecology of the hills depends on the economy of the hill people, which is overwhelmingly agricultural. With these facts firmly in mind, the agriculture and livestock working group centered its deliberations on the hills rather than the whole agricultural sector of Nepal. It was further acknowledged that: (1) hill people are in many instances being compelled to consume their productive assets through overexploitation of forests, pastures, and cultivated lands; and (2) harmful ecological changes cannot be halted merely through technical interventions and remedial work. Instead, ecological stabilization will require viable economic alternatives to present destructive resource-use practices.

Agricultural Production

Major declines in soil fertility and productivity appear to be occurring in cultivated upland soils (as opposed to paddy) and on those lands that have recently been brought into cultivation. The fertility status of hill soils is low, and generally farmers recognize that production of a second crop on paddy land results in subsequent declines in yields. Apparently, nutrient inputs and losses on these lands under a single cropping system are in approximate equilibrium (albeit at a low level). However, fertility is declining on cultivated uplands, and on newly cultivated uplands erosion is generally severe.

Two keys to increased production on arable lands in the hills are fertilizer and irrigation. The cost of fertilizer for the hill farmer is so high that a 200 percent subsidy is currently required.

Use of ammonium sulphate as a source of nitrogen has lowered the pH of already acidic soils. On the other hand, it was reported that cropping systems developed by the Integrated Cereals Project through on-farm research can be profitable even without the fertilizer subsidy.

Government-built hill irrigation systems typically serve 50-100 hectares, at an average cost of Rs.30,000-35,000* per hectare. Not much is known about the costs of construction and maintenance and methods of operation of village-built systems. It was suggested that the high water requirements of hill agricultural soils--about 5 liters per second per hectare--contribute to high costs. These could be met with better water management and cropping intensification on irrigated lands.

It was concluded that inorganic fertilizers and irrigation could not be relied on as the sole techniques for raising hill agricultural production and incomes.

Regional and local markets for agricultural surpluses are extremely important for stimulating production and increasing cash flows and local purchasing power. For example, in Jumla apple production was developed but the apples could not be marketed. For the opposite case, many hill areas serviced by roads do not take advantage of better market opportunities.

Livestock Production

In the hills of Nepal, agriculture, livestock production, and forestry are intimately related. About two-thirds of the ruminant animals are fed from croplands, the remaining third from public forests and grazing lands. As demands upon public lands increase for fuelwood, fodder, and grazing [individuals consider it to their advantage to utilize as much public land productivity as possible], environmental degradation ensues. Forests with full canopies are transformed to forests with scattered trees, and then to scrub. Frequently these lands are terraced and cropped, and finally they become barren due to excessive erosion. As wood supplies decline, precious animal dung is used as fuel rather than fertilizer in some areas, and thus production of cultivated crops decline.

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*Twelve rupees equals approximately US$1.00.

Livestock are, in effect, a "cash crop" and are within the reach of many hill farmers. However, available feed provides less than half of nutritional requirements, resulting in animals that are low producers. Cross-bred introductions cannot realize their full genetic potential. Overall production and numbers of cattle have fallen in the hills in the last 10 years, while the number of buffalo has remained at the same level. A shift in favor of more buffalo and fewer cattle would reduce the number of livestock grazing the pastures and forests. There is no equivalent of the Integrated Cereals Project dealing with these problems of hill livestock.

Lower-Income Farmers and Other Rural Poor

Lower-income farmers and other rural poor make up the majority of the hill population, and control poorer and smaller amounts of land--primarily upland, poorly terraced, erosion-prone tracts of cultivated land. They have only their labor, and of necessity follow a mixed strategy of subsistence agriculture, provision of local goods and services (e.g., blacksmiths, tailors, cobblers); and seasonal migration to unskilled jobs on the plains. Forced conversion of these lands from cultivation would harm people who already have the most precarious livelihoods. Unfortunately, little attention has been given to alternative production systems for these kinds of lands that would conserve the soil and maintain production.

Group approaches to small holders seem to have some chance of getting government resources to the rural poor (local institutions tend to be controlled by wealthy and socially prominent people), and this approach is more efficient from the viewpoint of hard-pressed government officers. Such an approach also builds self-confidence and gives economic opportunities to group members. The Small Farmers Development Project appears to be a useful beginning.

Community Management of Public Forests and Pastures

A lack of mutually agreed-upon rights and responsibilities toward public lands, both between communities and government and among people in the communities themselves, has been a major contributor to degradation of public lands. Local institutions that managed these resources earlier have fallen into disuse. In any case, they might not be able to cope with today's increased population pressures and demands on public lands. Several successes with local organization for resource management, notably at Tupche, were discussed. However, it is not clear how to replicate these successes elsewhere.

Research and Extension

Results from the Integrated Cereals Project show the fruitfulness of on-farm research and suggest an expansion of the project's scope to encompass farming systems. However, ongoing research problems include the following:

- What further socioeconomic and management constraints hinder farmer adoption of improved hill farming technologies?

- Given the number and diversity of hill agroclimatic zones, to what extent do new farming systems technologies have to be developed for each?

- How many different varieties and species of plants and animals need to be considered in farming systems research programs, beyond the basic cereal grains?

- What is the role of government subsidies in agricultural inputs and food in terms of who pays and who benefits?

Good land management in the hills will require good delivery systems for information, new technology, and other needs. Ultimately good land management will also require that government decision- and policy-making systems are geared to local problems and needs. Apparently these systems are not functioning as well as might be desired.

There are also not enough junior technicians and junior technician assistants to provide the extension services required by hill farmers. Further, existing institutional structures do not encourage these extension workers to visit farmers in the field. Junior technicians and junior technician assistants frequently lack knowledge of local environmental conditions and sensitivity to local socioeconomic conditions. Finally, extension workers in the hills often have extremely narrow areas of specialization which results in conflicting advice being given to a farmer by different workers.

TECHNICAL OPTIONS

The panel identified numerous existing technologies that could be applied to the problems of agriculture and livestock management in the hills of Nepal. However, the economic viability and local acceptability of these technologies must be investigated.

Enhancement of Agricultural Productivity

The keys to enhancement of agricultural productivity are water, nutrients, and crop husbandry. Water requirements for hill agriculture are comparatively high, as are the costs of irrigation systems and inorganic fertilizers. Technical options considered for hill cropping systems are listed in descending order of immediate availability:

1. Improvement of compost making, storage, and use
2. Improvement of existing irrigation systems
3. Efficient use of available plant nutrients
4. Introduction of legumes in the cropping sequence to increase soil fertility and livestock feed
5. Production of nitrogen by means of mini-hydro projects in the hills
6. Biological nutrient enhancement by using azolla and legumes

Enhancement of Livestock Production

Attention to nutrition, husbandry, health, and genetic improvement is the basis for increasing livestock productivity. The panel considered the following technical options for hill animal husbandry systems:

1. Range management through reseeding, fertilization, and replacing nonforage weeds with dual-purpose trees
2. Introduction of forage species or dual-purpose crops in the cropping sequence
3. Genetic improvement of livestock populations through cross breeding and selection
4. Adoption of preventive and curative measures against prevailing diseases
5. Improvment of herbage conservation methods
6. Introduction of a silvi-pastoral system in new plantations

The panel also recognized the importance of studies about the technical feasibility of the hill farming system as a whole, especially:

1 Investigation of production levels under existing conditions and the expected impact of environmental modification on production systems

2 Classification of cropping patterns based on water regime and soil fertility

3 Investigation of integrated farming systems in various environments

4 Investigation of alternate cropping systems that best utilize the complex hill environment

5 Cost-benefit analysis of the different technical options

ENERGY

One of Nepal's major natural resources is its forests, and for centuries fuelwood has been the country's primary source of energy. Historically, fuelwood has been obtained free simply by harvesting forests, which required only the labor necessary to gather and carry it to houses, villages, and urban centers.

Over the past two decades, however, increased local demand for fuelwood to serve energy needs has resulted in wholesale destruction of Nepal's forests. At the same time, a tremendous growth in tourism has exacerbated the process. Approximately 1 million hectares have been lost in only a few years and forests now comprise only about 29 percent of the country. Loss of forests on the steep slopes of hills and mountains will greatly accelerate erosion.

It has been estimated that unless there is a concerted effort to manage forests and encourage use of other energy-producing renewable resources, the forests of Nepal will be almost totally destroyed by the year 2000. Fuelwood is emphasized here because in the near term there are few other energy alternatives for Nepal.

A coordinated, systematic energy program is urgently needed in Nepal if there is any hope of reversing the above trends. In addition, the development of technologies based on nonconventional forms of energy is greatly needed to (1) reverse environmental degradation by lessening the almost exclusive reliance on wood for energy; (2) reduce dependence on imported fossil fuels; and (3) enhance the quality of life of the people of Nepal.

CURRENT STATUS OF ENERGY PRODUCTION AND USE

Comprehensive primary data have been compiled by the Energy Research and Development Group of Tribhuvan University (RECAST) and others on energy sources presently used, estimated energy

requirements to the year 2000, and the progress of both conventional and alternative energy sources programs. These reports are summarized only very briefly as follows.

Fuelwood. This resource provides approximately 87 percent of all energy in Nepal and up to 95 percent in the rural areas. Estimated consumption amounts to about one cubic meter per capita per year, but estimates can vary as much as by a factor of 60. Commercial and industrial consumption of fuelwood is substantial--up to 25 percent of demand in some areas. Forests are being depleted at a rate of nearly 100,000 hectares per year. Villagers often must walk for several hours to obtain firewood, and the cost of fuelwood in towns and cities is increasing rapidly.

The Department of Forests is beginning to reverse this trend, however, by introducing fast-growing trees and reforesting some denuded forest areas. Nevertheless, these programs are only in the initial stages, and the destruction of forests to obtain firewood is still occurring much faster than can be balanced by the reforestation program. [The recent National Research Council publication on firewood crops* responds to the need for increased development of this source of energy.]

Electricity. About 64 megawatts of electric power is produced in Nepal--60 percent from hydro and 40 percent from diesel or other sources. Because of the heavy rainfall, along with snow melt in summer months, hydropower has great potential in Nepal. In fact, estimates indicate that the entire energy needs of the country could be supplied by using only about 40 percent of the potential hydropower.

The cost of hydro is high, however, and in most cases beyond the capacity of potential utility groups and even the central government. Initial capital costs are in the range of Rs.25,000-50,000 per kilowatt. With maintenance and operation, lighting costs per household would be a mimimum of about Rs.20 per month. As most rural people cannot afford this, hydropower would initially be most applicable to towns and more densely populated areas with higher family incomes.

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*National Research Council (1980) Firewood Crops: Shrub and Trees Species for Energy Production. National Academy Press, Washington, D.C., USA.

Hydroelectric projects would be especially attractive candidates for funding by donor countries. It was generally concluded, however, that more hydrological data are necessary to determine the most feasible projects.

Water Power. Harnessing of water power for milling and other mechanical operations is well developed throughout Nepal, and its continued and accelerated use is rightfully being encouraged. Such "run of the river" use of water does not require dams which would fill rapidly with silt, given Nepal's severe erosion conditions.

Alternate Energy Sources. Energy from biogas, wind, and solar is appropriate to small-scale use and remote areas of Nepal. Progress is being made in both the technology and numbers of installations, and such efforts should be encouraged. In the case of alternate sources of energy, however, the capital costs are high, and therefore there are no alternatives at this time to fuelwood and water as primary sources of energy that can be provided on a massive scale.

Fossil Fuels. Nepal has practically no fossil energy except for a few small gas pockets, and therefore fuels such as kerosene, diesel, and gasoline must be imported. With the difficulties of transportation caused by Nepal's terrain, this more than doubles the cost of these fuels over their costs in countries that have access to transport by sea. For example, kerosene for cooking and even for lighting purposes is becoming prohibitively expensive at a cost (1981) of Rs.5.15 per liter.

TECHNICAL OPTIONS

Afforestation projects such as forest plantations close to villages will provide the most effective short- and long-term solutions to environmental problems (erosion, landslides, siltation of water courses) and to fuelwood shortages in Nepal. At the same time, however, the development of energy sources that decrease demands placed on the forests (e.g., biogas) or promote energy independence from imported fuels (e.g., hydro) should be encouraged.

In addition to afforestation, this working group identified five technologies that have received considerable attention in terms of research, development, and actual or planned implementation. These technical options are examined in terms of (1) availability; (2) in-country production capabilities; (3) governmental, institutional, private, and donor agency efforts to disseminate the technologies; and (4) constraints to widespread implementation.

Hydropower for electricity generation and labor-saving devices (rice husking, flour milling, oil expelling, drying, pumping, irrigation). Nepal's manufacturers of small water turbines include the Butwal Technical Institute in Butwal, Balaju Yantra Shala in Kathmandu, and Nepal Yantra Shala. Turbines are also imported from India. All three Nepalese companies offer survey, installation, and monitoring services. The Small Hydro Development Board, the Nepal Electricity Corporation, and the Electricity Department of the Ministry of Water Resources are HMG agencies concerned with water turbine installation. Canadian, Swiss, and American donor agencies are currently involved in small water turbine projects. Problems encountered regarding widespread installation include high costs, transportation, maintenance, lack of hydrological data, funds for research and development, and manpower constraints.

Biogas for fuel, lighting, and as a source of nitrogen-rich fertilizer. Other potential uses include the utilization of methane gas for internal combustion engines, refrigeration, welding, and bottling. Two basic biogas plant designs--the Indian drum model and the Chinese underground model--are manufactured in Nepal by the Agricultural Tool Factory in Birguni, Balaju Yantra Shala, and the Butwal Technical Institute. All three companies offer installation and follow-up monitoring services.

Approximately 750 biogas plants have been installed in Nepal. Since 1976, the Agriculture Department (Soil Science Section) and the Agricultural Development Bank have been involved in a program designed to encourage the use of biogas plants by farmers. Problems most frequently cited include high costs, transportation difficulties, an adequate water supply, and low gas production of plants in higher and cooler environments.

Cooking stoves that are smokeless and fuel-efficient. "New Chulas" have received much publicity, and are intended to reduce family fuelwood demands while promoting a healthier household environment. Research and development activities have been conducted by the Research Center for Applied Science and Technology (RECAST), the Fuelwood Corporation, the Community Forestry Project, private firms, and individuals. However, it is generally agreed that more field tests are needed before actual large-scale implementation of the stoves in villages.

Solar energy for heating and distilling water and drying fuelwood, vegetables, and fruits. By far the most widespread use of solar energy (besides the indigenous practices of drying vegetables, grains, and paper in the sun) is for heating water. Balaju Yantra Shala manufactures two types of solar water heaters and has installed over 500 in various parts of Nepal. Primary installation

sites include residential housing in Kathmandu, National Park Headquarters, hospitals, and tourist hotels along trekking routes. Providing heated water for the tourist industry could be a major application of solar energy.

No government agency is presently concerned with the installation of solar water heaters. Research regarding the development of solar stills and solar kilns for the drying of fuelwood and produce is currently being conducted by RECAST. The Resource Conservation and Utilization Project (RCUP) plans to promote solar water heating and drying in its energy component activities. Problems cited regarding widespread implementation of solar devices include high costs, transportation difficulties, the reported marginal success of existing water heating units, and insufficient time to field test other solar devices.

Wind energy harnessed by windmills for water pumping and irrigation. This is one of the newest technologies introduced in Nepal. In the past, trial windmills have been built by Peace Corps Volunteers and UNICEF. Since August 1980, Shakti Magazine and Nepal Yantra Shala in Patan have been testing a windmill designed to pump water. The Resource Conservation and Utilization Project plans to introduce windmills as part of its energy component. No government agency is presently concerned with windmill research, development, or implementation. In addition, there are no wind device manufacturers or conclusive tests of windmill performance in Nepal.

Based on the preceding assessment of technical options available for the alleviation of energy-related problems, the Energy Working Group summarized the status and problems as follows:

- Various technologies, including hydro, solar, biogas, etc., are available from Nepalese sources. Research, development, and implementation capabilities also exist in Nepal.

- HMG, in dealing with energy-related problems, has emphasized afforestation, hydropower, and biogas projects. While these are acknowledged as being important elements of Nepal's energy activities, the energy working group felt that due consideration of other alternative sources of energy (wind, solar, etc.) is lacking.

- The major constraints to the widespread implementation of nearly all alternative technologies are economic (high cost per unit), logistical (transportation and maintenance difficulties), and social (lack of villager awareness, reluctance to change traditional energy practices).

- Interest in the research, development, and implementation of energy technologies is high in Nepal. This includes involvement from the institutional (e.g., RECAST), private (e.g., Nepal Yantra Shala), donor (e.g., SATA, World Bank, USAID), and government sectors (e.g., Agricultural Department, Water and Energy Commission). However, there is a serious lack of coordination and communication between these sectors which has undermined the ability of all concerned to deal effectively with the research, development, and implementation problems encountered.

- In addition to the above, there is no national energy plan designed to practically and systematically address the serious energy problems facing Nepal. The lack of such a plan has contributed to the scattered, largely ineffective efforts to deal with current energy problems.

CONCLUSIONS AND RECOMMENDATIONS

The basic constraints to the alleviation of Nepal's energy problems are (1) lack of a single central agency that deals exclusively with energy and energy-related problems; (2) lack of coordination and communication between institutional, private, donor, and government energy entities; and (3) lack of an overall energy plan. In view of the above and an assessment of energy as it relates to management of renewable natural resources in Nepal, the energy working group drew up the following recommendations:

- There is no alternative form of energy that can be provided on a massive scale at this time that would replace fuelwood and water power as primary sources of energy. Production of more fuelwood in individual house gardens should be encouraged and more accurate measurement of fuelwood uses for domestic and industrial purposes required. The special problems of providing fuelwood for urban use should be addressed.

- New smokeless and fuel-efficient stoves may reduce family fuelwood demands, but more field tests are needed prior to the actual large-scale implementation of such stoves in villages.

- Accelerated use of water power for milling and other mechanical operations should continue to be encouraged.

- Hydroelectric power is currently affordable only in towns and densely populated areas with higher incomes. While hydroelectric projects are attractive candidates for donor funding in view of Nepal's extensive resources, more hydrology data are necessary to determine the most feasible projects.

- Energy from biogas, wind and, solar sources is appropriate to small-scale use and remote areas; efforts to improve the applications of these technologies where appropriate should be encouraged and accelerated. Solar and other alternate energy technologies should be considered especially for specific uses, such as providing heat and hot water in areas of major tourist impact (trekking trails, national park headquarters, hotels, etc.).

- To provide a coordinated attack on the energy problems of Nepal, to instill a sense of urgency among the people and at all levels of government, and to ensure the immediate implementation of an action program adequate to cope with the problems, a National Energy Commission should be considered. As an alternative to the establishment of such a commission, the existing Water and Energy Commission should be strengthened. The responsible institution should have sufficient status to bring to the attention of both government and the people the urgency of the energy problem and should have sufficient influence to bring about a coordinated plan of action.

- The institution responsible for energy coordination should prepare a national energy plan that focuses on specific annual energy requirements and targets for each year of the Sixth 5-Year Plan and beyond.

- A clearinghouse should be established by the responsible institution to exchange knowledge on each energy technology. It was suggested that, for example, a copy of each publication on each technology be lodged with a central agency, such as RECAST, as one step.

- The responsible institution should engage in the systematic implementation of technologies in the rural areas through education, training, and demonstration efforts.

- The responsible institution should encourage the research and development of alternative sources of energy, such as biogas, small hydro projects, and solar energy, including

wind. It should also encourage the development of those industries that consume small amounts of energy until a future time when more energy is available from hydro sources.

- The responsible institution should set clear targets or goals for each energy source per year, and then monitor the actual performance as a continuous function.

- The responsible institution should integrate its efforts closely with those of the National Planning Commission.

HUMAN RESOURCES

This report contains conclusions and recommendations relating to human resource issues in renewable resource management in Nepal. Because of the breadth of the topic "Human Resources," this working group divided its activities into four subtopics, each addressed by a subcommittee:

1 Population and resource issues

2 Government cooperation and interagency coordination

3 Education and manpower training needs

4 Problems of individual and community participation

POPULATION AND RESOURCE ISSUES

Management of Nepal's resources is directly affected by various demographic factors including rate of population growth, population distribution and settlement patterns, and occupational structure of the population.

Population Growth

The present estimated rate of population growth of 2.5 percent a year is expected to increase because of the age structure of the population and the fact that mortality rates will decline more rapidly than birth rates. Despite a growing emphasis on family planning programs, the current percentage of users of birth control methods is still very low (an estimated 3 percent of females between 15 and 49 years of age in 1976).

Continuation of such high rates of growth may create intolerable pressures on Nepal's resource base, particularly in the more fragile hill environments, which already accommodate over 1,000 persons per square kilometer of arable land, and therefore rank

among the most densely settled rural areas in the world. Such high population growth rates also contradict efforts to increase per capita standards of living and may defeat efforts to manage Nepal's resources on a sustainable yield basis.

In view of this direct connection between population size and growth, on the one hand, and the prospects for success in resource management, on the other, this working group reaffirms the urgency of implementing effective family planning programs to assist in reducing population growth rates. It further recommends that particular attention be given to the seriously overcrowded hill areas, although it is aware of the difficulties presented in implementing such programs in remote areas with dispersed settlement patterns.

Population Distribution and Occupational Structure

Nepal is a predominantly rural nation, with perhaps 96 percent of the population residing in rural areas. Urban growth has been slow and the majority of the nation's urban residents comprise residents of the Kathmandu valley.

The occupational structure of Nepal reflects its rural character. More than 90 percent of the labor force is employed in agriculture and related industries (although many receive a substantial share of their income from other sources). No major shifts in the labor force composition have occurred over the last two decades.

Nepal is a densely settled nation with an estimated 78 persons per square kilometer of cultivable land and more significantly 598 per square kilometer. The distribution of its predominantly rural population is highly uneven in relation to its agricultural resource base. The hills and mountains have some three times as much population per unit of cultivable land as the Terai. As a result, areas with the least agricultural potential and fewest employment opportunities outside agriculture must bear the greatest population pressure on agricultural and related resources. Further, population settlement patterns in the hills often consist of small villages or isolated homesteads. When added to the problems of access and transportation in hill and mountain environments, this presents enormous difficulties in the delivery of basic needs and services to the hill population.

The overwhelming disparities between hill and Terai man-to-land ratios result from historical, cultural, and institutional factors, including land ownership patterns. Some lessening of disparities

has occurred over time through migration from the hills to the Terai. A small percentage of the migrants have been accommodated in planned government resettlement schemes, but the vast majority have been spontaneous migrants, many of them settlers responsible for the illegal clearing of Terai forest lands.

With the disappearance of forest lands in the Terai suitable for settlement, the scope for planned resettlement schemes of the type formulated in the past has diminished. The Sixth Five-Year Plan reduces emphasis on planned resettlement schemes in the Terai and emphasizes instead retention of population in the hills through increased agricultural productivity and creation of off-farm employment opportunities. However, there will likely be a continued spontaneous migration of population from the hills to the Terai, in view of the overwhelming disparities in hill and Terai man-resource ratios, and in addition, a significant immigration to the Terai from adjoining areas of India, which are also more densely populated.

The above underscores the urgency for Nepal to develop a national settlement policy in conjunction with a national land-use policy. A national land-use policy (discussed elsewhere in the report) based on a detailed study of land capability in Nepal would present a basis for estimating population-carrying capabilities for agricultural populations in the various regions of Nepal. A national settlement policy should address the following issues among others:

- Macro-scale settlement patterns, including the relative distribution of population between the hills and the Terai
- Means of accommodating the continued flow of spontaneous migrants from the hills to the Terai
- Examination of related policies regarding land reform, tenure, minimum farm size, etc. which may need revision in view of desirable settlement policy
- Means of stimulating employment and growth in an appropriate network of smaller towns and settlements
- Development of a basic needs delivery system that can be reconciled with Nepal's dispersed settlement pattern and the possible need for rural settlement consolidation
- Means for achieving desired settlement patterns based on incentives guiding spontaneous migration, as opposed to forced or coercive measures.

The working group therefore recommends development of a national settlement policy, possibly through a task force organized by the National Planning Commission, as a matter of high priority.

GOVERNMENT COOPERATION AND INTERAGENCY COORDINATION

In his opening remarks, Dr. Mohan Man Sainju, member, National Planning Commission, suggested that this workshop give serious thought to coordination of agencies dealing with renewable natural resources. The National Council for the Conservation of Natural Resources (NCCNR) has been formed to provide policy direction, insure needed coordination, and evaluate performance. Dr. Sainju urged participants to consider specific recommendations on promoting intra- and interagency coordination at all levels within the HMG system. Implicit in Dr. Sainju's remarks was the need to have continuity of involved personnel.

As HMG has already agreed to establish the Council, discussion will center on recommendations that will help NCCNR gain a solid institutional base. NCCNR responsibilities established by HMG include:

- To advise HMG on national natural resource conservation strategies, policies, and actions before they are promulgated

- To help HMG develop new policies, guidelines, actions, and strategies for the conservation of natural resources

- To help coordinate integrated resource conservation and utilization projects jointly implemented by several HMG line agencies

- To review project implementation plans of such projects and monitor their progress

- To promote measures that minimize the adverse environmental impacts of new dams, reservoirs, irrigation, roads, and agricultural development programs. While doing so, the council will try to establish a mandatory allocation of some percentage of the project cost to finance conservation activities in the affected watershed.

- To be final advisor to HMG on all conservation-related projects after they and their consistency with the national policy have been carefully reviewed

- To review district- and panchayat-level resource conservation committee actions and provide direction as needed

As an additional function, NCCNR should consider matters of government structure in areas of management and prepare governmental reorganization plans where appropriate.

Achievement of these objectives will require ongoing and adequate staff support. Background and position papers must be prepared on a wide range of policy issues for NCCNR consideration. Policy and program issues must be articulated and alternative courses of action developed for Council action. Staff should also monitor progress in implementing Council action and report back on successes and problems encountered. Finally, the staff should serve as a liaison with district-level coordinating bodies and report back to the Council on their operation.

The staff might act in much the same capacity as the Population Division of the National Planning Commission acts for the National Commission on Population. Beginning in 1979, USAID provided $2 million in grant funds over a 5-year period to aid the National Planning Commission in this effort. This funding is used by the Population Division to conduct research, to assist in the general operating costs of the Population Commission Secretariat, to train 15 Nepalese in research to the M.A. level, to provide consultants as needed, to conduct workshops, to disseminate results, and to arrange study tours by HMG officials to the United States.

Recommendations

- HMG should seek donor assistance to aid NCCNR in developing a secretariat for carrying out its mandate. These funds should be used for similar activities carried out by the Population Division and should also be administered by the National Planning Commission.

  At the district level strong coordinating mechanisms must also be developed. These bodies could be organized following political or natural resource boundaries, depending on the type of activity. District-level responsibilities would include: (1) reviewing program planning and implementation, deciding on priorities and funding needs, and recommending appropriate NCCNR action; (2) maintaining coordination among different program elements; (3) minimizing overlap and duplication with other areawide activities.

It is suggested that at least one-half of the proposed staff be selected from affected panchayats. The key to the Council's success hinges on provision of solid staff support.

- If the first recommendation is adopted, a portion of this money should be allocated to staff local bodies dealing with renewable natural resources.

- Integration and coordination of activities among various line agencies may be enhanced if they are encouraged to engage jointly in location-specific projects. Project monitoring and evaluation should be based on local impacts and outputs rather than inputs, and should cover performance of all involved agencies and personnel.

This intergovernmental structure needs not only a coordinated thrust and adequate staff support but also continuity of high-level administrators within the HMG governmental structure, both in Kathmandu and in the field. These will prove equally difficult to achieve. It is beyond the scope of this working group to suggest ways in which these problems can be reduced. However, it is not beyond our scope to mention this as a serious problem that will affect implementation of major natural resources programs and policies.

Another area that warrants consideration is the need to train skilled managers to guide efforts of this type. Donor-assisted programs such as the AID support grant for the Population Division contained a training component. Provision should be made to include this activity as a major thrust of NCCNR.

EDUCATION AND MANPOWER TRAINING NEEDS

This working group discussed various issues and problems associated with the current status of education and manpower training needs in Nepal. Among the issues considered were:

- Lack of adequate attention to Nepal's renewable resource management problems as a component of general education

- Problems associated with training various levels of specialists in agricultural and renewable resource management including: (1) selection of students, (2) capacity and location of training facilities, and (3) rigidity of curricula and approaches

- Problems of utilization of trained manpower
- Diffusion of information and technology

General Education

To improve understanding of agriculture and renewable resource management problems in Nepal as part of general education:

- It is recommended that the curriculum in the primary schools be modified to place greater emphasis on agriculture and renewable resource management. This would seem particularly important in agricultural areas where the vast majority of children only receive an elementary school education. If this education is made more relevant to their life and likely occupation, it may serve to increase acceptance of the desirability of education by parents and serve as a means of diffusing useful knowledge to rural families. As part of their curriculum change and reorientation, rural elementary schools should be provided with resources for garden plots and ponds.

- At the academic secondary school and higher education level, general education should include a component treating Nepal's agriculture, renewable resources, and environmental problems. At the college or university level this might well be incorporated in the required course on Nepalese studies.

Specialized Training

To remedy current problems in training more specialized manpower required for agriculture and renewable resource management:

- Programs in agriculture, renewable resource management, and related technologies and cottage industries should be strengthened in the vocational secondary schools. Incentives, such as lower tuitions or the initiation of work-study programs, should be considered to make these schools more attractive to students generally and more accessible to children from poorer families and the under-represented female population. The practice of discriminating against vocational graduates in admission to agriculture colleges should be ended.

- The current network of higher education facilities devoted to agriculture and renewable resource sciences (Institute of Agriculture and Animal Sciences-Rampur, agricultural campuses at Lamjung and Paklihawa, animal science campuses at Tripureswar and Khumaltar) has an inadequate capacity to meet local needs for trained manpower. Further, the location of these facilities is unbalanced, since only that at Lamjung is located in the hills. Therefore, it is recommended that the highest priority in development of additional capacity be given to the proposed Institute of Renewable Natural Resources to be established at Pokhara which will specifically address problems of agriculture and resource management in hill regions and environments.

- Development of additional government-sponsored, higher-level agricultural and resource management institutions should be considered only after the Institute at Pokhara is well established, and if adequate funding exists and there is a demonstrated need for additional capacity. If additional facilities are to be established at some future date, they should be carefully sited, most appropriately at the Regional Development Centers located in the hills. Any such new facility should be linked to an existing institution to permit sharing of science facilities, libraries, and teaching personnel.

- We have taken note of the desire expressed by the Nepalese participants to establish the best conditions for effective cooperation among the various departments, ministries, and offices of His Majesty's Government. In all countries, government bureaus inevitably compete for budgets, prestige, and security. What is indispensable--and feasible--is to ensure that the individual higher civil servants have common training, so that as questions and problems arise they can confer with confidence and mutual understanding.

  Nepal has already taken steps to introduce management training in the University and as part of civil service activities. However, for the renewable resources sector to benefit optimally from these developments, it is essential that administrators and managers in finance, transport, public utilities, and indeed all related functions be able to refer back to a common background and methodology. Experience suggests that "in-house" training, while useful, is no substitute for thorough group preparation. To lay a basis for communications and teamwork among all higher

civil servants, we recommend that a Resident College of Organization and Management with a 1-year curriculum be established on the following basis:

1 Admission to the College should be by competitive examination.

2 The College should focus on graduate pre-service management training, with candidates in two categories: (1) pre-selected after qualification for government service and provided with a stipend during the study term, and (2) destined for the private sector and charged normal tuition (except students qualifying for scholarship aid).

3 To ensure the very highest standards of scholarship, the College's charter should allow the university, His Majesty's Government, and private sector and appropriate donor institutions to nominate members of the Governing Board.

4 Attendance and satisfactory completion should be a prerequisite to government appointment at higher levels.

5 The college can, in addition, provide in-service training.

Proper coordination and liaison should, of course, be established with existing and prospective management training programs, but we emphasize the central importance of establishing--with the full authority of the government, the university, and the private sector--an independent Resident College comparable in quality to the leading institutions abroad. (Full accreditation by the Education Ministry is necessary.) To this end, a task force should be constituted at the earliest possible moment to recommend: (1) a charter that will permit donations of land and money, under optimally assured conditions, by Nepalese and other donors; (2) a curriculum fully adaptable to the Nepalese context, but that represents a high level of scholarship; and (3) guidelines for recruiting faculty, selecting students, and managing the college.

o Many students currently pursuing higher education in agriculture and resource management seem oriented toward securing academic credentials leading toward white collar, administrative positions rather than gaining knowledge to

be utilized in field positions or production-oriented work. It seems desirable to increase the proportion of students who come directly from rural families and who themselves have a background in day-to-day farm work. Selection procedures should be reoriented to favor such candidates, including those from vocational-agricultural secondary schools. Further, strenuous efforts should be made to increase the proportion of women attending such schools, perhaps through the establishment of quotas, scholarship programs, etc.

- The establishment of private institutions devoted to agriculture, renewable resource management, selected technologies, and cottage industries should be encouraged, and these institutions should be allowed to develop their own accredited curricula, not necessarily following that established for government institutions. They should be encouraged to develop innovative programs--such as work-study programs, adult education programs with flexible hours, etc.--in an effort to serve students not able to attend government institutions.

Manpower Utilization

Serious problems appear to be associated with the current utilization of manpower and career advancement in Nepal. A disproportionate number of trained personnel are engaged in office administration and an inadequate number in fieldwork, particularly in remote locales, which suggests the need for strong incentives for field placement and reconsideration of existing allowance policies. Also, general dissatisfaction exists with terms of service and career advancement. This working group recommends that study of these problems be undertaken immediately with a view toward formulating a policy of more effective manpower utilization. Such a study should also review current methods of performance evaluation to place emphasis on actual accomplishment, not merely on pro forma fulfillment of duties.

Dissemination of Information and Technology

The problems of developing a more effective extension service are treated by another working group. We recommend the following additional measures:

- Reinstitution of the National Development Service (NDS) through which university students spend approximately 1 year in domestic service. We further recommend that NDS place substantial emphasis on renewable resource management programs.

- Use of individuals who may not have academic credentials but do have specialized skills in aspects of resource management and related technologies and cottage industries as consultants for demonstration and training programs. They might also be employed as members of mobile teams, offering training in settlements and centers without pre-existing facilities.

- Existing technologies and practices employed in agriculture and resource management vary widely among Nepal's ethnic groups. Individual groups have a reputation for being skilled in specific aspects of resource management, for example, the Tharus in water management, the Sherpas in forestry, the Jyapus in agriculture. Substantial gains in productivity might result if the best practices currently used by such groups were widely disseminated and adopted. It is recommended that in-depth studies be conducted of the more successful resource management practices by individual ethnic and caste groups to determine the feasibility of their wider dissemination and adoption.

PROBLEMS OF INDIVIDUAL AND COMMUNITY PARTICIPATION

Local participation in management of renewable natural resources has frequently been interpreted to mean either contributing free labor to development projects or attempting to persuade local people to accept intervention strategies developed by outside development personnel. While both of these interpretations can be legitimate components in involving local people in the management of their own resources, they do not in themselves constitute genuine participation. Local participation is better understood if it is preceived as a mutual process of consensus and agreement in which the concerns of both local people and development agencies are made to coincide with regard to particular activities. Essentially, local participation involves decentralized decision-making and management authority, designed to make people self-reliant in partnership with development agencies in order to promote and maximize sound management of renewable resources--not to provide a free resource for stretching development agency budgets.

The implications of genuine local participation for planning, implementing, and evaluating development activities, as well as specific constraints and recommendations are outlined below.

Planning and Decision Making

- Macro-level land-use planning must be based on encouraging people to move toward sound land management by offering them better alternatives to present practices and by providing incentives to cover the additional short-term cost of changing present land-use behavior. Planning should not be based on coercive measures developed on purely technical grounds as such measures are neither economically nor socially feasible.

- Local resource management plans must be based on mutual agreement in which all parties clearly understand their respective strategies and responsibilites. Inevitably, this requires mutual accommodation and compromise, even on some technical issues such as optimum carrying capacity for pastures, optimum fertilizer application, etc.

- Managers and planners cannot expect most people to come to them to develop these local plans and interventions; they must go to the people.

Implementation

- Voluntary labor should not be automatically expected from local communities, particularly in relation to long-term projects. Except where immediate benefits are apparent or a community wishes to supplement or expand planned activities, labor should be compensated. The existence of high underemployment in Nepal in the face of low incomes is an indication of low productivity and the need for more secure employment without seasonal migration--not an invitation to utilize free labor.

- The cost of development resources (land, capital, commodities, water, etc.) should generally be provided by the developing agency. However, where the resource manager receives direct benefits (e.g., irrigation water on his/her field) or where the local community wishes to expand a project, locally contributed resources can be sought as appropriate through mutual agreement. Development projects should not, in general, be budgeted on the basis of requiring additional inputs from the local community.

Evaluation

Evaluation should be based on the impact of the project on the people and the environment--not only on inputs delivered. Thus people need to be involved in assessing outputs, effects, and impacts in resource development work.

Constraints and Opportunities

Specific constraints to local participation in resource management and opportunities for overcoming them through projects and incentives are listed below in three categories: behavioral, legal, and administrative.

CONSTRAINTS	OPPORTUNITIES
Behavioral	
Lack of grazing control on public land	o Provide additional sources of fodder from agriculture and forestry
	o Provide closer water sources for watering animals
Poverty and long-term nature of most conservation strategies	o In integrated programs tie long-term activities to short-term projects with high local priority
	o Reduce financial and labor costs associated with program, e.g., by providing free seedlings, by adjusting work time
People lack feeling of ownership	o Provide more authority to local communities to manage owner resources e.g., panchayat forest laws, local irrigation committees, etc.
People lack knowledge of technological options and alternatives	o Use multiple channels and and groups to disperse information, e.g., youth groups, extension, media, etc.

CONSTRAINTS	OPPORTUNITIES
Social distance from officials and hesitancy to approach them because of domineering attitude and vast differences in status	o Need for officials to approach people themselves and change attitudes o Need for training in communication
Lack of equality of opportunity across socially, economically, and sexually differentiated groups	o Need to target some specific opportunities for special groups and ensure weak groups are involved
Existence of local factions leadership rivalries	o Need to consult all local leaders and establish working committees at the local level with members of different groups, e.g., wards, voluntary groups, clubs
<u>Legal</u>	
Feelings of insecurity with regard to tree plantations	o Need to publicize new laws on private tree ownership o Need to finalize immediately private forest ownership rules
Feelings of insecurity with regard to ownership of upland fallowed fields	o New forms of agricultural land use need legal recognition, e.g., fodder tree orchards, agri-silviculture, rotational farming
Traditional resource management institutions have no legal status	o Incorporate local institutions into new systems where possible, e.g., forest protection into the Panchayat Protected Forest, irrigation committees using traditional systems, etc.

CONSTRAINTS	OPPORTUNITIES
	o Give flexibility to district level to recognize existing systems
Ambiguity of land ownership of wasteland in unsurveyed areas	o Provide authority to DFO Land Revenue Office to insist that areas either be privately managed (e.g., planted in trees or pasture) or donated to community for sound management (e.g., Panchayat forest)
	o Place priority on completion of cadastral survey in remaining districts
<u>Administrative</u>	
"Volunteer" labor is sometimes forced	o Institute two-way planning and joint agreement of responsibilities
Lack of continuous technical support, e.g., knowledge and maintenance	o Train local people and improve training of extension personnel
	o Provide for maintenance costs
Lack of effective communication through wrong approaches	o Provide training in communications
	o Provide incentives for district personnel
	o Hire local liaison people
Noninvolvement of women	o Target the hiring and training of women in programs
Lack of appreciation of knowledge	o Institute two-way local planning
Decreasing local initiative	o Provide recognition of and rewards for local initiatives
	o Clarify responsibilities through local agreements

CONSTRAINTS	OPPORTUNITIES
Lack of appreciation of local ecological and agroforestry system interdependencies	o Adopt a systems approach in developing new technologies and respect local knowledge
Lack of system for monitoring and evaluating outputs and effects	o Establish appropriate systems for monitoring project impacts and for providing continuous feedback on problems and processes

The constraints and opportunities associated with clarity and stability of land tenure mentioned above are essential to rapid advances in the management of renewable natural resources. For this reason, speedy completion of cadastral surveys and clarification, finalization, and modification of laws and rules dealing with different land categories have been stressed. In addition, it is recommended that more advanced practices in the recording and storing of verified information on land titles be established in surveyed areas. Clarity in land-use rights and land-use public policy will also make it feasible in due course to encourage carefully controlled investments in land development on the part of private sector investors, should the government wish to move in this direction. This possibility is mentioned in light of the development history of other developing countries.

To implement these recommendations in a comprehensive and equitable manner, it is further recommended that the government consider naming a special task force to deal with these problems.

APPENDIX A

Pokhara Area Field Trip, February 6-8, 1981
Donald A. Messerschmidt

This field trip gave U.S. panelists a chance to observe a watershed conservation project in the Middle Hills. The Phewatal Catchment Area Demonstration Project, currently in its fifth year under HMG auspices, was chosen in part for the problems and successes it demonstrates, and in part for its proximity to Pokhara.

The objectives of the Phewatal Project* are to demonstrate the benefits of improved land-use and conservation practices, and to reduce the rate of siltation of the Phewatal (lake), thereby protecting downstream investments in fisheries, hydroelectricity, irrigation, and tourism.

The Phewatal Project, begun in 1975, covers an area of 116 square kilometers (km) and contains a population of 20,000 people, 6 village panchayats, and 23 subwatersheds.

Demonstration activities to date include soil and water conservation demonstration plots, involving afforestation, forest protection, grass plantations, horticulture, terrace improvement, checkdam construction, landslide protection, river training, and drinking water supply. Six village panchayat soil conservation coordination committees have been formed under leadership of the village panchayat chairman (pradhan panch). Each consists of a vice chairman, nine elected village panchayat members, and nine farmers, usually selected for their interest in innovative conservation activities.

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*Based on a brief note from Project Chief Y. P. Khatiwada.

As of July 1980, the following achievements were recorded: afforestation, 100 hectares (ha); forest protection, 125 ha; horticulture plantation, 17 ha; grass plantation, 20 ha; checkdams, 250; terrace improvement, 75 ha; terrace construction, 14 ha; landslide protection, 3 facilities; and embankment construction, 560 meters.

A comprehensive watershed management plan has been prepared for the area with the following major activities and goals: afforestation, 1,000 ha; terrace improvement, 240 ha; torrent control, 110 ha; drinking water schemes, 7; grass plantation, 200 ha; stock ponds, 40; trail improvement, 70 ha; and various agriculture and livestock development activities.

This implementation project is planned for a 5-year period and is presently under consideration for funding by the Food and Agriculture Organization (FAO) of the United Nations. The projected budget is $2.5 million. Work will be carried out on a subwatershed basis.

OBSERVATIONS

Afforestation

We observed the following sections of the Phewatal Project area: the Forest Department's Protected Forest, observed on the Seti Watershed (east) side of Sarankot ridge, near the beginning of the trek; the Protected Forest within the Phewatal Project area, near Sarankot; an orchard plantation near Sarankot; and a forest seedling nursery below Sarankot.

The forests observed were all fenced with barbed wire and had controlled access (discussed below). The lush growth of seedlings and grasses under protection was quite distinct from the overgrazed, barren, and dry slopes and bracken-covered hills outside the protected sections. Ground water was once again available within one afforested area where there had been no water during the dry season before.

Species. Early on, Chir Pine (*Pinus roxburghii*) was a popular plantation species, but in the Phewatal area other species are now more popular. Pine was planted in part because it was indigenous and therefore a hardy, resistant tree. It grows slowly but has a good survival rate, and therefore is demonstrably more successful. Presently, more popular species include *Alnus nepalensis* (alder), which is fast-growing, nitrogen-fixing, resistant, and fairly good

for fuel, as well as for fodder and (when large enough) for building and furniture-making materials. Also noted were Castinopsis indica and Schima wallichia, resistant and good firewood species. The nursery had several other species. Bamboo plantings were also mentioned, especially on private land along torrents. The main orchard species is guava, although some citrus species are also planted. There were a few tea bushes (this is not actively promoted), but no coffee trees. The group noted that nursery production fluctuates between 50,000 and 150,000 seedlings per year; 2,500 seedlings are planted per hectare, with a better than 50 percent survival rate.

Fencing. All forest plots, the orchard, and nursery were fenced with barbed wire. The cost for 5-strand barbed wire in this area is reportedly between Rs.10 and Rs.15, as compared with only Rs.5 per running foot for a stone fence. However, barbed wire can be erected much faster than stone fences, and villagers reportedly prefer it for its authority and visibility.

Controlled Access. Each protected forest area has controlled access for grass cutters. The pradhan panch (village assembly chairman) is responsible for access. Villagers pay 25 pice (one-quarter of a rupee) per bharia (a load ranging from 40 to 60 kilograms (kg) of grass) cut within the protected areas, although access is sometimes given free because of the overabundance of available grass and the need to have it harvested. In time, thinning of trees, including trimming and fodder cutting will be allowed, and new plantings will be made as necessary in the future.

Outside the protected areas, fuelwood collection goes on as before, and we noted women and children heading to Pokhara to sell loads of fuelwood twigs. The reported price per load is 7 rupees.

Problems Discussed. When asked about what was not happening, our host indicated that it was difficult to develop additional protected plantation areas on the open grazing land. While villagers might understand the long-range benefits, they could not accept the short-range changes that closed forest plantations meant. They would have to stall-feed their animals, and cut fodder and grasses by hand. Furthermore, stall-feeding requires a ready supply of water which is not available. A 17-km water supply system is planned for the future project, but until that is realized one of the main goals--more forest plantations--is thwarted. Undoubtedly other social and political consideration exists, but the water supply problem is a critical constraint at the moment.

Social and Political Factors. Initial resistance to the project was high, resulting from villager suspicion of government intentions, resistance to changes imposed from outside and above, and the unacceptable novelty of the new social and economic patterns that the project implied. One of the first strategies of project developers was to engage the cooperation of one of the local pradhan panchs who donated, in one place, a 3-ha plot atop a potential slide area that threatened a lower village.

Village participation is arranged through conservation councils representing each of the six village panchayat areas in the project. This group oversees much of the conservation effort at the local level and control of access into protected forests, encourages local participation, and works closely with the project staff, foresters, and forest rangers. The council also helps to counter the feeling that no one individual is responsible for the project activities.

Upon installation of the proposed 17-km water system, one social problem is anticipated from villagers in the immediate vicinity of the source on Rainche ridge north of the project area. They are unlikely to fully appreciate drawing water away from their area. The project chief indicated that when the time came, villagers throughout the water supply area would meet to discuss implications of the project, and the full support of the upstream villagers would have to be guaranteed.

Some initial resistance to earlier forestation efforts was noted when a faction opposed to the fencing and other changes managed to cut the fence at one point and drive over 100 head of animals into the newly seeded area. The ringleader was apprehended, and his support is now apparently secured.

Some independent plantings around private farmsteads has occurred and is encouraged. But when asked why more trees are not planted in this fashion by individuals, one reply was that "trees attract birds; birds eat our grain." This, of course, reflects a short-term concern and a misunderstanding (experiments with species that attract fewer birds could be made, for example), and appears to be insufficient cause for planting activities on private land.

Other Observations in the Phewatal Project

Other aspects of this project that we observed were: checkdams for torrent control; livestock watering pond; house-building; firewood and grass and fodder cutters; and irrigation canals.

APPENDIX B

Workshop Agenda

FRIDAY, FEBRUARY 6

9:30	Registration, Blue Star Hotel
10:00	Introductory speech, M.D. Joshi, Director General, Department of Soil Conservation and Watershed Management, and Chairman, Nepal Panel
	Introductory comments, Roland J. Fuchs, Chairman, National Research Council Panel
	Informal comments, U.S. Ambassador Philip Trimble
	Inauguration speech, Makeshwar Prashad Singh, Minister of Forests
	Remarks, Mohan Man Sainju, Member, National Planning Commission
11:15	Reception
P.M.	Leave for Pokhara for observation trip by air and bus

SATURDAY, FEBRUARY 7	Trek through Phewatal Watershed Area in Pokhara, accompanied by Mr. Khatiwada, Project Manager
SUNDAY, FEBRUARY 8	Return to Kathmandu (bus)
MONDAY, FEBRUARY 9 - WEDNESDAY, FEBRUARY 11	Meetings of working groups
	Group 1: Forest, Rangeland, and Wildlife Management Group 2: Watershed Management and Irrigation Group 3: Agriculture and Livestock Group 4: Energy Group 5: Human Resources
MONDAY, FEBRUARY 9	
10:00	Group 1, first session Group 3, first session Group 5, first session
12:45	Working lunch
13:30	Group 1, second session Group 3, second session Group 4, first session
TUESDAY, FEBRUARY 10	
10:00	Group 1, final session Group 2, first session Group 3, final session
12:45	Working lunch
13:30	Group 2, second session Group 4, second session Group 5, second session
18:00	Reception hosted by U.S. Ambassdor Trimble

WEDNESDAY, FEBRUARY 11

10:00	Group 2, final session Group 4, final session Group 5, final session
12:45	Working lunch
13:30	Chairmen and rapporteurs draft working group reports
16:00	Chairmen meet to review working group reports

THURSDAY, FEBRUARY 12

10:00	Plenary session to hear reports of working groups, Shankar Hotel
13:30	Adjourn to complete compilation and approval of reports

FRIDAY, FEBRUARY 13

10:00	Official presentation of conclusions and recommendations by workshop co-chairmen Joshi and Fuchs, Hotel Blue Star,
11:00	Concluding remarks, M.M. Sainju
11:30	Closing of workshop and tea serving
12:00	Lunch - Hotel Blue Star - hosted by Mr. Joshi

APPENDIX C

List of Workshop Participants

NEPAL PANEL

M. D. Joshi, Director General, Department of Soil Conservation and Watershed Management (DSCWM), Chairman

S. Adhikari, Chief Meterologist, Department of Irrigation

D. M. Amatya, Civil Engineer, DSCWM

P. M. Baisyet, Project Chief, Bagmati Watershed Project

D. D. Bhatt, Research Officer, Centre for Economic Development Administration

T. N. Bhattarai, Chief, Training & Motivation, Community Forest Project

U. R. Bhuju, Soil Conservation Officer, DSCWM

Rabi Bista, Ecologist, Department of Wildlife and National Parks

Robin Bogati, Project Chief, Mahekali Integrated Rural Development Project

Sribindi Bojracharya, Agriculture Consultant, Resource Conservation and Utilization Project (RCUP)

R.K.L. Joshi, Medical Officer, Department of Health Services

S. P. Joshi, Forestry Officer, Tinau Watershed Project, DSCWM

V.B.S. Kansakar, Centre for Economic Development and Administration

I. N. Karmacharya, Engineer, Ministry of Water Research

Y. P. Khatiwada, Project Chief, Phewatal Watershed Area

T.B.S. Mahat, Planning Officer, Department of Forests

K. B. Malla, Planning Chief, DSCWM

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APPENDIX D

Introductory Speech
M.D. Joshi, Director General
HMG Department of Soil Conservation
and Watershed Management

It gives me much pleasure to welcome you to this inaugural ceremony of the "Workshop on Management of Renewal Natural Resources: Problems, Strategies, and Policies," which is being held under the joint sponsorship of the Department of Soil Conservation and Watershed Management, Nepal National Committee for Man and the Biosphere, and the U.S. National Academy of Sciences. In particular, I welcome the distinguished scientists who have come from the United States to join us on this occasion.

The Kingdom of Nepal is now undertaking a difficult stage of development while at the same time the forces leading to environmental degradation are building up very rapidly. His Majesty's Government of Nepal has launched various development activities in such fields as irrigation, hydropower development, forestry, roads, and integrated rural development. Nevertheless, unplanned and uncontrolled exploitation of natural resources has created a great threat to the ecological balance, particularly to our mountain environment.

It is in the national interest to conserve and, wherever necessary, restore the invaluable natural assets of soil and water, and in this way to improve the base for producing fiber, fodder, fuel, and the other fundamental needs of the people.

The Kingdom of Nepal is located in the young, steep, and somewhat fragile Himalayan ecosystem where an imbalance will adversely affect agricultural production which has now been shown to be declining. It will also increase the flooding of lowland areas accompanied by deposition of debris on prime agricultural land. To give some quantitative data, the percentage of Nepal's land area

covered in forest has declined from 45.5 percent in 1964 to 34 percent in 1974 and is now only 29 percent. At this rate there will be no forest cover left after another 20 years have passed. About 87 percent Nepal's energy needs are met from fuelwood. The opportunity that exists in other countries to substitute fossil fuels for fuelwood simply does not exist in Nepal, nor can it exist in the near future. Other facts about Nepal are:

- Nepal's hydropower potential equals that of the United States, Canada, and Mexico combined and is the highest in Asia but this cannot be fully utilized.

- Nepal's livestock population exceeds its human population, and it is not surprising to find that our fodder resources are totally inadequate.

- Crop production has been increasing at a rate of 2.1 percent but our human population has been increasing at about 2.4 percent and recently Nepal has had to import food grains.

- A recent inventory completed by the HMG/FAO/UNDP Integrated Watershed Management Project has shown that over 18,000 sq. km of Nepal is in unsatisfactory condition.

Nepal is a very poor country, and is classified as a "Least Developed Country," "Landlocked," and "Most Seriously Affected." Against this background the Department of Soil Conservation and Watershed Management is trying to find a workable solution for the government. You will agree that this is a massive task, especially when I remind you that six and one-half years ago this department did not exist. Against these gloomy facts and ever-worsening situation there are a few rays of hope. They include:

- The natural ability of the landscape to recuperate since the climate is, by and large, suitable for plant growth and the soils are deep and comparatively quite fertile

- The fact that in most places environmental degradation can be halted by improvements to land use

- Indications that the people themselves are usually prepared to cooperate in improving the environment

We are beginning to know the dimensions of the problem and the government is not only concerned about the situation but is also prepared to take active measures to improve the situation.

I am looking forward to the next few days when we will be considering such problems as conservation and improvement of forest and rangelands to supply basic needs not only of people but also of wildlife, improvement of watershed conditions and improved capabilities for irrigation, increased yields from crop and animal husbandry, the energy situation, and human resources. The second part of the title of this seminar, namely, "Problems, Strategies, and Policies" has been deliberately chosen to provide an orderly approach to our considerations.

APPENDIX E

Introductory Comments
Roland J. Fuchs, Chairman
National Research Council Panel

The serious problems of environmental degradation facing Nepal and the need to incorporate effective resource management in Nepal's development planning have already been recognized by His Majesty's Government. This awareness is reflected in many existing development programs and activities and is explicitly emphasized in the Basic Principles of the Sixth Plan. A considerable number of reports dealing with various aspects of resource management problems in Nepal--forest and watershed management, agriculture and rangeland management, water resources and irrigation, energy, and human resources--have already been prepared by His Majesty's Government, international donor agencies, and local and foreign consultants.

It is not our intent in this workshop to review all existing programs or to prepare detailed reports on specific aspects of resource management. This is unnecessary in view of previous studies and would, in any event, be impossible because of time constraints. It is our hope instead that together with our Nepalese colleagues, we can provide broader recommendations on opportunities, strategies, and policies that may be useful in improving the management of renewable natural resources in Nepal. Many previous studies have of necessity focused on individual resource and environmental issues; we will attempt to take into account the interdependency of resource systems so that our strategy and policy recommendations are mutually compatible. We will also keep in mind that our recommendations must be acceptable in terms of their capital and human resource requirements. Finally, we will try to remember that the only realistic recommendations are those that can be reconciled with His Majesty's Government's commitment to improving the standard of living and welfare of its citizens, in the short run as well as the long run.

Our success in achieving our goals will depend on the discussions and deliberations carried on in the working groups, which represent the "heart" of the workshop. Groups have been organized to treat forest, rangeland, and wildlife management; watershed and irrigation; agriculture and livestock; energy; and human resources. Each group will review issues and problems within the subject area and possible technical options. These will be considered and evaluated in terms of their capital and human resources requirements and compatibility with other development objectives. Each working group will prepare conclusions and recommendations regarding short- and long-term strategies and activities, institutional frameworks and needs, training and research needs, and policies and legislation.

The American participants in the working group deliberations and representing the National Academy of Sciences, consist of 10 persons drawn from various institutions in the United States. All have previous experience overseas, some in Nepal, and bring to the workshop a wide range of talent and experience. None of them are paid by the Academy for this service but rather have responded to the Academy's invitation to participate through professional interest and their desire to be of service. I would like to introduce them at this time:

- Charles Bailey of Cornell University. Mr. Bailey is a resource economist specializing in rural development and public policy. He was formerly a Peace Corps Volunteer in Nepal.

- Frank Davidson of MIT. Dr. Davidson has interests in system dynamics, macro-engineering, and mountain environments.

- L. Harlan Davis, University System of Georgia and Georgia Institute of Technology (currently seconded to USAID in Panama). Dr. Davis is a specialist in rural technology, employment and development as well as agricultural economics.

- Eckhart Dersch, Michigan State University. Dr. Dersch is a specialist in resource development and conservation and familiar with land- and water-use problems in Nepal.

- Thomas Dunne, University of Washington. Dr. Dunne, a geologist, is an authority on problems of hillslope erosion and hydrology.

- J. M. Hughes, Dean, College of Forestry and Natural Resources, Colorado State University. Dr. Hughes is a specialist in forest sciences and forest economics.

- Donald A. Messerschmidt, Washington State University. Dr. Messerschmidt, an anthropologist and a former Peace Corps Volunteer in Nepal, has interests in cultural and socioeconomic systems and integrated rural development.

- Rolf T. Skrinde, Executive Vice President, Olympic Associates, Seattle, Washington. Dr. Skrinde is a specialist in civil and environmental engineering and renewable energy resources.

- John M. Street, University of Hawaii. Dr. Street is a biogeographer specializing in problems of the creation and maintenance of grasslands derived from forests.

Our group also includes two staff members of the Board on Science and Technology for International Development, Rose Bannigan and Dennis Wood, and an observer from AID in Washington, Ming Ivory.

In participating in the workshop and its working groups, our panel does not consider itself technical consultants able to provide ready-made solutions to technical problems, nor do we bring preconceived answers to the difficult problems of selecting resource management strategies and policies appropriate to Nepal. Our participation, if it is to be successful, will depend greatly on the understanding of local problems, priorities, and constraints to be contributed by our Nepalese counterparts. We look forward to the pleasure of working with you, and learning from you in the week ahead.

APPENDIX F

Inaugural Speech
Makeshwar Prashad Singh, Minister of Forests
His Majesty's Government of Nepal

I am pleased to inaugurate this workshop on management of renewable natural resources. As natural resources constitute the basic wealth of the Kingdom of Nepal, I need not go into more details of the significance of this workshop.

The people of this country--where 90 percent of the population is actively associated year-round with soil and water, where 87 percent of the population utilize firewood for their domestic fuel consumption, and where 90 percent of the population earn about 15 percent of their income from animal husbandry--understand, I think, the significance and purport of natural resources more than any other society. Nepal, the Nepalese people, and nature were in a state of balance in a healthy environment, as complimentary to each other, until some years ago. For example, the terraces of mid-Himalaya, livestock farming of high Himalaya, and crop farming in the valley and Terai are still fresh in our minds.

In recent years, various reasons have led to the deterioration of the balance in the utilization of natural resources, and many drastic situations have appeared. The tendency to migrate in search of livelihood is increasing as employment opportunities in the nonagricultural sector could not be created in proportion to the growth rate of population. Difficult geographical conditions constrain the extension of intensive and scientific agricultural practices on a nationwide scale. Forest-based industries cannot be adequately expanded for lack of capital. National production is being destroyed through the unwise use of limited water resources. In view of the overall situation, it would be more beneficial if this workshop makes concrete suggestions on measures to be taken for scientific management of natural resources instead of analyzing what has happened and what strides would have been better in the past.

I hope that participants in this workshop will exchange their views with particular attention to the following points:

- Concrete policy changes in the conservation and utilization of natural resources is the call of the day. If traditional practices are changed only on theoretical grounds, ill-consequences may increase. For this reason participants should make policy suggestions also taking into account the practical aspects.

- To my mind, some changes in the present organizational set-up for the conservation of natural resources are also necessary. The number of trained technicians is increasing every year, as is the number of technical advisors from friendly countries and international organizations. Investment is rising, too. HMG has been increasing allocations in the administrative budget. Yet achievements are lagging behind the targets. Naturally, under such conditions, you should be paying attention to organizational aspects.

- It is felt at present that the conservation and management of natural resources is the responsibility of the government alone. But efforts to conserve resources are not possible unless local people utilizing them also participate in the management. That is why it is necessary to discuss how to make the people participate actively in implementation of conservation programs.

- Natural resources in Nepal are already scarce. Therefore, I hope that participants in this workshop will also discuss the alternatives to natural resources.

APPENDIX G

Opening Remarks
Mohan Man Sainju, Member
HMG National Planning Commission

When discussing the problem of management of renewable natural resources in Nepal, the history of planned development must be kept in perspective. Nepal was not open to the outside world until 1951 and in 1956 Nepal started its development planning efforts with the First Five-Year Plan. The allocation of 330 million rupees was thought to be too ambitious then, and indeed it was because at that time Nepal did not have the necessary administrative machinery to execute and achieve the planned targets. However, now Nepal has tremendous experience after 24 years of planned development, and there are many examples of successes and failures. Planners have realized that economic development in Nepal must overcome several constraints. Five areas of concern to everyone in Nepal are:

- Improving infrastructure in a setting of difficult topography; this has proven to be a herculian problem.

- Population growth has neutralized economic growth.

- Population distribution is uneven--two-thirds of the population live in the hills and mountains which have one-third of the cultivated land, and one-third of thepopulation lives in the Terai which has two-thirds of thecountry's cultivated land.

- Even with all past efforts, the nonagricultural sector has not flourished; it has not been able to absorb the growing farm population. As a result, marginal lands in the hills are being increasingly used for agricultural production which has caused serious ecological and environmental problems.

- There is an increasing need for energy. During the next few years, this need will be met by the forests, even though there is a vast and unlimited potential for hydropower from water resources.

In this context, the Sixth Five-Year Plan addresses these concerns about management of natural resources in Nepal. A specific chapter inserted in the plan deals with land use and environmental policy.

Now I would like to identify five areas of policy concern to HMG, and I hope that the week-long deliberations on the issues of management of natural resources will address these policy questions.

The first policy concern is the problem of intra- and inter-agency coordination and cooperation. It appears clear that the problem of natural resource management is not a unidisciplinary effort. It is multidisciplinary and multisectoral in nature. To bring about integration and coordination, to provide overall policy direction, and to evaluate performance, HMG has organized a National Council for the Conservation of Natural Resources. This council will be chaired by the Honorable Minister of Forests and will comprise leading executives from various HMG agencies. The new council will provide policy guidelines, review programs, and seek coordination and cooperation whenever it is required. The words coordination and cooperation are popular, but, in practice, they are difficult to implement. They involve the attitudes of the people involved in the game and changing attitudes is a very difficult process. It is hoped that this workshop can make some recommendations that could be useful in this area.

The second area of policy concern is that there are several natural resource management programs that will be implemented through specialized agencies in different ministries and departments of HMG. Recommendations that will help in meshing these individual programs--how do they fit into each other--how do we do it--by whom--and in what order--would also be useful.

The third area of policy concern is the appropriate application of the body of knowledge that is available and the known technology in-country to carry out interventions in renewable natural resources. We must first determine how to make maximum use of our rural and technological capabilities. We must then identify areas where available technological capabilities cannot address the problems and look for possible technical tools to solve them.

The fourth area of policy concern is the change in the behavior at the grass-roots level--in each household and family, or, in other words, at the individual level--that goes hand in hand with the management of natural resources. Can implementable and effective management of natural resource programs be undertaken without proper and adequate community participation? Then, if community participation and local-level involvement is a prerequisite to the management of natural resources, how do we get communities to participate in the proper sense of the term? How do we seek their cooperation? How do we involve them in the decision-making process itself? Not only should people at the community level be educated about natural resources and its degradation, but I feel that our own knowledge about community behavior and community perceptions must be increased.

A fifth area of concern is that from the viewpoint of national policy on management of natural resources, a long-term perspective is lacking. The Sixth Plan has not revealed a long-term picture. We hope that the participants in this workshop will be able to help us in this regard.

APPENDIX H

Microhydro Projects: An Alternative Source of Energy

D. M. Amatya
Department of Soil Conservation
and Watershed Management

Nepal has more than 6,000 rivers, totaling about 45,000 km in length, with a total annual run-off of about 70 billion cubic meters. Nepal's estimated power potential is about 38,000 MW, or about 2.3 percent of the world's total hydropower potential. Presently, only about 38 MW of hydropower is available (Trishuli, about 21 MW; Sunkoshi about 10 MW; and the rest constituted by other small plants).

The long-term policy of HMG of Nepal is to reduce gradually the contribution of petroleum products to the total energy supply by developing hydroelectric power. Prime emphasis has been given to installing micro-hydro power plants that use locally available labor, material, and simple technology as much as possible to develop agriculture, commerce, and cottage and small agro-based, cottage industries in the hills and remote areas of the Kingdom. This should help reduce the present degradation of forests, which are used as a cheap source of fuelwood. Bigger projects require large capital investments, advanced technology, a large qualified technical cadre, and a substantial period for construction, which seem quite difficult tasks for a developing country. Hence it is time to exploit existing natural water resources by constructing micro-hydro projects as an alternative source of energy.

AGENCIES UNDERTAKING MICRO-HYDRO PROJECTS

Formerly, HMG Electricity Department under the Ministry of Water Resources was the only agency undertaking the construction of micro-hydro projects. However, now the following agencies under Ministry of Water Resources are undertaking feasibility surveys and construction of micro-hydro projects.

The Rural Electrificiation Division of HMG Electricity Department is responsible for mini/micro-hydro projects which are constructed largely under a people's participation program in small villages in various parts of the Kingdom. Under the initiative of this division, a 60-kW micro-hydro project in Gorkha-Illam has already been completed and a 32-kW project in Dhading is nearly complete. Other projects under construction are Syangja, 80 kW; Manang, 160 kW; Darchula, 100 kW; Helambu, 100 kW; Gorkha, 90 kW; Dandedlhura, 110 kW; and Baglung, 100 kW.

In accordance with His Majesty's Government's policy of launching multipurpose micro-hydro projects in various parts of the Kingdom, the Small Hydel Development Board (SHDB) was established in the mid-1970s under the Ministry of Water Resources. Previously, HMG Electricity Department had undertaken a feasibility study and construction of a small hydro project in Birendranagar Surkhet (345 kW) which is in the far western development region and another in Dhankuta (240 kW) in the eastern development region. Both projects were completed about 2-3 years ago and are under operation. About 6-7 years ago, the NOR-consult for the first time conducted feasibility studies of 10 micro-hydro projects in various parts of the Kingdom. On the basis of these feasibility study reports, the SHDB carried out detailed designs, and construction is now under way in the following areas.

Project			Installed capacity	Donor
Namche	(Eastern)	1st Phase	520 kW	Austria
		2nd Phase	260 kW	Austria
Doti*	(Far western)		200 kW	Yugoslavia
Salleri*	(Eastern)		80 kW	Swiss (SATA)
Phidim*	(Eastern)		260 kW	OPEC
Jomson	(Western)		260 kW	OPEC
Jumla	(Far western)		200 kW	OPEC
Baglung	(Western)		175 kW	HMG/Nepal
Taplejung	(Eastern)		125 kW	UNCDF**
Khandbari	(Eastern)		250 kW	UNCDF
Bhojpur	(Eastern)		250 kW	UNCDF
Pkhaldhunga	(Eastern)		125 kW	UNCDF
Ramechhap	(Central)		75 kW	UNCDF

*Nearly complete.
**United Nations Capital Development Fund.

In addition, a visiting Asian Development Bank team recently agreed to provide capital for eight different projects in various parts of the Kingdom in the first phase. The second phase is subject to extension depending upon progress achieved in the first phase.

Although small hydro projects and mini-hydro and micro-hydro projects are not well defined, SHDB considers projects in the range of 101-999 kW as "small hydro projects" and projects in the range of 20-100 kW as "mini/micro-hydel projects."

It is very important to note that local participation has not been included in projects launched by SHDB. They are either undertaken singly by HMG or jointly by HMG and a foreign donor.

SHDB's target is to provide electricity in all district headquarters, in places important from the viewpoint of the tourism or cottage industry, and in other areas depending on the demand for, urgency of, and feasibility of electricity generation. For the past 3-4 years, SHDB has used the services of local engineering consultants for the prefeasibility and feasibility studies of mini/micro-hydro projects in various hilly and remote parts of the Kingdom. SHDB recently developed criteria for prefeasibility studies of micro-hydro projects in the districts by providing consultants with questionnaires for villagers to be filled out during the field survey. This means that special emphasis has been placed on carrying out socioeconomic studies in detail and then analyzing them before justifying any place as a feasible load center for electrification.

On the basis of the questionnaires, it appears that drinking water, health posts, suspension bridges, and irrigation have first priority with villagers--not electricity. In other words, electricity used for drinking water or irrigation or cottage industry is given more priority than electricity for lighting and cooking.

The Nepal Electricity Corporation, under the Ministry of Water Resources, recently completed construction of the 32-kW capacity Gajuri micro-hydro project, located on the highway from Kathmandu to Pokhara. Unfortunately, this project is suffering from technical difficulties. This is a joint venture of the corporation and local people's groups.

MANUFACTURERS OF ELECTROMECHANICAL EQUIPMENT FOR MINI/MICRO-HYDRO PLANTS

The Mechanical Division of Balaju Yantra Shala (BYS) is one of the leading local manufacturers of water turbines up to 45 kW capacity in 9 different sizes. These turbines are used mainly for

mechanical power to drive various machines or are attached to a generator and governor to produce electricity. The cost of a turbine varies from Rs.12,000 to Rs.18,000, excluding transportation charges. An entire system, including steel penstock pipe, turbine, metallic screens to protect the system from rocks and debris, control gates, power pulley, etc., costs about Rs.25,000 for mechanical power only. The extra governor and electrical generator required to generate electricity are imported.

BYS offers technical assistance to potential users to determine proper size and placement for a hydropower installation and emphasizes operational simplicity and transportability over the difficult trails of Nepal. BYS recommends the installation of water turbines for operation of the following mechanisms: rice huller, water pump, oil expeller, paper beater, power loom, flour mill, and saw mill.

Turbines can also be used for lighting, operation of welding sets and electric motors, industrial heating, cooling and space heating, etc. To date, BYS has successfully built and installed about 20 small turbine systems, including two units with a capacity for generating electricity.

The Butwal Technical Institute (BTI) manufactures turbines for mechanical purposes, as well as a few firms in the private sector that deal with small water turbines (perhaps up to 2 kW).

RCUP HYDROPOWER PROJECTS

RCUP feasibility studies of mini/micro-hydro projects will be carried out in the Gorkha, Myagdi, and Mustang districts. APROSC (Agricultural Projects Services Centers) has discovered many potential river sites of at least 10-kW capacity in Jomson, Gorkha, and Jumla. To obtain the full potential benefits of hydropower, erosion, siltation, and flooding problems are addressed by RCUP projects in reforestation, controlled grazing, irrigation, and watershed management and hydrology.

RCUP recommends that hydropower be utilized for the following on a priority basis: village water supply (to provide good sanitation and public health); electrification of health posts, schools, and veterinary posts; irrigation; flour milling and oil expelling; fertilizer production; cottage and small-scale, agro-based industries; powering ropeway transport systems; and illumination.

PROBLEMS CONNECTED WITH HYDROPOWER PROJECTS

- Lack of proper coordination among agencies implementing hydro-power projects

- Lack of hydrological and meteorological data on potential rivers and streams that could generate electricity for design purposes

- Lack of transport and communication in the hill and remote areas of the Kingdom needed to transport electromechanical equipment

- Lack of technological know-how necessary to implement micro-hydro projects

- Lack of trained personnel in the responsible agency during maintenance and operation of projects (manpower constraint)

- Limited budget allocation for operation and maintenance

- Lack of knowledge in the villages about the benefits of introducing mini/micro-hydro projects as an alternative source of energy supply, i.e., lack of communication and demonstration in remote areas to convince villagers about the exploitation of cheap water resources for generation of electricity

- Technical difficulties with projects already installed. For example, discharge seems to be much less than that allowed in the design due to lack of hydrological data, siltation of power canals, seepage problems, inefficiency of power turbines and penstock pipes, etc. In SHDB projects aided by foreign donors, the donor countries have agreed to install locally made water turbines (BYS or BTI) even if the cost is higher by up to 15 percent than the cost of those from the donating country and if the local turbines or mechanical equipment meet technical requirements. However, as BYS turbines or steel penstock pipes are manufactured from imported steel from India, they can hardly meet the necessary technical specifications, and SHDB has been thus far bound to install Indian-made "Jyoti" turbines in the Jomson, Baglung, Phidim, and Jumla mini/micro-hydro projects. Only in the Salleri, Solukhumbu district have two 40-kW capacity turbines been installed, manufactured by BYS. Thus the technical know-how required to manufacture water turbines must be obtained, either by providing in-country training and research or overseas training.

- The very high initial costs of introducing micro-hydro projects as an alternative source of energy compared to other sources of energy. Although, for a country like Nepal rich in water resources, hydropower will be the only cheap source of energy in the long run after the forests have deteriorated. SHDB's experience thus far shows that the per kilowatt cost of installation of micro-hydro power projects (including civil and electromechanical works) varies from Rs.25,000 to Rs.45,000. The Rs.60,000 costs per kilowatt in Salleri is an exception.

- The low annual per capita income of villagers. Most cannot afford to pay Rs.200 for electrical installation and Rs.20 per month for lighting (as standardized by SHDB in 1979-1980). Villagers prefer to use fuelwood for lighting and cooking which they have to fetch by walking 2-3 hours daily to a nearby forest.

THE RISING NEPAL

(FEBRUARY 8, 1981)

Renewable Natural Resources

A week long workshop on Management of Renewable Natural Resources is presently being held in Kathmandu under the joint auspices of HMG Department of Soil Conservation and Watershed Management, Nepal National Committee of the Man and Biosphere and the National Academy of Sciences of the United States. The participants at the workshop are slated to deliberate and provide broad recommendations on opportunities, strategies and policies useful to the improvement in management of renewable natural resources. In view of the fact that proper and efficient management of natural resources is a high priority task, the workshop is to be considered a highly relevant exercise.

Unscientific and thoughtless manner of utilisation of available natural resources could lead to sad consequences. As a case in example may be cited the forest resources. The increasing demands made on forest resources, partly as a result of the rapid growth in population within recent decades, has led to rampant destruction of forests on an alarming scale. Forest resources have been consumed at a progressively increasing rate while not enough thought was given by the consumers to the need to ensure that the resources they were consuming would remain perennial. Reafforestation, in the absence of enough attention being paid to it, could not take place at the rate to match the rate at which forests were being destroyed. By now the far reaching grave consequences of the rampant destruction of forests within the past decades have largely been realised and measures are being taken to check further continuation of this process. However, to repair the damages that have already been caused it is going to take time

Renewable natural resources could indeed become unrenewable, when they are utilised in a careless manner over a length of time. The diminishing of these resources could also lead to other grave and irreparable damages. The need for scientific and efficient management of renewable natural resources cannot in fact be over-emphasised. Concrete policies have to be adopted and practical measures enforced in order that renewable natural resources are utilised in the best possible way without bringing about undesirable consequences. The present workshop at the end of its session will be expected to come up with many useful and practical suggestions that could be incorporated into the future official policies on the management of renewable natural resources.

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WorkshopOnManagement Of Natural Resources

(By a Staff Reporter)

Kathmandu, Feb. 13:

The Workshop on Management of Renewable Natural Resources, Problems, Strategies and Policies in course of its weeklong deliberation has made long strides in achieving a success.

Over sixty delegates from the Department of Soil Conservation and Watershed Management, Nepal National Committee for the Man and the Biosphere and National Academy of Sciences, U. S. A. and other bilateral and international agencies have as a result of their efforts produced a host of recommendations..

The delegates were divided into five different groups each deliberating on forestry, rangelands and wildlife management, watershed management and irrigation, agricultural and livestock, energy and human resources separately.

Each group has presented separate recommendations in their respective areas of deliberation

The working group on the forestry, rangelands and wildlife management has recommended that to remove confusion regarding desirable land use in different physiographic regions and to facilitate local participation and implementation, land use legislation outlining criteria for appropriate land use should be enacted and a coordinating agency designated.

In watershed management and irrigation, the working group has recommended that planning and implementation of technical options should be designed to avoid proceeding "too far and too fast." Educational, demonstrating and local participation activities should be included in projects.

The working group on agricultural and livestock has concluded that agricultural production in the hills was not keeping pace with hill people's needs for food and fiber, higher incomes, and more jobs. Therefore agricultural productivity must be increased through the use of new and improved techniques, intensification of cropping and more adequate and appropriate animal nutrition, breeding, and disease control.

On energy the workshop the group has recommended that production of more fuelwood in individual house gardens should be encouraged and more accurate measurement of fuelwood uses for domestic and industrial purposes is required.

On human resources the recommendations say, because of the serious difficulties caused by Nepal's very high population growth rate for resource management and conservation, high priority must be given to programmes in ended to reduce fertility rates, particularly in overcrowded hill areas.

On education and manpower training needs to improve general education and public knowledge of resource management and conservation problems and practices, the elementary school curriculum should be modified to emphasize agriculture and renewable resource management relevant to a rural population.

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APPENDIX J

Background Material

GENERAL INFORMATION

AID Country Development Strategy Statement, Fiscal Year 1982. Agency for International Development, Washington, D.C.

AID Excerpts from Annual Budget Submission, Fiscal Year 1982. Agency for International Development, Washington, D.C.

Basic Principles of the Sixth Plan, 1980-1985, National Planning Commission Secretariat, Kathmandu, Nepal.

Making Planning Relevant: Nepal's Experiences, 1968-1976. Asian Survey October 1980.

National Economies: Nepal's future growth tied to investment in agriculture, tourism and hydroelectricity. IMF Survey June 25, 1980.

Nepal. PanAm World Guide. McGraw-Hill Book Company, New York, New York, 1979.

Nepal. Asia Yearbook. Far Eastern Economic Review, Hong Kong, 1980.

Nepal Background Notes. Department of State, Washington, D.C., 1978.

Nepal Country Economic Memorandum. Report No. 1873a-NEP. World Bank, Washington, D.C., 1978.

Nepal: physical and social geography. Far East and Australasia. Europa Publication, London, England, 1980.

Nepal releases budget for coming year. Journal of Commerce October 29, 1980.

FORESTRY, WILDLIFE AND RANGE MANAGEMENT

Carpenter, R. and Matthews, W. (1980). NEPA: environmental innocence abroad. East-West Perspective 1(4):6-11.

Carter, M. (1979). Range Management and Animal Husbandry Components. Resource Conservation and Utilization Project, Kathmandu, Nepal.

Levenson, B. (1979). Fuelwood utilization: a study of the demand and available fuelwood resources at six selected villages. U.S. Peace Corps, Kathmandu, Nepal.

Library of Congress, Science and Technology Division (1979). Draft environmental report on Nepal. Agency for International Development, Washington, D.C.

National Academy of Sciences. 1980. Firewood Crops: Shrub and Tree Species for Energy Production. National Academy of Sciences, Washington, D.C.

Shrestha, B.B. (1980). Geology, Soil Erosion and Litho-Structural Division of Nepal. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Upreti, B.N. (n.d.) Conservation of Wildlife Resources in Nepal. National Parks and Wildlife Conservation Office, Kathmandu, Nepal.

World Bank (1978). Nepal: Forestry Sector Review. South Asia Projects Department, World Bank, Washington, D.C.

World Bank (1980). Nepal: Staff Project Report Appraisal of the Community Forestry Development and Training Project. South Asia Projects Department, World Bank, Washington, D.C.

WATERSHED MANAGEMENT AND IRRIGATION

Fearnside, A., Nelson, D.O., and Baisyet, P.M. (1980). Policy and organization for soil and water conservation in Nepal. Project Working Paper WP/15. Food and Agriculture Organization of the United Nations, Rome, Italy.

Laban, P. (1979). Example Description of an Ecological Region in Nepal. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Ministry of Forests. (1977). Land Inventory: Karnali-Mahakali Watersheds. A Basic Inventory for General Assessment of Land Degradation. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Sjoholm, H., Bhuju, U.R., and Fearnside, A. (1979). Towards a Soil and Water Conservation Education Programme for Nepal. Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Stevens, M.E. (1978). Land Use Pattern for Marginal Land and Erosion. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Van Gelder, A. (1978). Comments on Erosion Control Activities of the Department of Soil and Water Conservation. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Van Gelder, A. (1978). The Integrated Watershed Approach for Erosion Control Project Formulation. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

White, P.G. (1979). Watershed Management Report of the Resource Conservation and Utilization Project. Agency for International Development, Washington, D.C.

Zollinger F. (1979). Analysis of River Problems and Strategy for Flood Control in the Nepalese Terai. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

AGRICULTURE AND LIVESTOCK

Agricultural Projects Services Centre 1979. Resource Conservation and Utilization Project. Volumes 1 and 5. Prepared for His Majesty's Government of Nepal (Department of Soil and Water Conservation) and U.S. Agency for International Development. Agricultural Projects Services Centre, Kathmandu, Nepal, with collaboration of the South-East Consortium for International Development.

Green, R. (1978). The Construction and Management of Bench Terracing System in the Hill Areas of Nepal. Integrated Watershed Management Project, Ministry of Forests, Department of Soil and Water Conservation, Kathmandu, Nepal.

Hagen, D.L. (1979). Economics and alternatives of hydroelectric fertilizer plants in Nepal. Paper presented at the Symposium: New Dimensions of Appropriate Technology, sponsored by the International Association for the Advancement of Appropriate Technology for Developing Countries, November 10-11, 1979, Cambridge, Massachusetts.

World Bank (1979). Nepal: Agricultural Sector Review. South-East Asia Projects Department, World Bank, Washington, D.C.

ENERGY

Asia Society (1977). Seminar on Development of Small Scale Hydroelectric Power and Fertilizer Production in Nepal. February 28 - March 3, 1977, New Hotel Crystal, Pokhara, Nepal. Asia Society, New York, New York.

Axinn, N.W. and Axinn, G.H. (1978). Report on energy flow on small farms. Institute of Agriculture and Animal Science, Rampur, Nepal.

Hein, G.F. (1977). Energy Options for the Khumbu Region of Nepal--a Report to the World Bank. NASA-Lewis Research Center, Cleveland, Ohio.

Institute of Science (1976). Nepal: The Energy Sector. Energy Research and Development Group, Institute of Science, Tribhuvan University, Kathmandu, Nepal.

Revelle, R. (1979). Energy sources for rural development. Paper presented at Conference on Energy Alternatives, sponsored by the United Nations University, January 9-12, East-West Center, Honolulu, Hawaii.

HUMAN RESOURCES

Freeman, F. (1980). Women in Development in the Resource Conservation and Utilization Project. Paper submitted to the Director of the U.S. Agency for International Development. Kathmandu, Nepal.

Johnson, M.L. and Brownwell, J.N. (1979). Report to His Majesty's Government of the Kingdom of Nepal. Recommendations for Institutional and Functional Organization to Achieve the Coordinated Management of Natural Resources. Johnson Company, Inc., Plainfield, Vermont and Brownwell and Hoyt, Norwich, Vermont.

Messerschmidt, D.A. (1981). Nogar and other traditional forms of cooperation in Nepal: significance for development. Human Organization 40(1).

World Bank (1979). Population projects for Nepal. World Bank, Washington, D.C.