PN-ABY-625
90662

USAID Working Paper No. 219

Center for Development Information and Evaluation

Sustainable Agriculture and theEnvironment: *Nepal Case Study*

March 1994

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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Sustainable Agriculture and the Environment
NEPAL CASE STUDY

by

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U.S. Agency for International Development
Center for Development Information and Evaluation

March 1994

This Working Paper is one of a number of case studies prepared for CDIE's assessment of USAID Sustainable Agriculture and the Environment programs. As an interim report, it provides the data from which the assessment synthesis is drawn. Working Papers are not formally published and distributed, but interested readers can obtain a copy from the DISC.

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Bibliography

GLOSSARY

USAID	USAID mission in Nepal
bari	Rainfed terraces planted to corn, millet
chulo	Smokeless stove
coppicing	Cutting a tree at the base allowing new shoots to grow
DFO	District Forestry Office
DOA	Department of Agriculture
DOF	Department of Forestry
DSCO	District Soil Conservation Office
DSCWM	Department of Soil Conservation & Watershed Management (MOFSC)
FYM	Farm yard manure
gabion	Rock wall held together by wire mesh, used in erosion control
GON	Government of Nepal
ilaka	Government service unit composed of 9-17 VDCs
IOF	Institute of Forestry
khet	Irrigated bunded terraces planted to rice and wheat
lekh	Highland grasslands used for seasonal grazing
MOA	Ministry of Agriculture
MOFSC	Ministry of Forests and Soil Conservation
MLD	Ministry of Local Development
NFE	Non-Formal Adult Education
NGO	Non-Governmental Organization
Middle Hills	Physiographic region of hills up to 5000' elevation between the Siwaliks and Upper Hills

pakho	Non-tilled scrub land
panchayat	Former political unit equivalent to town, now VDC
PCRW	IFAD-ADB sponsored Production Credit for Rural Women
PVO	Private Volunteer Organization
RCE	Resource Conservation Education (NFE class of UMN)
riser	Front wall of a terrace
SCF	Save the Children Federation
SFDP	Small Farmer Development Project a credit agency linked to DOA
Siwalik	Physiographic region in Nepal of rolling hills located between Terai and Middle Hills
Terai	Physiographic region in Nepal of alluvial lowlands along Indian border
VDC	Village Development Committee (town), composed of nine wards
WID	Women in Development
WDO	Women's Development Office (MLD)

UNITS OF MEASUREMENT

bigha	Unit of land area, 1.5 bighas = 1 ha
mana	Unit of weight = 0.4 kg (10 manas = 1 pati)
muri	Unit of weight 1 muri = 80 kg (1 muri = 20 pati)
quintal	Unit of weight, 1 quintal=100 kg
pati	Unit of weight 1 pati = 4 kg.
ropani	Unit of land area 20 ropanis = 1 ha, 1 ropani is 0.05 ha
Rs	Unit of money Nepal Rupee (1US$=47 Rupees)

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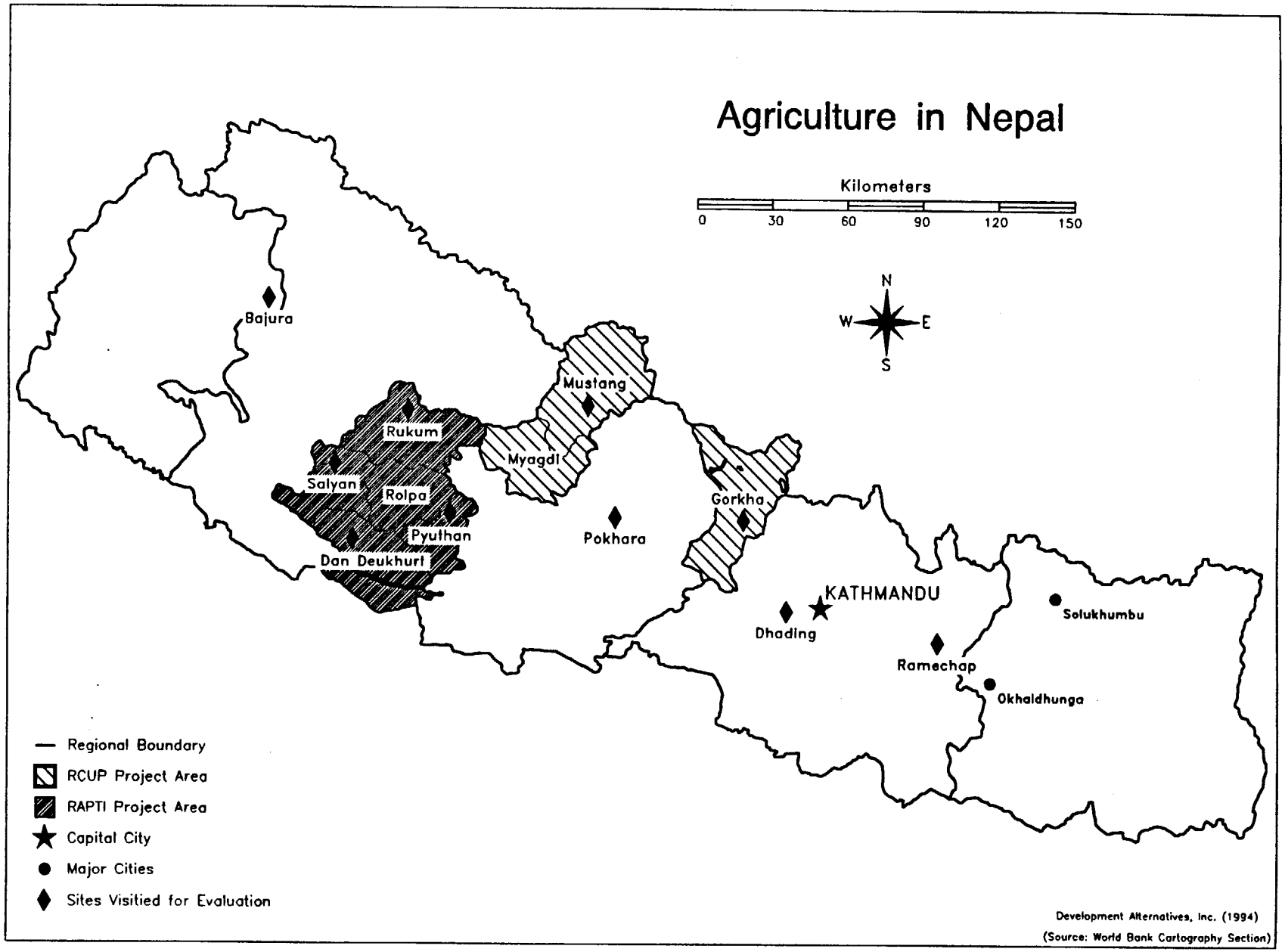
Agriculture in Nepal
Kilometers
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30
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N
W
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S
Bajura
Mustang
Rukum
Myagdi
Salyan
Rolpa
Gorkha
Pyuthan
Pokhara
Dan Deukhurt
KATHMANDU
Dhading
Solukhumbu
Ramechap
Okhaldhunga
Regional Boundary
RCUP Project Area
RAPTI Project Area
Capital City
Major Cities
Sites Visitied for Evaluation
Development Alternatives, Inc. (1994)
(Source: World Bank Cartography Section)

1. INTRODUCTION

In November-December 1993, a five-person, interdisciplinary team carried out an assessment of USAID's support to land productivity conservation and sustainable agricultural practices in Nepal. During this time, the team collaborated with a second CDIE team that concurrently examined the community forestry program in many of the same project areas. The objective of these assessments was to identify development approaches supported by USAID since the late 1970s that have promoted environmentally sound natural resources management in Nepal.

This assessment focuses on the soil and water conservation, and the land productivity enhancement efforts of the Government of Nepal (GON) supported by USAID. These efforts include interventions in land stabilization, soil erosion and fertility management, agroforestry, water supply, community-based livestock and pasture management, improved fodder production and the promotion of cash crop production. These interventions have largely been supported under the soil conservation and watershed management components of USAID's major natural resource management projects. Two major projects, the Resource Conservation and Utilization Project (RCUP) and the Rapti Integrated Rural Development Project (Rapti) were initiated in the late 1970s and were later complemented by a number of NGO-implemented efforts supported by the Nepal Resource Management Project (NRMP) and the PVO Co-Financing Project. For the purpose of this assessment report, the interventions affecting Nepal's agroecoysytems have been grouped under the rubric of *land productivity conservation*. Land productivity conservation implies the linkage between cropland conservation and agricultural intensification. In Nepal, this linkage incorporates the application of erosion control, soil moisture conservation techniques, agroforestry and intensive use of organic fertilizers in order to support production increases and diversification into commercial agriculture.

The assessment attempts to identify the program level changes introduced through these USAID-supported efforts to improve land productivity conservation in Nepal. It examines the degree to which the USAID's program implementation strategies have created enabling conditions for improved cropland management practices. Using CDIE's analytic methodology, the team sought to identify linkages between developments in GON's resource management policies, the implementation of those policies (through technological, institutional and education/awareness-raising strategies) and developments in the practices of Nepal's farmers that affect long term socio-economic and biophysical conditions. A detailed discussion of the assessment methodology can be found in Appendix A.

CDIE team based its findings on a review of USAID project documents, formal and informal interviews with individuals knowledgeable about sustainable agriculture in Nepal, and visits to nine field sites in six districts. These methods permitted an assessment of impact from the perspective of both project implementors and intended beneficiaries. Team members collected data on key technical, institutional, economic and social indicators to evaluate the performance and determine the impact of Nepal's program of land productivity conservation. This report attempts to distinguish the specific contributions of the USAID-funded activities under the program, presents evidence of their impacts, and makes judgements with respect to present and likely future performance of these activities.

The report consists of seven sections including this introduction. Section Two provides an overview of Nepal's land productivity conservation efforts and background information concerning USAID's contribution to those efforts. Sections Three through Five present the evaluation team's findings of USAID's experience in project implementation, performance and impact. Section Five treats the **effectiveness**, the economic **efficiency**, the **sustainability** and the **replicability** of USAID support to land productivity conservation. The sixth and seventh sections highlight respectively the lessons learned from the Nepal experience and the outstanding issues of relevance to USAID's overall program of support to sustainable agriculture. The results of this study contribute to a multi-case analysis of USAID's assistance to natural resource management using sound agricultural practices.

2. LAND PRODUCTIVITY CONSERVATION IN NEPAL

The Problem

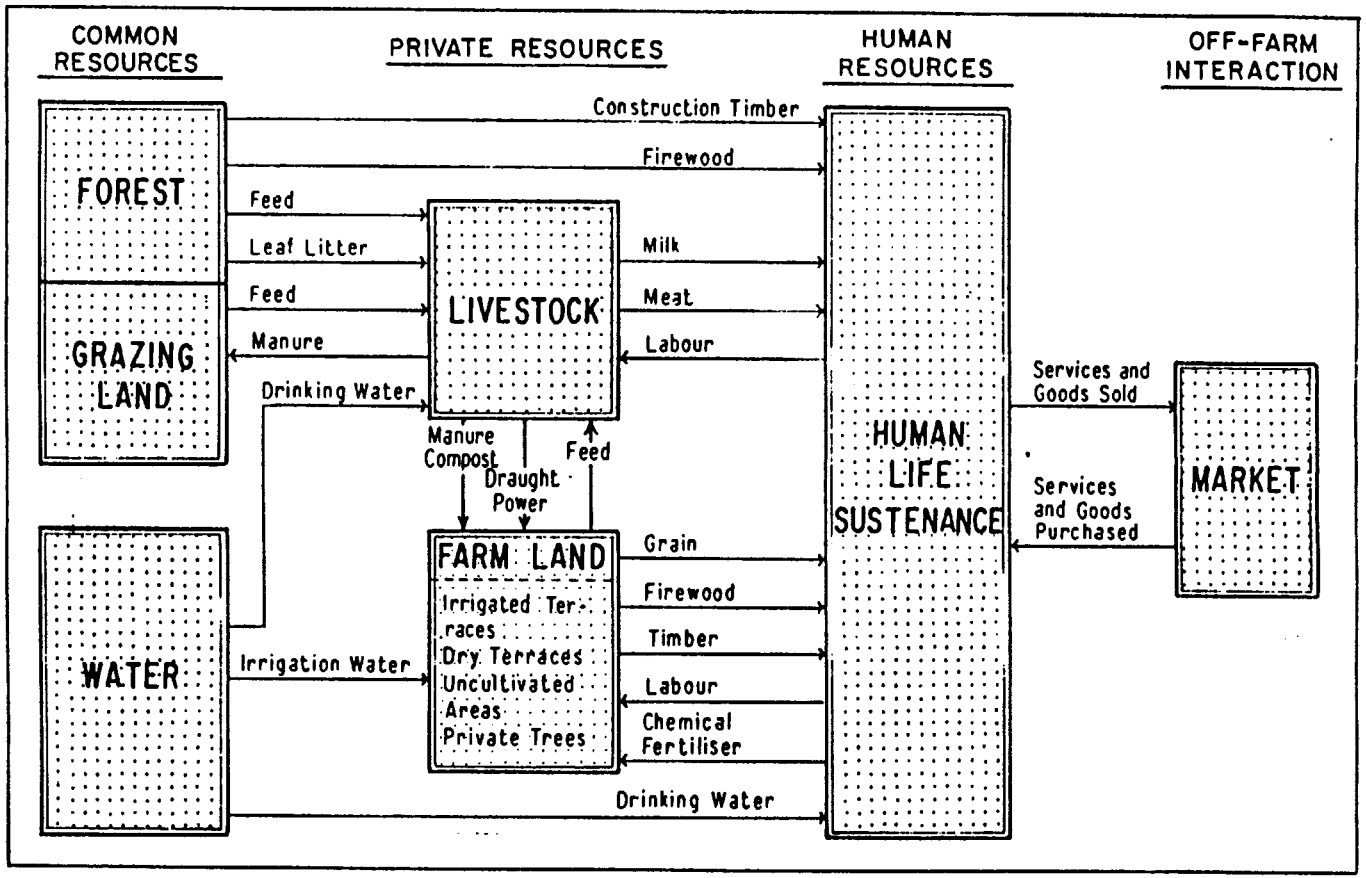
With a per capita annual income of $180, Nepal is one of the world's poorest countries. The current population of 18.4 million is estimated to be growing at a rate of 2.7 percent per year. Agriculture and livestock production provides the major source of livelihood for about 90 percent of this population. However, the population's rapid growth, persistent poverty and relative lack of economic alternatives to subsistence agriculture places increasing pressure on Nepal's land and forest resources. The factors of human intervention are compounded to an incalculable extent by the geological dynamic of the Himalayas, which, having provided the country with a dramatic topography, subjects that topography to frequent upheavals, landslides and devastating floods.

Human and livestock populations, especially in Nepal's heartland, the Middle Hills, far exceed the carrying capacity of the land. Intensive cultivation practices, overgrazing by livestock, the unmanaged harvesting of forest resources and the occupation of marginal lands (i.e., slopes exceeding 30 degrees) inevitably result in severe soil erosion, reduction of soil fertility and diminishing crop yields. Topsoil loss on marginal crop lands amounts to 25 metric tons per annum and 40 metric tons per annum on overgrazed pasture (Mishra 1984, Carson 1992). The decline of Nepal's subsistence farming economy has no more dramatic indicator than the high rates of seasonal and often permanent out-migration of village populations to the urban centers of Nepal and throughout India.

The country can be divided into three major zones: the Terai (including the Siwalik hills and Inner Terai), the Middle Hills, and the High Mountains (see Map 1). The slopes and valleys of Middle Hills are home to approximately half of the country's rural population, and the region remains the principal target of donor assistance to alleviate rural poverty. Despite poor levels of communication, infrastructure development, and extension of government services, the Middle Hills, with its many unique agro-ecological niches, possesses substantial and largely unrecognized potential for the development of commercial agriculture and sustainable forest resource management.

Agriculture in Nepal's Middle Hills is dominated by the subsistence production of cereal crops, chiefly irrigated rice and rainfed wheat and barley. Adoption of modern farming methods has been poor due to the cost of inputs (fertilizer and biocides), lack of farmer interest in high yielding varieties of cereal grains

FIGURE 1



Flow chart of the complex interrelationships linking forests with agriculture and human subsistence in a typical Middle Hills agriculture area (Gilmour and Fisher 1992).

(low straw-to-grain ratios) and the poor performance of the country's agricultural extension services. Since the 1970s, crop yields have stagnated. Recorded yield increases are attributable solely to the expansion of agricultural areas at the expense of forests, especially in the Terai (Bajracharya, 1983a).

Nepal has one of the densest ratios of human population to arable land in the world -- 5.1 persons per hectare of arable land. As Figure 1 illustrates, Nepalese farmers have evolved highly complex farming systems based on biomass and nutrient cycling linkages between forest, livestock, and crop subsystems (Gilmour and Fisher 1992; Mahat, Griffin, and Shepard 1987). Without the continued flow of energy and nutrients from the forests and grasslands, the agricultural base would soon degrade and the system collapse (Moench and Bandyopadhyay 1985). The viability of this system is thus tied to the environmental stability of surrounding forests and grazing lands. However, pressing demand for arable land has diminished the holdings of the majority of hill farm families to less than one hectare, a size insufficient to support subsistence farms even when coupled with intensive livestock raising. Each generation sees a decline in farm size (Karki 1988), and this has forced farmers to harvest fodder and fuelwood at increasing rates (Bajracharya 1983a). Growing resource scarcity has resulted in competition and conflicts between forest, grazing, and agricultural land uses.

In sum, Nepal's rapid population growth, poverty and lack of economic alternatives to largely subsistence agriculture have placed increasing pressure on the country's natural resources. Three decades of unrestricted use of nationalized hill forests led to their steady degradation. From 1964 to 1978 alone, an estimated 25% reduction occurred in the crown cover of Nepal's hill forest (Wallace, 1988). This decline in forest quality has resulted in increased hardship for the majority of the population. Deforestation has been shown to adversely affect agricultural production, food consumption and nutrition because of the additional work required to collect essential forest products, primarily fuelwood, forest litter for livestock fodder and composting, and grasses (Kumar and Hotchkiss, 1988). The workload of women, in particular, increases as deforestation expands, and this burden inevitably reduces the overall labor inputs a household has available for agricultural production. As a result, a women's reduced availability for agricultural labor, compounded by a low capacity for substitution between men's and women's labor, can lead to a much larger overall decline in labor inputs to agriculture with deforestation.

Also, agricultural production systems in Nepal's Middle Hills are dependent on forest resources for the maintenance of soil fertility. The degradation of soil fertility and reduced crop yields is a direct result of the increasing cultivation of marginal lands and overexploitation of hill forest by small farmers. While

current evidence suggests that the rate of deforestation in Nepal has stabilized, and that improved livestock management practices have begun to check overgrazing of pasture land, these are only partial developments in the evolution of sustainable agriculture. As Carson (1992) argues, the motivation for farmers to maintain good soil fertility management practices is a productive and profitable agricultural system. Thus, an improvement in the overall environmental conditions of the country is tied to changes within the agricultural production system.

Intensification and increasing commercialization of the subsistence production systems in the ridge-valley complexes of the Middle Hills, already underway, must be encouraged to complement the development of industry and larger scale forestry and agriculture in the Terai, and the tourism, merchant trade, and extensive livestock production of the high mountains. The Middle Hills are important to Nepal, therefore, not only for their economic contribution but also for their service to a national economy whose growth prospects in other areas depend on the mid-hills serving as a socially stable, democratic and productive base for a large segment of the country's population.

Yet, as the following analysis suggests, there are important constraints, many of which are specific to the institutions of the GON, that discourage cooperation among the government's line departments in the development of sustainable agricultural systems.

The Nepal Program of Soil Conservation and Watershed Management

The government agency responsible for the conservation of public and private lands is the Department of Soil Conservation and Watershed Management (DSCWM). DSCWM is one of three departments in the Ministry of Forestry and Soil Conservation (MOFSC), which also includes the Department of Forestry (DOF) and the Department of National Parks and Wildlife Conservation (DNPWC).

In the late 1970's, the GON became concerned with the conversion of extensive tracts of forest to agriculture and with the overuse of remaining forests and shrublands adjacent to farming areas. In many localities, the forest cover necessary to maintain ecological balance between farm and forest land had been either destroyed or degraded to the point where natural regeneration was no longer possible. Moreover, the government found it virtually impossible to enforce forest protection through legislation alone. The GON sought donor funding to support reforestation and resource conservation projects and began addressing related policy issues.

With the addition of watershed management, the DSCWM was formed in 1980 from the Department of Soil and Water Conservation in response to evolving government and donor understanding of the

importance of integrated watershed management to the control of land degradation. Its current programs encompass land use planning, land productivity conservation, infrastructure protection (e.g., roadside stabilization, shelter belts and buffers), and natural hazard protection (e.g., river training, stabilization of steep slopes), and extension programs intended to raise the level of community awareness and participation in soil conservation activities (see box 1).

Technologies Promoted by the Department of Soil Conservation and Watershed Management

- Gully and landslide rehabilitation through revegetation, water flow diversion, and construction of check dams (check dams are made of bamboo for small gullies or rock for large gullies);
- Stream bank protection with stone walls either of loose rocks or rocks tied in wire mesh gabions;
- Irrigation canals, trail, and roadside protection with grass and tree plantation;
- Retarding water runoff by check dam and pond construction (ponds are also used for fish rearing);
- Water source protection from erosion by planting vegetation around the source;
- Soil erosion protection with shelter belts made from rows of trees to protect against wind and livestock; vegetative contour strips to protect lowland fields and vegetative cover on risers to protect hillside terraces;
- Degraded land rehabilitated by increasing ground cover with deciduous fodder trees, fruit trees, and fodder grasses and legumes.

With a small budget, DSCWM has placed its limited staff of District Soil Conservation Officers (DSCO) in 31 of Nepal's 79 districts where soil degradation is particularly problematic, especially in the Middle Hills. From 1975-88 the agency was responsible for the construction of 1129 check dams, 37 km of stabilized slopes, 276 stabilized gullies, 662 ha of developed grasslands, 43 ha of fruit tree plantations, 2893 ha of fodder/timber tree plantation, 1753 ha of conservation planting, and 560 ha of terrace improvements (DSCWM 1992). Over this 12-year period the agency affected less than 1% of Nepal's landscape. Clearly more extensive efforts must be undertaken to make an impact on the soil/water conservation problem from a national perspective.

The diffusion of responsibility for agricultural research, agricultural production, and soil and water conservation among government ministries and departments is the single most important constraint to the GON's ability to promote sustainable agriculture. In the area of land management there are at least five government agencies, each having a distinct sectoral responsibility. Overall, the lack of a watershed management perspective limits their integration. Upstream watersheds and grazing, for example, are managed by MOFSC, while private farmland and agriculture production are the responsibility of the Ministry of Agriculture (see Box 2). Land stabilization and rehabilitation of public lands is the responsibility of DSCWM while afforestation usually involves DOF. Flood control is a responsibility of the Ministry of Water Resources.

Several national level efforts have been attempted to improve inter-agency coordination (MOFSC 1988). In 1977, for example, the National Conservation Advisory Council was formed to develop policy between DOF, DSCWM, DOA, Department of Water Supply, and Department of Family Planning. However, while there appear to be informal links at the district level among the programs of a number of these departments, there is no institutional cohesion in the implementation of policies that link soil conservation/watershed management with agricultural production.

Agriculture and Natural Resource Policy Environment

GON policies are articulated in a series of Five-Year Plans, coordinated by the NPC (National Planning Commission 1976, 1981, 1986, 1991). The most recent is the Eighth Five-Year Plan (1990-95). The Plans put forth policies by sector but do not provide the framework for the coordination of common policy implementation, such as watershed management, between sectors.

Historically, government policies have greatly affected natural resource management. During the period of Rana rule (1846-1951), agricultural crops were heavily taxed, and government policies promoted the widespread reclamation of forest lands for cultivation. A full range of state enterprises were also supported by revenues from land grants ranging from the maintenance of the army to the smelting of ore for coinage (Metz (1991; English 1983). Much of the terraced landscape that characterize Nepal's Middle Hills is thought to have been completed well before the end of the Rana regime.

The Private Forests Nationalization Act of 1957 had a devastating effect on the country's forests. Intended to protect the country's dwindling timber stock, the Act overlooked the requirements of indigenous forest users and the resource management practices that those users had developed over generations. As a result, villagers did little to limit access to their common forest resources and prevent uncontrolled exploitation. For example,

Institutions Providing Support to Agriculture in Nepal

The Department of Agriculture (DOA), a department of the Ministry of Agriculture (MOA), is exclusively concerned with agricultural research and production. The DOA was established in 1924 and until the 1970s focused on adapting agricultural technologies introduced from abroad at a number of regional agricultural experiment stations and demonstration farms mostly located in the Terai (eg. the National Wheat Station in Bhairawa and National Rice Station in Parwanipur) (Farrington and Mathema 1992). Initially, the diverse agricultural stations were highly multi-disciplinary, but in the 1950s, the DOA began developing many specialized agencies. Sufficient trained manpower was in place by the 1970s for the country to engage in crop breeding and other production management and support programs.

Agricultural research is coordinated by the Nepal Agriculture Research Council (NARC), a semi-autonomous body linked to the MOA. NARC, along with agricultural universities, performs basic research. The DOA recently merged its various functions (agronomy, horticulture, livestock, fisheries, marketing) into divisions. The DOA has five regional offices from which the District Agricultural Development Offices (DADO) serve the farm community. The Small Farm Development Project (SFDP) functions as a credit agency linked to DOA's regional offices. It lends money and provides savings facilities for groups of 8-25 farmers. The average loan is $600 repayable in 1-10 years.

Several other institutions are linked to the MOA including the Agriculture Projects Service Center (APROSC), which undertakes in-depth policy studies of the agricultural sector. There are several parastatal agencies also linked to MOA including: the Agricultural Input Corporation, which handles dissemination of seed and agro-chemicals; the Agricultural Development Bank, which handles credit for individual farmers; and the Cotton Development Board, a commodity agency.

The Ministry of Local Development (MLD) is active in all districts and supports the Women's Development Office (WDO). MLD's Production Credit for Rural Women (PCRW), supported by UNICEF and IFAD, targets rural women to whom it provides agricultural credit.

forested area in Nepal decreased 24 percent in the Terai and 15 percent in the Siwaliks from 1964-78 (Pearce, et al. 1990).

The first concerted effort by the government to assess the problems of deforestation, soil erosion, and landslides came following pleas made on the global stage during and after the 1972 UN Conference on the Human Environment. A Task Force on Land Use and Erosion Control was established within the Planning Commission. The tone set by the Task Force was followed more specifically in the Fifth Five-Year Plan (1975-80). The plan stipulated a reduction in forest harvesting, promoted afforestation schemes, and established the DSWC to provide technical services to rural populations.

The National Forestry Plan of 1976 recognized the importance of people's participation in government efforts of forest conservation, management, and development. The Plan gave farmers

nominal control over common forest land, but full implementation of the Plan was limited by political interests at the local level throughout the country.

The Sixth Five-Year Plan (1981-85) incorporated water resources, energy, environment, land use, people's participation and integrated rural development as part of Nepal's general development strategy. This strategy responded to the international donor community by stressing the satisfaction of basic needs.

The 1990 Democratization Act formally ended the traditional panchayat system whereby the central government controlled the appointment of local political leaders. Political liberalization has provided farmers with greater control of public lands, and this control has fostered the proliferation of natural resource user groups and management associations. These developments, as this report will emphasize, have had a great impact on Nepal's subsistence farming system.

The GON has no explicit sustainable agricultural program, and as Box 2 indicates many institutions affect the agricultural sector (Farrington and Mathema 1991). Policies supportive of land productivity conservation for sustainable agriculture are defined as early as 1982 in the Soil and Watershed Conservation Act. The act calls for insuring "proper land use by managing land to maintain its inherent fertility whereby its physical and chemical properties are not to be weakened or destroyed." However, agricultural policies put forth in successive Five-Year Plans have promoted the increase of food grain production through expansion of irrigation infrastructure, subsidized agricultural inputs such as high yield variety seeds and chemical fertilizers, and access to agricultural credit.

Successive Plans have advocated labor-intensive production technologies to provide rural employment. In recent Plans, the GON has sought to promote the development of commercial agriculture with emphasis on farmer-driven approaches to agricultural research and development. The Seventh Five-Year Plan (1985-90) advocated self sufficiency in cereal production in the Middle Hills by the year 2000. The Seventh Plan also called for programs to encourage the afforestation of eroded lands and the increase in rural employment opportunities, and provides for the participation of NGOs in the implementation of agriculture and natural resource management activities.

The Eighth Five-Year Plan (1992-97) carries forth the goals of its predecessor with the objective of creating a balance between agricultural development and the environment. The Plan calls for agriculture sector activities that enhance soil fertility and encourage private sector agricultural market development. Agroforestry policies integrate fodder and other multi-purpose tree

species into existing farming systems while insuring that they are sustainable in terms of forest resources.

In sum, there has been a gradual development of GON policy, largely reflecting trends in donor support, that acknowledges the importance of natural resource management to the country's farming systems, and the importance of resource user's participation in the management of those resources. Where this policy development has fallen short is in providing the institutional framework for the coordinated management of natural agricultural resources, i.e., the conservation of land productivity through soil and water conservation, agroforestry, livestock management, agricultural research and market development.

The USAID Assistance Approach

During the 1970s, intense flooding in the Ganges and Brahmaputra plains attracted the attention of international donors who attributed the problem to what was believed to be an alarming acceleration in erosion and environmental deterioration in the Himalayas. Although subsequent evidence (Ives and Meswserli 1989) questions this so-called "Theory of Himalayan Environmental Destruction", a more objective understanding follows a decade of development assistance. To support GON initiatives, USAID designed two large projects beginning in the late 1970s: the Rapti Development Project (Rapti) and the Resource Conservation and Utilization Project (RCUP). These two projects recognized the lack of infrastructure and trained manpower to deal with the challenges of agricultural production and integrated watershed development.

The two projects constitute USAID's most substantial investments in addressing specific technical and institution-building issues related to improving natural resource management in Nepal. These two projects supported forest and watershed management on public lands, as well as improved livestock management, community-level reforestation and cropland management activities on both public and private lands. USAID's mandate in the 1970s involved concentration of development assistance on the poor, thus USAID/N targeted the country's Inner Terai and Middle Hills regions, where most of Nepal's poor farmers live.

After 1985, the Mission funded the second phase of the Rapti and five smaller projects with natural resource management components. These activities ranged from research and extension programs, which promoted local resource conservation, to technical assistance to strengthen the GON's higher education, research, and planning institutions dealing with the agricultural sector.

This review of sustainable agriculture focuses on four USAID/N projects with total funding of about $90 million. This sum is divided over the multiple sectors covered by each of the projects; CDIE made a generous estimate of total program costs for the land

productivity conservation/sustainable agriculture activities at less than half, or about $35 million:

- **Resource Conservation and Utilization Project, 367-0132** (RCUP) ($32.5 Million: $27.5 million USAID contribution; 5.0 million GON contribution) (1980-88),
- **Rapti Project,** 1980-95 (Rapti), Phase I Rapti Zone Rural Area Development Project, 367-0129 (1980-87; $25.7 million, about 5 percent for land productivy conservation), Phase II Rapti Development Project, 367-0155 ($27.4 Million: $18.8 million USAID and $8.8 million GON contributions),
- **Private Volunteer Organizations** (PVO) Co-Financing Project II ($10 Million)(1987-97), and
- **Nepal Resource Management Project** ($.4 million including $130,000 direct grant) (1989-92).

Rapti Development Project

The Rapti project purposes were to improve income, farm production, and other measurable quality of life indicators in the project area It also aimed to increase local demand for, and control of, extension systems for agriculture, resource management, health, family planning, and education. Rapti embraced 10 ministries and agencies in the areas of farming systems, rural works, institutional development, and employment and skills development. In agriculture the goal was to increase crop production by 25% through small scale irrigation systems, and new cropping patterns, improved livestock breeds, bio-intensive kitchen gardens, and improved fruit and nut orchards.

In the renewable resource management component, fodder trees and fuelwood species were planted in panchayat community forests where nurseries were also established. Rapti also promoted community forest management of existing forests. Mobile soil and water conservation teams were to establish demonstration plots in eroded areas and assist local residents in preparing anti-erosion land use plans. The DOF intervention was to reforest more isolated areas, undertake research on afforestation methods, and establish nurseries. A modified taungya agroforestry scheme was introduced for afforestation. In Phase II family planning, health, and education were pruned away.

RCUP and Rapti started at the same time, taking their justification from a 1977 USAID-sponsored development assistance

strategy (Bushen et al. 1977). The strategy coincided with the GON's more serious concern with the environment. Both were very large multi-sectoral projects. Both RCUP and Rapti supported the GON's policy at the time of devolving responsibility to local government and involving farmer organizations to implement its rural development program. The two projects adopted implementation

Resource Conservation and Utilization Project

As a complement to its generally top-down orientation, RCUP, especially in its final two years, attempted a "bottom-up" approach by targeting village panchayats as an appropriate entity for local planning and responsibility. The project established Catchment Conservation Committees in village panchayats to coordinate line agency activities and organize local participation in public works projects. To encourage horizontal integration between line agencies, RCUP constructed sub-district service center office buildings. In agriculture, the project introduced improved cereal varieties, fruit tree seedlings, and vegetable seeds. RCUP also built roads, trails, irrigation systems, and large scale engineering structures to halt erosion. It tested revegetation and mechanical methods for gully control and river training structures, built large impoundments, improved terraces, and stabilized trails and roads. River beds were channeled and straightened to protect irrigated terraces. Pilot projects for forest management tested the effectiveness of managing forests under several forms of public and private ownership; uncultivated lands were reforested and revegetated; forest inventories helped in planning; and tree and forage nurseries were developed. Alternative energy sources were developed to save fuelwood with smokeless stoves and biogas generators, micro-hydropower installations, windmills and water impoundments. In rangeland management it coordinated planting, replanting, and intensive management of grazing land. For livestock development, improved animal husbandry practices, better breeds, and animal health programs were implemented.

approaches that encouraged involvement of Village Development Committees (VDC) and small farmer organizations.

RCUP was designed by 94 local and international experts. The design alone cost $1.2 M. Its purposes were to 1) assist GON in the

protection and restoration of the soil, water, and plant resource base upon which the rural subsistence agriculture population is totally dependent and 2) assist GON in developing institutional infrastructure to manage natural resources. The lead agency was DSWC and there were 11 counterpart agencies in agriculture, irrigation, animal husbandry, forest management, range management, energy alternatives, watershed management, public health, and public works. RCUP focused on two large river basin watersheds: 1) the Kala Gandaki catchment in Mustang District over 4000 square kilometers and 2) the Daroundi catchment in Gorkha and Myagdi Districts 800 km2. RCUP addressed natural resource conservation on a broad front and operated on the assumption that new institutions were needed to set policies and organize field programs. GON established the National Committee for Conservation of National Resources by the NPC to formulate and coordinate national policies. Training funds went to MOFSC to train senior managers and line agency staff.

Concerning the Rapti Project, the GON had encouraged donors to support regional development programs during the 1970s, but USAID had hesitated because of an apparent absence of models for this type of project in Nepal. However, when the World Bank financed a highway into the Dang Valley in 1977, USAID agreed to undertake a rural development project in all five districts of the Rapti Region with the MLD as the counterpart agency. Rapti's first phase included five major components: rural works which emphasized construction of local roads to expand market networks, provision of social services, increasing local employment, farming systems crop research, and technical assistance to local development activities. Livestock and forestry were added to address the project's omission of provisions for stabilizing the agricultural environment, especially agricultural water supply and soils. About 12 percent of the Phase I budget went into this Renewable Resource Mangement Component. The forestry objective aimed to provide forest products on a sustainable basis. Working through the MLD, the Rapti Project defined the *panchayat* as the level at which to raise local capacity to plan and implement natural resource management activities. Democaratic reform and the Decentralization Act helped redefine local in less political and more user-based terms.

Focus on local level implementation. After the two large projects, USAID made a dramatic shift to fund smaller activities with less emphasis on infrastructure and formal training. More support went to NGO initiatives which involved a bottom-up approach where farmers planned and implemented activities, rather than directly to GON line agencies.

The PVO Co-Financing II Project often implemented activities in or near former RCUP site areas. After success of PVOs in the area of integrated rural health in Nepal, USAID sponsored three projects administered by NGOs to develop the capabilities of communities to plan and implement natural resource management and

sustainable agricultural practices. In 1989 the United Missions Nepal (UMN) initiated a project in the former Nepal Coppice Reforestation Project which had tested a number of introduced multipurpose tree species in Dhading and Ramechap Districts to develop improved production systems for fuelwood and fodder. The second phase of that project was termed the Nepal Resource Management Project.

The CARE/Nepal has two projects with similar agendas but distinguishing commercialized and non-commercialized areas. The Natural Resources Management Project is in Mustang while the Remote Areas Basic Needs Project (RABNP) is in Bajura and Solokhumbu Districts. RABNP is distinct from NRMP in that it emphasizes more infrastructural support and subsidies as necessary in areas not served by roads. Each project works with the small watershed management model developed during the last two years in RCUP and Phase II of Rapti. CARE/Nepal received $0.9 M for 1990-93, the first three years. In a former RCUP site in the Gorkha district the NGO, Save the Children Federation (SCF), received PVO Co-Financing funds to undertake similar programs in Gorkha. SCF had worked in Gorkha in public health in the first phase of PVO Co-Financing.

Each of the three NGOs follows a similar program of community development services with an agenda of natural resource management. Development work centers on four areas: 1) health services (undertake community health and education programs), 2) education services (undertake a wide scope of formal and non-formal activities), 3) industrial development (technical training and dissemination of appropriate technology), and 4) rural development (help rural communities to improve the quality of their life through awareness building and technical support). Community capacity development focuses on assisting user groups in the turn over of public forests and to work with similar committees on other activities.

Such groups, assisted by NGOs, carry out the program of the DSCWM and substitute their own staff if a DSCO is not available. NGOs aim to improve the working relations between line agency staff and the farmers. They depend on GON institutions. They encourage the user groups to help pay for the services. NGO sites also carry out a full range of agricultural projects and work with the DADO if available. Better breeds of livestock are introduced and stall feeding is emphasized. Fodder crops are distributed from community nurseries. New crops are introduced particularly in kitchen gardens tended by women. Women and minority groups receive special emphasis through awareness and confidence building training tailored to their level. Mothers' clubs receive training in health, sanitation, family planning, leadership skills, and smokeless stove installation. Environmental awareness education takes many forms. Potable water sources such as springs are

stabilized and water conserved and made hygienic with a concrete tank with faucet spouts.

Additional USAID projects have relevance to this study. An ongoing project is the Agro-Enterprise and Technology Systems Project (ATSP) which is developing new cash crops and markets. USAID also sponsored the Integrated Cereals Project which trained a large number of scientists now active in developing new varieties of rice, wheat, maize, millet, and barley -- food staples of the country.

3. EVALUATION FINDINGS: PROGRAM IMPLEMENTATION

This section presents the evaluation team's findings regarding the impact of USAID-supported activities in land productivity conservation as it relates to sustainable agriculture in Nepal. It highlights findings related to program implementation.The Nepal assessment considered developments in four cross-cutting strategy areas of USAID's program in land productivity conservation and sustainable agriculture to be critical indicators of program impact and performance: 1) institution building, 2) awareness and education, 3) technology introduction, and 4) policy change. The following section identifies significant outcomes in each of these areas.

Institution Building

The team's findings in this strategy area confirm an important assessment design assumption: effective institutional strengthening facilitates the participation of all stakeholders. Central planning and coordination, outreach and implementation, and local organizational capacity were all affected by USAID activities. The assessment findings suggests that, to the extent that USAID supported a balance between these different organizational levels, it helped to create conditions that facilitated the adoption of the community-based land productivity conservation.

Village committees, associations and resource user groups are effective local level institutions for achieving land productivity conservation.

In both its RCUP and Rapti projects, USAID gradually moved from a traditional "top-down" technical service delivery to a more "grass roots" approach in which farmers participated in the planning and implementation of natural resource conservation. Initially, the Rapti Project and RCUP provided institutional strengthening to the district level panachayat where central and local political interests -- not user interests -- were paramount. Participation was generally induced, financially or otherwise. The lack of success of local development actions in the early period led to a rethinking of the appropriate level to bring about meaningful participation. As these large projects were implemented it became increasingly clear that mechanisms to transfer responsibility to organized local groups would be needed. RCUP's small catchment approach involved limited geographic areas, involved farmers in defining the problems, and proposed simple, low-cost technologies to address the problems. From this Rapti, and other (including USAID support to improved irrigation management)

projects, the concept of a local level user group gradually became formalized. This transition led to an improvement of agricultural practices often involving cash crop rather than subsistence crop production.

For example, the Rapti contract team and the DSCWM have supported the formation of eight resource user groups at the project site of Narayanpur Village Development Committee (VDC) -- the sub-district administrative unit that replaced the *panchayat* government. Villagers formed user groups for community tree nursery establishment, community forest protection, the promotion of conservation awareness and afforestation, and irrigation management. Sixteen hectares of highly eroded land in the project area has been planted with six species of fodder grasses in a collective effort on the part of all user groups to curtail soil erosion. Farmers in the project site have also reforested the watershed in an effort to retard the recession of ground water levels. supplies. The success of these activities encouraged neighboring VDCs to request grass seed. Narayanpur villagers found a great demand for their forage species and now sell these seeds. Proceeds from these sales are deposited in a community bank account to support community development activities. The Narayanpur villagers are rehabilitating eroded gullies by building check dams and planting napier grass on steep banks with the technical assistance of the DSCO.

Under the Nepal Resource Management Project (NRMP), the NGO United Mission to Nepal (UMN) implements a program in rural development that includes soil erosion conservation in Naubise VDC, just south of the Kathmandu Valley. UMN assists rural communities to organize to formulate, design and implement their own development activities. Village committees carry out surveys to catalogue community resources, and to document the uses to which those resources are put. This cataloguing serves as a basis for identifying community development priorities. It also establishes baseline data against which community development progress can be measured.

User group formation has been most effective as a means of project implementation in areas where there is a local tradition of community involvement in resource conservation. USAID's support to Nepal's community forestry program has provided sharp definition to the importance of project managers building on indigenous systems of forest management. Similarly, the assessment team found that indigenous organizations became essential institutions in the implementation of improved the soil and water conservation activities under RCUP Rapti. For example, Narayanpur farmers formed effective and well organized user groups for afforestation and land rehabilitation based on their experience with community management of small-scale irrigation works that have survived for generations. The Jana Jyoti Youth Organization, was formed in 1932 by the inhabitants of Tikuri VDC (in the Rapti Zone's Pyuthan

District) to secure an unstable hillside that threatened the villages river-bottom rice land. This organization became the focal point for a United Nations program to introduce improved goat breeds, and for the Rapti project's introduction of watershed management and community forest management practices. In 1986, Rapti contract staff supported the DSCO to form new user groups to protect three watersheds surrounding the VDC. While forestry may provide the entry point for a user group approach, building on the community organizational efforts of the community forestry program, facilitates agricultural development programs.

The success of the GON land productivity conservation program is limited by the lack of coordination between those public sector institutions responsible for natural resource management and those responsible for agricultural production and marketing.

Land productivity conservation strategies cut across a number of agricultural sub-sectors including: research and extension, soil conservation, on-farm water management, livestock, agro-forestry, integrated pest management, credit and marketing. Improved soil and water conservation creates the potential for farmers to intensify and diversify production to exploit agricultural niche markets. Farmers are better motivated to engage in conservation activities if those efforts are tied to cash enterprises. In the absence of private sector services, farmers rely on public sector institutions for technical support to agricultural enterprises. However, as the program and policy discussions of the preceding section indicate, there is little linkage among the various departments of the Ministry of Agriculture, for example, or between the Ministry of Agriculture and the Ministry of Forests and Soil Conservation to support National Planning Commission policies for environmentally sound agriculture.

Support services for both conservation and farming enterprise activities are clearly interrelated. For example, farmers organized in a goat raisers association in Satbariya VDC supported by Rapti embarked on a soil reclamation and revegetation program to improve village common lands. To meet the forage requirements of the groups' improved goat breeds, members have planted grasses and legumes on both eroded public land and their own farmland. They use the cut-and-carry system to stall feed the goats, which are bred for cash sale. Although the improved breeds are more adapted to stall feeding, they are more susceptible to diseases. However, the Livestock Department is not adequately staffed to meet such specialized needs. Nor had the Rapti project provided resources to the Department for support of such project activities. Farmers reported that recently, eight goats died for lack of adequate veterinarian care. In a similar program supported by SCF in Gorkha District, one hundred goats died (Poudyal 1992).

RCUP attempted to promote inter-agency coordination for land productivity conservation within the GON by developing an institutional context for natural resource management projects (Parker, et al. 1988). To encourage the decentralization of government technical services, the project set up Catchment Conservation Committees made up of district officers of the departments of Forestry, Agriculture and Local Government. However, because these committees were run by the local political leaders, there was little meaningful participation of the farmers and the committees were ineffective. At the national level, RCUP promoted the formation of the National Council for Conservation for Natural Resources with the DSCWM director as secretary. Committee membership included the secretaries of Forestry, Agriculture, Water Resources, Local Development and Transportation, as well as the Vice-Chancellor from Tribhuvan University and an independent environmentalist. The structure of the committee has evolved over the past decade, and it now meets under the auspices of the NPC. However, these "top-down" attempts at coordinating resource management have not had tangible impact on the function of line agencies in support of land productivity conservation. The final evaluation of RCUP recommended a more community-based focus natural resource management planning and implementation (Parker, et al. 1988)

Rapti has made a significant contribution to the development of cash crop enterprises through research, implementation and market development. In the Rapti project areas, DSCWM works with farmers to establish nurseries of multipurpose trees in the same way as the DFO works with farmers to establish nurseries of timber trees. The two departments, often work together to meet the multiple needs of farmers for fodder, orchard, and timber trees. The contribution of these private and community nurseries has been important in shifting production to trees that farmers desire and to thereby giving shape to the agroforestry program. Similarly, UMN/NRMP and CARE's Remote Area Basic Needs Project have had similar, albeit more modest, success in promoting kitchen garden vegetable and fruit crop production and marketing. However, these successes has been achieved largely at the initiative of each project's technical assistance teams working closely in support of GON technical field staff. USAID attempts to encourage the institutionalization cooperative agricultural enterprise support services of line agencies on a national level (through the Agroenterprise and Technology Systems Project have encountered traditional obstacles of bureaucratic specialization and administrative hegemony.

Participant training activities improved the technical and administrative abilities, and broadened the land productivity conservation awareness of line agency staff some of whom are or will eventually rise to key positions in government agencies or NGOs.

RCUP and Rapti together supported the training of 314 line agency and project personnel in agriculture, soil conservation, forest management and project management through programs of participant training in foreign degree programs and local non-degree programs (see Appendix E).

While difficult to quantify, there is no doubt that the extent of USAID supported training has improved the technical capacity of line department staff, and the abilities of staff to introduce and support technologies that contribute to land productivity conservation.

NGO efforts have been more effective at integrating conservation farming practices with other development and income generating activities than have large GON multi-sectoral projects.

The team visited field sites of the four NGO projects supported by the USAID PVO Co-financing project. Each of the NGOs -- CARE, SCF and UMN -- employs similar methods of community development. Field staff live in target villages for extended periods of time working with local development "motivators" recruited from among the village population. The NGO projects tend to have broad, multi-sectoral scopes (eg., literacy, public health, sanitation and nutrition) that correspond to local priority requirements, and many use small-scale infrastructure (e.g., potable water supply schemes) as a point of entry for community organizers to promote participatory development and the strengthening of local institutions. Where government services are available, NGO staff work closely with line department technicians to secure the delivery of services.

Natural resource management activities under these projects are modeled on the same "user group" formula employed by organizations implementing community forestry projects. CARE's Remote Area Basic Needs Project in the districts of Bajura and Solukhumbu, for example, support soil and water conservation, reforestation, hillside stabilization through community associations together with the promotion of small-scale agricultural enterprises such as kitchen gardening and orchard plantation.

The advantage of the NGO model of support to natural resource management over large, multi-sectoral projects or government line agencies in general, is that NGO staff target a specific and confined area, and provide dedicated services to that area for long periods of time. The disadvantage to the NGO model is that staff often attempt a wide variety of development interventions that exceed the technical support capacity of government line agencies or the NGO technical staff members themselves. Beneficiaries of many NGO projects are experimenting with a broad range of crop species, many of which were new to the areas, new breeds of

livestock, as well as various income generating activities. Kitchen gardens, in particular, are testing grounds for vegetable, fruit tree, and high value crops. NGO projects are also experimenting with various fodder and green manure species.

While NGOs can be effective at community organization and the targeted implementation of community development activities, they cannot provide the level or extent of technical services that the government line departments are required to provide. However, NGO programs provide valuable insights into the dynamics of community-based resource management that can be applied by line agencies to improve the implementation success of their own programs.

Awareness and Education

All of the USAID-sponsored projects under review included awareness-raising and skills development components for beneficiaries. Project funds were used to test a wide array of communication methods to educate farmers on environmental issues and technologies with which to manage community natural resources.

USAID-supported projects improved public awareness of environmental issues and natural resource management.

Almost all farmers interviewed by team members could relate the decline in land and water resources on their lands to deforestation and overgrazing. These villagers stated that the symptoms of environmental degradation were loss of soil, declining crop yields, lower water tables, and the seasonal or total drying up of springs or rivers. These changes had occurred during their lifetimes. Those interviewed stated that they had learned these lessons from material used in non-formal adult education classes, village group meetings including those where role playing was undertaken, individual contact meetings with project staff, dramas performed by villagers, songs and poems written by villagers, puppet shows, environmental fairs, audio-visual presentations, and a radio program sponsored by DOF.

A large proportion of the rural adult population in Nepal is illiterate (FAO 1991). Non-formal adult education classes have been used as an entry point into communities by CARE, UMN, and SCF staff (CARE 1993b; NRMP 1993; Poudyal 1992). NFE brings students to a literacy standard that will enable them to join formal primary education services at a later date. These programs target young adults who cannot attend the formal school system, many of whom are women. Classes are normally started six months after a worker enters a community. There were four NFE classes at the CARE, Bajura site in 1993. From 1985-91 SCF educated 10,000 adults in Ilaka 1 of the Gorkha District.

NRMP, in its program of Resource Conservation Education, incorporates environmental awareness and development messages into the curriculum. Each class is run and supported by a committee which selects a volunteer facilitator (who receives 15 days of training beforehand). The committee manages the class and handles the class funds (the project gives Rs3300 for school supplies). The class members raise 10 percent of the cost of the class through fund raising activities which are the first steps in user group formation. There were 21 Resource Conservation Education (RCE) classes in Naubise in 1993. Both the Resource Conservation Education and the non-formal adult education classes are highly organized.

Cross visits and short courses supported by projects and NGOs exposed farmers to new technologies in natural resource management and sustainable agriculture. Farmers have also learned leadership and management skills that enabled them to take greater control of their own community development.

Both Rapti and RCUP engaged project and line department staff as well as project beneficiaries in training activities (including cross visits and short courses of several days to two weeks) which covered a wide range of agroforestry and sustainable agriculture practices including: bamboo propagation; forage grass/legume propagation; landslide stabilization; water system management; terrace improvement; nursery establishment; reforestation; improved livestock management; check dam construction; subsistence and cash crop culture, intercropping, agricultural marketing, kitchen gardens, and composting. Projects facilitate agencies to provide technical training and, at NGO sites in particular, the beneficiaries were encouraged to fund their training activities.

Under the NRMP project, beneficiaries pay a small fee for such technical training that contributes to the per diem of trainers. This policy engenders a feeling of ownership among the beneficiaries of the particular training program and is a stimulus for greater participation and learning. If the training is scheduled outside of the VDC, meetings are held beforehand to enable the user group members to decide on the merits of the training and choose their delegates. These delegates are compelled, in turn, to implement the results of the training activity on their own farms as well as those of their neighbors.

Cross visits also enable participants to share experiences of user group formation and resource management.

A strong sense of cooperation exists among many of the donor-supported natural resource management projects currently underway in Nepal. The coordinating functions provided by the Forestry Sector Support Committee has engendered a wide exchange of both technical and organizational strategies in community-based management of natural resources and sustainable agriculture. The

Rapti contract team continues to provide a high level of technical support, through technical and management training, to GON line department field staff within the project area.

Technology Introduction

USAID has supported the dissemination of technologies and practices that have enhanced land conservation and increased incomes of project beneficiaries.

Natural resource conservation and sustainable agriculture activities within all of the USAID-sponsored projects that the team visited resulted in beneficiaries adopting land productivity conservation practices. These practices were linked to agricultural enterprises, which in turn increased household incomes. The team identified six distinct practices:

- Stall feeding livestock, as opposed to traditional open grazing, accelerates tree and fodder regeneration. Farmers benefit from the collection of farm yard manure which is applied to kitchen gardens. Vegetables cultivated in those gardens provide better nutrition and cash income when sold at local markets. Stall feeding has led to the rearing of improved livestock breeds, which, in turn, yield improved quantities of meat, milk and milk by-products.

- Recycled waste water from the household or pipe irrigation overflow (from community tank water sources) is used to irrigate off-season vegetables as cash crops.

- Forage grasses such as *napier* are planted on eroded agriculture land to check further erosion. Livestock diets are improved, and grass seeds are harvested and sold for cash.

- Marginal and eroded rainfed land in the Middle Hills is increasingly being abandoned and allowed to regenerate naturally or is planted with fodder and fruit trees. Abandonment is due to labor shortages (as a result of emigration of adult males) and the lack of farmyard manure.

- User groups are rehabilitating common lands with fodder tree species and species that produce by-products of commercial value such as cooking oil and soap.

These innovations compliment traditional practices that farmers have employed to stabilize hillside terraces, and to conserve soil moisture and fertility. These practices include the cultivation of leguminous food crops and fodder on terrace risers.

The introduction of new sustainable agricultural practices must be carefully planned with the participation of the potential beneficiaries.

The Rapti project introduced an agroforestry system developed in Burma called *taungya* to the Satbariya VDC. Under this system, a deforested area is planted with rows of trees and intercropped with subsistence or cash crops.

Under the Rapti system, administered by the DOF at Satbariya VDC, beneficiary farmers protect the plantation for three years in exchange for the right to cultivate and harvest crops before the tree canopy closes. Each farmer was provided 0.6 ha and paid by the DOF to plant coppice species -- sissoo, Melia, and eucalyptus. Landless farmers are given priority as beneficiaries. The farmer moves to a new plot every three years and thus cultivates three plots of land in the nine year cycle of tree maturation. The trees are the property of the GON but tree cuttings from thinning and pruning can be used by the farmer.

The team noted several problems with the system as designed. After the fourth year, the farmers had not transferred to new plots due to the lack of contiguous land. New plots 10-20 km away were too distant for farmers to commute. Even if they did move to the new plots they would have difficulty protecting the old plots. Roaming cattle had eaten or trampled large numbers of young trees. According to the farmers the DOF would not let them move onto their plots to enable them to undertake more continuous protection. Such reticence on the part of the DOF is symptomatic of the institutional obstacles to combining agricultural production and reforestation and of the propensity of the DOF to work only on public lands.

Farmers were encouraged to cultivate cotton as a cash crop and eucalyptus trees. The team saw that the cotton crop looked poor (yields were 4-5 quintal/ha) as many fields were weedy. The shade of the trees, now in their fourth year, caused poor growth and delayed cotton maturity causing more insect pest problems and the need to spray more insecticide. The farmers would have preferred sissoo or other fodder producing species but many were given eucalyptus without any choice. Many of the problems with the taungya scheme could have been prevented if user groups had participated in the design phase.

Policy Change

USAID-supported field activities have led to the definition and diffusion of a land productivity model that has become the basis for a national policy of integrated watershed management.

The MOFSC has adopted the Rapti project's Narayanpur site as a model for its program throughout the country. At Narayanpur, project staff and the DSCWM established community nurseries to multiply successful cover crop species of legumes and grasses for distributed to farmers in the soil conservation user groups that

are formed for planting on eroded lands. The cover crops provide fodder for stall fed livestock. Proceeds from the sale of seed to neighboring farmers are deposited in a fund to pay local laborers to plant the cover crops on eroded public watersheds and harvest the seed and fodder for sale. The system in effect pays for the rehabilitation of public lands.

RCUP's contract approach to implementing land degradation conservation activities proved unsuccessful because centralized policies failed to engender a sense of ownership and commitment among local populations.

Under RCUP, GON field staff implemented hillside stabilization works without beneficiary involvement (Parker et al. 1988). Landslides were stabilized with expensive concrete rock walls whereas farmers have long used more inexpensive methods with equal results. RCUP supported the construction of check dams and gabions for river training. Many of these structures could not withstand seasonal floods and became buried in the river beds. Had the structures been made of loose stone instead of stone encased in wire mesh, villagers could have replaced them. The check dams could have been made with more appropriate materials at a much lower cost by building wood structures with napier grass. The check dams proved to be cost ineffective (0.2 rate of return) (Parker, et al. 1988).

The failure of these investments has been a lesson for project managers in the importance of community involvement in the design and implementation of resource management activities. Community involvement in design and construction of infrastructure typically generates a sense of community ownership in that infrastructure and a responsibility for its maintenance.

The complex topography and its susceptibility to natural processes or erosion and mass sliding imply that when population densities increase, individual farmers must work together in a closely coordinated fashion. While this seems to be the natural tendency in isolated hill areas, political and economic integration have undermined the stability of many Middle Hills agro-ecosystems. Reversing these trends under the large catchment approach of RCUP did not work precisely because it was assimilated by them. Policy changes allowing more handing over of management authority to local populations began to take shape only at the end of RCUP's project life.

4. EVALUATION FINDINGS: PROGRAM IMPACT

This section highlights findings related to program impact through changed practices that have or will have on the biophysical and socioeconomic conditions in target areas. It presents evidence that USAID-sponsored projects affected farmers' adoption of land productivity conservation practices associated with sustainable agricultural systems. In turn the team has assessed the impact of these practices on improved biological and physical conditions of the land productivity base and/or improvements in the economic and social well-being of the beneficiaries.

Impact on Practices

As a result of greater environmental awareness, farmers are rehabilitating eroded soils.

During site visits, team members saw much evidence of land rehabilitation activities by farm communities. In Narayanpur, farmers built check dams in gullies, stabilized soils with vegetative cover, and planted contour hedgerows with napier grass on gully slopes in a 16 ha area. In Mulpani (3 ha), Salyan women's forest, and SCF sites farmers rehabilitated rockwall terraces and planted on the risers to strengthen their erosion control properties. Landslide stabilization was undertaken in UMN, CARE, SCF, Pyuthan, and Mulpani sites with revegetation and water diversion canals. As a result of RCUP's introduction of napier grass, and aided by UMN's diffusion of this species, farmers within and beyond project areas have benefitted from its forage and land stabilization properties.

Farmers have shifted from subsistence cropping to cash cropping and other market enterprises. This shift has had a positive, but not necessarily intended, impact on land conservation.

At each site visited by the assessment team, farmers are increasing their investment in commercial agricultural enterprises. Many of these enterprises involve planting cash crops or fodder trees on marginal lands, which typically receive the lowest priority in land management. However, for the cultivation of higher value crops, farmers are prone to apply more fertilizer, rehabilitate terraces, protect against livestock foraging, and build check dams to curtail erosion.

By increasing the quality of a field's micro-climate, farmers' adoption of land productivity conservation practices enables farmers to accelerate the shift of their cropping patterns. At Narayanpur, improved water management enabled farmers to double (rice-wheat) and triple (rice-wheat-mustard) crop their khet lands,

and improve production per crop (yields tripled). A number of farmers at Satbariya VDC have replaced cereal and mustard crops on rainfed lands with vegetables using recycled irrigation water. Farmers in the SCF project areas of Gorkha District were intercropping fruit trees with millet. Under CARE/NRMP in Mustang, farmers adopted forage legumes and grasses to intercrop with orchard crops. Because of tourist related demand for pack animals, hay prices were actually twice those of apples.

Stall feeding of livestock has reduced the pressure on overgrazed upland pasture land and allowed the regeneration of trees on public and private lands. Penning livestock has also increased the available manure for improving soil structure and fertility.

The team saw high levels of stall feeding at the UMN, SCF, and Narayanpur sites. In Narayanpur the percentage of farmers stall feeding rose from <5% to 50% (Napit and Yadner 1993). Stall feeding has steadily increased in Naubise (Nepal Resources Management Project 1993). This change has occurred nationwide over the past several years as a result of protection of farm and forest lands by user groups from open grazing (Fox 1992; Gilmour 1990). Walks by the team members through protected forests and terraced hillsides showed extensive regeneration of sal and other tree species as well as increased and intensively managed tree growth on private lands.

USAID-funded activities have accelerated the trend toward planting multi-purpose trees and fodder grasses/legumes on farms and public lands.

USAID-funded activities have formalized and spread the concept of user groups in Nepalese communities. Community forest user groups have protected public lands denying open grazing and collection of fodder (Gilmour 1990, Fox 1993, Malla 1993). This change has resulted in a shortage of locally available fodder to maintain livestock. As a result, the team saw evidence in most sites of farmers planting fodder trees, grasses, and legumes on their own lands. Farmers have responded by planting a wide array of fodder species. Choice of a wide variety of fodder types ensures a more nutritious mix of animal feed as well as year round availability (Carter 1992). Increased vegetative cover from fodder planting reduces erosion and stabilizes slopes.

In the Pereni sub-watershed of Naranyanpur fodder use is now 50 percent instead of 25 percent from private lands (Napit and Yadav 1993). The project introduced seven new species of multi-purpose fodder crops (stylo, dina nath, desmodium, napier, pigeon pea, mollasses, and setaria). Goat raisers user group members in Satbaryia reported that 28,000 seedlings of Melia, sissoo, chat, Ficus and Acacia were produced in community nurseries over the past few years.

The DSCO in the Salyan women's forest site had distributed 50-500 multi-purpose tree seedlings (bohemia, bima, kutmera, Quercus, and Ficus) over the past 6-7 years to satisfy both fodder and fuelwood needs. In Mulpani the DSCO introduced Dolichos, vemal, and napier as fodder species which have been planted mostly on terrace risers. Farmers in Pyuthan told team members they planted more fodder trees on their farmland to feed the increasing goat herds they stall feed. In the SCF site at Garapini, Gorkha the project has encouraged farmers to plant a wide array of fodder species which are multiplied in community nurseries (tanki, kutmero, thuti, champ, sissoo, lakuri, bakaino, paspati, lopsi, and Leucaena). Farmers have planted these on both risers and bari terraces. In Naubise in 1991, 30,000 seedlings of a wide spectrum of fodder and fuelwood species were planted on private and public lands (utis, lankuri, khote salla, gobre salla, patual salla, lapsi, khari siris, painyu, champ, dhupi, kapur, Robinia, Leucaena, and sissoo) (NMRP 1992).

Adoption of agroforestry practices has contributed to increases in afforestation.

The modified taungya agroforestry scheme resulted in farmers planting 70 ha of eroded land to sissoo, Melia, and eucalyptus trees (Devres 1992). In the CARE/Mustang site, farmers have begun to introduce indigenous and improved forage species into irrigated orchard and fuelwood plantations. Forage grasses add value and produce immediate tangible benefits. Opening Mustang to tourism has stimulated high market prices for forage grasses. This income producing mechanism is serving as a vehicle to increase the adoption of agroforestry practices. Agricultural crop production in the forested areas ensured better protection of the forest plantings.

Protection of public lands and afforestation efforts by user groups have stabilized watersheds surrounding agricultural lands.

Afforestation reduces water runoff, increases infiltration to raise water tables and protects farmland downslope. With the recent change in GON policy, large numbers of communities are petitioning the local DFO for the rights to manage public lands (USAID 1994). USAID-supported projects which worked with farm communities developed workplans to protect and replant public lands. Project staff helped organize and train farmer user groups on how to meet DOF criteria required for the turn over of community lands to the local farmers. This turn over is viewed by the team as an essential component of the land productivity conservation program.

Team members saw much evidence of user groups in the sites protecting and replanting watersheds vital to the stabilization of farmlands. Narayanpur farmers (representing 500 households) are

protecting two areas of 16 and 140 ha each. The 16 ha is officially turned over by the DOF but the larger area is being considered for turnover. The goat raisers in Satbariya have 160 ha already turned over to them and are protecting a 1000 ha forest in the upper watershed area. In Mulpani a 250 ha community forest is being protected by 600 members of 98 households but the forest has not been officially turned over. The women's forest group in Salyan has official management rights to a 35 ha community forest. The DOF has turned over the 350 ha community forest in the Tikuri Rani Ban and Puywa Khola VDCs ha in Pyuthan. In the SCF site in Gorkha, 110 households manage 13 ha of community forest which has been turned over to them. The community forests in the UMN (42 ha by 37 households) and CARE (3.5 ha by 102 households) are being protected but have not been officially turned over to local user groups.

Farmers have stabilized land around springs and irrigation system canals to increases the supply and utility of water.

Areas around springs are ecologically very fragile and prone to erosion (Fleming 1978). Team members documented that farmers in Mulpani, CARE, and Salyan women's forest sites have planted trees and perennial grasses around natural springs to stabilize the soil. Water tanks with faucets were constructed to provide convenient, sustainable, and potable water. Where water flow is limited, faucets from collection tanks conserve the supply. Irrigation canals were repaired and stabilized with vegetative cover in Narayanpur and CARE sites. These construction activities involved shared resources with project funds purchasing the material and the farmers supplying labor. Maintenance user groups were established to ensure "ownership" of the structures so the beneficiaries were more prone to protect and repair "their" systems. These groups were reported to have followed "user group" models developed under USAID financed irrigation projects which the team did not examine.

Water is a limited resource in most villages in Nepal (DSCWM 1992). During site visits, team members witnessed much effort by farm communities to conserve their water supply. The water table dropped 20-25 feet over a 20-25 year period in the Satbariya goat raising site. Recycled water from the household in the SCF, UMN, and CARE sites was used to irrigate kitchen gardens. At the SCF site concrete slabs were built beside homes to collect water from dish washing and bathing. Farmers otherwise would have fetched more water from the public supply for irrigation. Runoff water from free-flowing springs was used to irrigate crops on nearby terraces in SCF and Mulpani sites. PVC pipes conveyed water from the source to their fields, some as far away as 1000m. Farmers obtained agricultural loans to purchase the pipes n Mulpani.

Farmers are beginning to purchase chemical fertilizer to supplement their organic sources.

Farmers with access to markets have begun to purchase limited supplies of inorganic chemical fertilizers. The practice of farmers in the Salyan women's forest and SCF sites was to mix small amounts of purchased chemical fertilizer with organic fertilizers to enhance biological breakdown of the compost (Bukdathoki et al. 1993). Studies in Nepal have shown that as farmers' incomes rise, they will purchase increasing amounts of chemical fertilizer (Malla 1993). Such purchases can be taken as an indicator of both willingness and capacity to invest in what are often considered marginal farmlands.

An increase in the limitations to free grazing on public lands has caused a change in livestock species composition, breeds, and herd size.

In almost every site, the evaluation team noted changes in the composition of livestock holdings. The shift to stall feeding has meant a dramatic reduction in sheep and an increase in buffaloes and goats (Shrestha and Evans 1984). Sheep require large grazing areas and much household labor. Buffaloes and goats produce milk and meat for sale. Cows have generally decreased in number, being only valuable for draft power and farm yard manure production. Buffaloes and goats are better adapted to stall feeding. Team members were told improved breeds have been introduced in Satbariya and Pyuthan sites. Herd sizes have increased in sites where livestock was developed into cash enterprises (Satbariya goat raising, Pyuthan, and Mulpani sites) and decreased in sites with limited fodder. Fox (1993) and Malla (1993) have reported these trends in Nepal over the past decade.

Biophysical Impact

Although the Rapti and RCUP projects initiated field activities more than a decade ago, it is still early in the process of rural change. The broad ranging adoption of new practices described in the previous section if it continues will lead to positive biophysical changes on a more general level. The Rapti and NGO-financed projects appear to build on general trends in rural land use, namely abandonment of marginal and distant agricultural terraces, increased tree planting on private lands (especially where trees on public lands are scarce), and a shift toward more intense stall-fed methods of livestock production. While program implementation facilitated these existing trends, USAID-supported projects have added private tree nurseries, land rehabilitation techniques, and saleable commodities (apples, khar grass, vegetables). The following section argues that cumulatively these changes are leading toward positive biophysical and socio-economic developments in Nepal's Middle Hills region.

Land productivity conservation practices have increased soil fertility.

The greatest constraint to increased production in Nepal is not land but fertilizer (Carson 1992). With a trend to stall feeding and with better quality fodder and animal nutrition, more farm yard manure is being collected for use on the farm. Replacement of fertilizer - demanding crop areas by fodder plantings or orchard trees -- frees more farm yard manure for use on low productive lands. Increased on-farm use of green manures and leguminous fodder crops, both of which fix nitrogen, will also enhance soil fertility. Increased biomass production from dried and green leaves in protected forest areas, as observed in Dhading District and elsewhere, can then provide greater sources of compost. More farmers have been trained in USAID-supported sites on how to make better quality compost. Team members were told that compost making courses were offered in Naubise, SCF, and CARE sites.

Soil erosion in protected watersheds and agricultural lands is declining in project areas.

In the goat raising sites of Narayanpur and Satbariya, the team observed successful filling of gullies where erosion processes caused soil to collect behind small check dams. The revegetation program has caused farmers in those sites to remark that small streams draining the rehabilitated watersheds now run clear. In user group-protected deforested areas, grasses have grown tall with large root masses to stop soil runoff. Animals in those two Siwalik sites are only allowed periodic grazing privileges. Leaf litter was being incorporated as organic matter.

In the Middle Hills, landslide areas are quickly stabilized after slippage occurs to prevent the eroded areas from widening. Team members saw that erosion along irrigation canals has been curtailed with vegetative cover. Rehabilitated terraces were sturdy with no signs of rill erosion in SCF, CARE, Mulpani, and UMN sites where this program is active. Terraced areas planted to cash crops were better cared for compared to terraces planted to millet and mustard or those left abandoned.

The incidence of landslides, which is highly correlated with vegetative cover (Fleming 1978), is also expected to be greatly diminished. Farmers reported that none has reoccurred in the Pyuthan site since the affected area was reforested beginning in 1932, but much depends on a given sit's topography.

Springs and irrigation canals were revegetated and stabilized to increase the sustainability of water flow.

Farmers reported to team members that greater water flow has occurred in the Mulpani water user group-protected springs. Other

water user groups are forming nearby to construct concrete tanks and plant napier grass and trees around the springs. Although still isolated, the examples of successful stabilization of fragile slopes may lead to more widespread impact. This was also one of the reasons that in the Pereni sub-watershed, participating farmers were able to increase the irrigated area from 45 hectares to 180 hectares over a four year period..

Community protected public lands and farmer protected farm lands are regenerating quickly thus increasing fodder and fuelwood biomass.

Protection of public lands for forest and fodder has provided incentive for farmers to plant fodder species (grasses, legumes, and multi-purpose trees) on their farmland, either intercropping with legumes or millet (as seen in SCF site), or replacing low productive crops on rainfed land such as mustard (as seen in goat raisers' site). As a result of protection, trees can regenerate naturally without expensive replanting. The result has been a replacement of annual crops with perennial crops providing more environmental stability to the landscape. Improved land and water management on irrigated rice plots was reported in some areas and can be expected to follow from improved water retention and upslope management of erosion.

Socioeconomic Impact

USAID-funded land productivity conservation activities have had demonstrable socioeconomic impact in those project areas where practices have become well established. The team observed significant impact in all nine sites visited. But the full economic impact of successful conservation practices cannot yet be evaluated, because the adoption of practices appears to be only one factor, albeit a significant one, in an inexorable transformation of agricultural production patterns in the Middle Hills of Nepal (Fox 1993, Malla 1993). Other factors include: the continuing monetization of the rural economy, rural labor shortages due to seasonal migration, and permanent rural-to-urban migration. As argued above, these factors combine to influence the abandonment of marginal farmland in favor of more intensive and varied cultivation of principal croplands. Nevertheless, the assessment team made the following findings with regard to the socio-economic impact of the GON soil conservation and agroforestry activities of the land productivity conservation program.

User group adoption of soil and water conservation practices has led to an increase in savings and investment both at the household and community level.

Well-established resource user groups typically pool their earnings from fees and fines levied on members into savings accounts that support local community development projects. By and

large these savings are modest, derived as they are from small fees levied on users, or from the sale of collectively managed resources. Investments are often made to repair or construct public buildings. User groups at Narayanpur, for example, utilized funds generated from the sale of fodder grass seed to purchase furniture for, and pay for the upkeep of, the local elementary school. The group also employed landless laborers to harvest grass seed for sale. The Satbariya goat raising group employed laborers to replant public lands with fodder trees. In addition, the assessment team found a number of user groups assisted by NGO programs that provided meals and accommodation for government line department technicians.

However modest user group savings may be, the investment of these funds represents an important development in collective decision making, cooperation and community "self-help". Donor and government support to these groups has provided important encouragement to participatory management of resources and to the familiarization of villagers with the principals of coordination and cooperation which are essential to building local democratic institutions.

Adoption of community-based land productivity conservation practices has contributed to improved household welfare in Nepal.

Any impact on the improved availability of organic matter for compost, animal bedding and mulch will be felt most significantly by women. Women have the major responsibility for activities directly related to food processing and preparation. These include the harvesting of both fuelwood for cooking and fodder for livestock feed. An IFPRI study on the consequences of deforestation on hill area women found that women's time spent collecting fuelwood, fodder and grass amounted to 2.5 hours per person, per day, averaged over the year (Kumar and Hotchkiss 1988). Deforestation increases the time women must spend to collect fuelwood and fodder, decreases the amount of time they devote to agricultural production, food preparation and child care.

The adoption of agroforestry practices, the expansion of vegetable production, the shift from open grazing of livestock to stall feeding and the subsequent improvement of livestock holdings that this shift supports have all combined to improve household incomes of farmers participating in resource user groups. Many of these improvements relate directly to a reduction in the workload of women.

Diversification into cash crop production, particularly vegetables and fruit crops, has led to improvements in household nutrition as well as income generation. In Bajura, for example, the proliferation of kitchen gardens using waste water from piped water schemes promoted by CARE are clearly linked to the reported

decline in vitamin A deficiency and the incidence of night blindness. CARE's initiatives at promoting a regional market for vegetables and other produce at Kolti are achieving modest success. These efforts provide important incentives for crop diversification, improved land use and production patterns, improved household incomes, and improved nutrition in Nepal's remote areas.

5. EVALUATION FINDINGS: PROGRAM PERFORMANCE

The final part of this section presents the evaluation team findings on the performance of USAID-supported activities in terms of their overall effectiveness, efficiency, sustainability and replicability.

Program Effectiveness

Top-down development approaches tend to favor wealthier and politically influential farmers. New technology is more readily adopted by that segment of the farm community, which can afford to take risks with new technology. The three NGOs involved in implementing USAID's natural resource management program -- UMN, CARE, and SCF -- are mandated to work with the poorest of the poor especially women, lower castes and minority ethnic groups as beneficiaries. The findings on program effectiveness relate to the equitable distribution of program resources for all these groups.

> **As a result of donor support, there has been a modest increase in the participation of women and disadvantaged groups in the conservation and sustainable management of soil and water resources in Nepal.**

There is a wide disparity among regions in the equitable distribution of land productivity conservation program inputs. The Hindu caste structure, and the disadvantaged position of ethnic minorities and occupational castes, and of women in general, within that structure, remains resistant to change in the rural areas, particularly of Far Western Nepal. Nevertheless, it is clear from the teams findings that USAID support to the program, particularly through NGO project implementation, has influenced the greater participation of these groups in community decision making regarding natural resource management.

The USAID/Nepal-sponsored study "The Status of Women in Nepal" (1979) was the first donor effort to recognize the central role of women in farm and non-farm activities (USAID 1989). Since that time, USAID has provided important support to ensuring that the requirements of women are met in project design and implementation. These efforts appear to be having an impact. The assessment team found that there is increased recognition among line agency personnel of the relationship between women's roles and project success, and an increased awareness among the user group membership itself of the need to include women in management committees. This finding was reinforced by discussions with the Narayanpur and Satbariya

user groups where women account for 25 percent and 15 percent of the user group management committees, respectively.

The team found that participation in government and donor-funded Non-Formal Education classes has improved women's willingness to participate in resource user groups. It is important to note that these women are supported and motivated by committed Women Development Officers (WDO) and local GON personnel. The level of participation of women is higher (as in the UMN site) as demonstrated by their eagerness to attend committee meetings, and interest in programs that educate them on the qualities of different species of trees, planting techniques, and soil conservation methods.

However, women's participation appears limited to the inclusion of women in management committees. Women do not yet appear to be fully involved in the community decision-making process regarding natural resources. Enhancing women's involvement requires first building women's confidence. This is better achieved in small women-only groups, which then can be expanded to include men. Such committees show more promise of effective management as evidenced by the Lali Guras user group in Salyan.

Similarly, USAID, in its program activities, has supported the inclusion of ethnic minorities and occupational groups in resource management. These efforts have been more successful in villages where the population is not dominated by a single caste, where the user group is more socially heterogeneous. The team found evidence of multi-caste or multi-ethnic representation in the majority of the project-supported user groups, including the Shiva Shakti group in Satbariya and the Takuri Ban group in Pyutan.

In the Terai communities, for example, many resource management committees are dominated by its more influential, higher caste members. The chairmen of the management committees (Baghmare and Dhana, Dang) are also chairmen of their respective VDCs. These men with strong ties to local power structures have perhaps contributed to the politicizing of user group committees. In Baghmare, the service caste exhibited a tendency to shy away from participating. No concerted effort seems to have been made to involve service caste and women in the management committee. This questions the ability of the management committee to represent the interest of all users, particularly the poorer service caste households and women headed households.

In the Garapani women's user group supported by SCF in Gorkha, service caste women are dominated by local elite women with the result that the former often do not voice an opinion, or even if they do their comments are disregarded by high

caste women. The women's group is not representative of the beneficiary group. The capacity of this group to manage its community resources will depend on the attitude and willingness of the high caste users to foster unity in the group. Early indications are this is unlikely to happen in the foreseeable future.

These examples underscore the difficulty of ensuring equity in support to community land degradation management. These examples also underscore some of the weaknesses in the community management model, particularly in the recognition by village elites of the rights that all members have in the management of their resources

The formation of user groups is strengthening democracy in Nepal through the empowerment of the rural population including women and lower castes.

A democratic society is based not on elections to parliament, but on strong local level institutions that embody the concepts of equality and fairness. Village level Nepal, burdened with an exclusionary system of caste, inequity toward women and a history of a privileged elites, is a weak base for democratic development.

Resource user groups are constituted on an entirely different basis. The inclusion of women and lower caste members in user groups gives a limited voice to the disenfranchised members of society, and promotes their confidence in community participation. More importantly, user group members are learning valuable lessons about working together to achieve a community benefit.

User groups are also demonstrating their political power. The evaluation team was told of user groups, such as those in Dhankuta, banding together to form associations to lobby at the district level. At Bhagmare, in the Rapti Zone, the user group, with support from the Rapti project, has petitioned the government for a national policy change that will allow them to operate a saw mill. These forms of local empowerment were unheard of in Nepali history. User group empowerment will help to keep the system of government in Nepal responsive to the needs of the local people.

Program Efficiency

Much of the $35 million in program costs represent sunk costs. Benefits from this investment are beginning to be felt but cannot yet be calculated.

Program efficiency is measured in the cost of USAID support relative to the benefits. The team evaluated the

effects of two models of program intervention, the top down model and the grass roots model which emphasized farmers' participation. The RCUP and Rapti project Phase I, representing the top down model, carried out large scale engineering works and introduced new technology without the involvement of the beneficiaries. This led to a number of white elephants such as unoccupied government offices in the project districts and also to barbed wire fences which still "protect" bleak patches of bare rock where forests were once envisioned. These initial project efforts were inefficient and sometimes counterproductive. Salary incentives and excessive construction (over $5.0 million of RCUP's budget) for facilities that may never have been filled or which brought on envy from line services that did not receive new quarters were costly but produced few or no benefits. However, what came out of the $27 million spent (of $32M obligated) under RCUP was a model that largely defined the natural resource component of the Rapti Phase II project and underwent modification and refinement by PVO Co-financed projects.

The RCUP design budget of $1.2M and the $1.4 for the Rapti design would now fund an entire NGO project affecting 10 districts for 3 years. Rapti Phase II and PVO Co-financed projects utilized participatory approaches and were engaged in institutional building to create client driven community development. The main benefit of the early investments was to pioneer simple, low cost technologies emphasizing the use of vegetative measures and local materials to curb erosion, better manage animal grazing, and conserve water resources important to the agricultural enterprise.

Despite the fact that the best example of this evolution, the Paranee sub-watershed model, has been adopted for the 31 districts most susceptible to cropland degradation, the actual area covered is limited relative to the more than 2 million hectares of bari and khet lands at risk in Nepal's Siwalik and Middle Hills regions. Direct economic benefits include higher margins on (sometimes dramatically) increased crop production, increased income from more saleable animals, and labor and cost savings from on-farm forage and fuelwood sources. More importantly these advantages are annually renewed by virtue of being ecologically sustainable. External benefits such as reduced siltation of distant irrigation systems or potential landslides averted can only be hinted at. The diverse ecological and market niches occurring throughout the project zones make it infeasible to make a general projection of overall benefits. The important conclusion appears to be, rather, that site-specific approaches are needed and based on the substantial investments made in infrastructure, training, and research in Rapti, RCUP and other projects, such approaches can now be implemented efficiently. Individual cost-benefit analyses carried out in conjunction with the

various PVO co-financed and the UMN/NRMP support this conclusion.

Program Sustainability

Land productivity conservation efforts implemented through community-based resource management groups and tied to income generating activities are the foundation of sustainable agriculture.

Benefits from land productivity conservation are rarely immediate and are generally shared by the community as a whole. Farmers were observed to be highly motivated to rehabilitate their resource base if that activity was linked to direct economic benefits. The planting of fodder grasses or legumes on eroded soils stabilizes landslides or could be used to feed to their livestock. Replanting pine trees does not have an economic return for decades. Planting fruit trees on low productive terraces on private land stabilizes the soil and will generate cash from sales within 3-4 years.

Many communities are forming user groups with the expectation of expanding their resource base. The team noted several sites where the user groups were highly cohesive and the members were well informed of their purpose and operational plans. These user groups had both management and membership as highly representative of the farm community geographically, by gender, caste, and ethnic composition. These user groups had subcommittees to undertake various functions related to public health, water supply, and income generating activities rather than forming different user groups for each leading to confusion among the members. Decision making was shared among community members.

User groups which managed community forests with standing trees of economic value were able to raise funds to support their own development efforts. In this way the community became independent of external aid and also freed up many activities normally under the jurisdiction of the GON. In sites where community lands had few trees of saleable age, it was important for the project to have other income generating opportunities such as crops or livestock.

Remote communities face more formidable obstacles to development than those where roads and other forms of communication are developed.

Roads open up markets as the team saw in the two Salyan sites which had a road constructed by the Rapti project but did not see in Jagannath CARE site which had only an air linkage or a 7 day walk to market town. Markets need to be

developed to break the subsistence cycle of poverty. Farmers in Jagannath were not very open to undertaking soil and water conservation activities as they spent many of their waking hours gathering fodder and fuelwood and caring for subsistence crops vital to their survival. The team felt that in the long run, development will occur if the proportion of their effort is shifted from the labor intensive subsistence cropping and livestock management to less labor and resource intensive cash enterprises. Freeing their time is important in their being able to undertake natural resource management (Malla 1993).

Indigenous NGOs provide vital support to user groups.

The team recognized three levels of NGOs. The first was the international NGO such as CARE and SCF where expatriates manage the organization and funding. These NGOs can undertake a wide range of activities as they have greater resources and international experience. At the other end of the scale the team saw emerging indigenous NGOs from community user groups. These organizations are undergoing the process of empowerment. There is a third level of NGO, that of the national NGO, which is organized by nationals and competes for funding. Some day, the user group NGOs and the national NGOs may merge but for now the national NGOs have a role to play in taking over from the international NGOs in supporting the user groups when the international NGOs phase out. Most international NGOs plan a phase out on the third year and train national NGO staff as part of their activities (Nepal Resources Management Project nd). National NGOs may emerge from former project staff who want to continue their work and believe they can compete for limited funding. The Jana Jyote Club in Pyuthan was successful in raising monies from the nation-wide Social Welfare Council, a GON organization.

Farmers were trained as paraprofessionals and supported both by communities and line agencies.

The team saw farmers being trained as paraprofessionals to take over many hands-on extension activities. The effort is part of a national trend (Handrill 1989). GON's budget is limited and the government cannot afford to supply technicians to even the majority of communities. The team saw a number of sites (UMN, SCF, and Naranyanpur) where local farmers took over the role of technicians in preventative health for livestock and in crop production.

Program Replicability

The team visited a wide array of sites having different organizational and biophysical conditions. This allowed for stronger generalizations regarding replicability and the

likelihood that the young program will be extrapolated to similar domains.

The team recognized six factors that contribute to the replicability of land productivity conservation programs:

Communities will become more interested in adopting where significant land degradation has already occurred.

Gilmour (1990) found that when the farmers' livelihood was threatened, they united and seriously faced their community problems. Team members saw soil erosion and lower ground water levels were significant in the Siwaliks. The team members heard from farmers in Satbariya that over two meters of top soil had been removed, and villagers said the ground water was declining one foot per year. Except in landslide areas of the Middle Hills and in Mulpani where water sources were diminishing, farmers required greater awareness training than in the Siwaliks to create interest in land productivity conservation activities. In the Middle Hills, the slopes are highly terraced and largely stable except in areas where large landslides had occurred such as Pyuthan. In Bajura, team members were told by CARE project staff of the difficulty in forming user groups to protect watersheds, as the farmers' livelihood had not yet been threatened.

Cross visits are important to areas where land rehabilitation practices have been undertaken and user groups have been formed.

Seeing is believing. Farmers became more interested in land productivity conservation activities after they had seen on-going projects. The team saw great excitement among farm communities in the Siwaliks and heard from those farmers that neighboring VDCs were also greatly interested in adopting the same land rehabilitation programs. In the Middle Hills, where roads were less developed, it was harder for villagers to visit neighboring areas to see an active program.

User group formation for forest protection and afforestation on public lands has stimulated similar interest in tree planting on farmlands.

The change in government policy giving legal status to user groups to protect and manage community forests on public lands has created great enthusiasm among farm communities nationwide for afforestation on private farmlands (USAID 1994). Protection of community holdings has resulted in a shortage of fodder and fuelwood supplies thus forcing farmers to plant on their own land. Community nurseries managed by the farmers supply seedlings for afforestation of both public and private lands. The same organizational framework, the user

group, which is taking off in forestry activities (and irrigation water management in other areas) can and is being adapted to actions related to the establishment of environmentally sustainable agricultural systems.

Programs that provide multi-purpose trees, rather than fuelwood species, will be more successful in agroforestry systems.

If replanting is warranted to stabilize the land, greater success will occur if farmers have the choice of species (Gilmour and Fisher 1992). Pine and eucalyptus grow well in harsh environments but have low utility as fodder or fruit. Farmers will be motivated more if the species are fodder or fruit trees. The team saw evidence that farmers also like to plant a wide array of species rather than one or two as line agencies are prone to prescribe. Farmers are motivated more to replant their own land than public lands as they derive direct benefits.

Replanting schemes benefit from nursery management training and technical support from line agencies.

Community user groups benefit from line agency support in establishing either public or private nurseries. Line agencies often provide start-up funds by buying seedlings from one community nursery for other villages. These needed funds can be used for activities necessary to embark on a rehabilitation program.

Land conservation programs that are supported by motivated line agency staff are more likely to succeed.

The DSCO is essential particularly in the Siwalik region where land rehabilitation efforts will be large. The DSCO has a major role to play in training the farmers on the various conservation methods and providing some funds to carry out these efforts. Successful land conservation programs were evident in Naraynapur, Satbaryia goat raisers, and Mulpani sites that had highly dedicated and motivated DSCOs.

6. LESSONS LEARNED

The following lessons are noteworthy for their broader application to USAID-supported land productivity conservation efforts in Nepal and elsewhere.

Cropland conservation initiatives implemented through local organizations are more efficient and sustainable than centralized top-down approaches.

An important conclusion from the large multi-sectoral projects was that integrating activities across different branches of the government bureaucracy is generally more difficult than can be efficiently handled within a project framework. Even when Rapti focussed its field efforts on two ministries' programs -- agriculture and forestry/soil conservation -- the mandates and interests of respective staffs limited any mutually reinforcing interaction at the field level.

True participation by local communities is imperative to the success of natural resource management programs. Insuring that conservation practices are linked to increased rural incomes raises enthusiasm, likelihood of replicability. In turn, the extent to which the majority of the population supports the program and is accountable for its action is critical to the success and sustainability of the effort. Beneficiaries will sustain a feeling of ownership of both the infrastructure and the introduced technology or institutional change.

NGO projects were successful because they did not start a project or training course until there is a definite commitment from the beneficiaries in terms of their time and inputs. No development assistance need be given free to beneficiaries who could pay, usually through their labor, for infrastructure projects, or through fees for training and or services.

Future resource management programs should encourage NGO involvement with GON technical staff to work with the farmers for best results. Training of GON staff in community development skills and NGO staff in technical skills would be desirable. Project implementation requires close monitoring and enduring support to overcome the cultural biases stemming from ethnic or caste differences. For these reasons, NGO-support to user group formation appears critical to insuring equity and sustainability of local organizations.

Development programs must avoid exceeding organizational and management capacity at the local level.

Donors and the government risk undermining the success of the resource user group model by encouraging a proliferation of village groups and sub-groups which can and in places has thwarted the

newly introduced practices. A wide array of technologies is being simultaneously introduced into farm communities in integrated rural development projects. User groups are being formed and trained in tree nursery and planting methods (for fuelwood and fodder species), horticultural and cereal crop management (for over 20 different crops), livestock management (health care and nutrition), income generating projects (making handicrafts or cloth), soil and water conservation techniques (from check dam construction and landslide rehabilitation), public health and sanitation methods, and non-formal education. Each of these interventions requires user group formation and technical support. The great diversity of interventions is often more than the local capacity, both villagers and NGO partners, can support. Functional group memberships obviously overlap considerably in small rural villages. More selectivity is needed to limit the number of simultaneous interventions that a given project undertakes.

Activities targeting women and disadvantaged groups do have an impact and are sustainable.

Women in Nepal have a predominant role in decisions related to agricultural production and resource utilization. Activities that improve the awareness of women in land productivity conservation and promote women's involvement in community decision making related to resource utilization have immediate and long term impact. Similarly, activities that target low caste groups strengthen the ability of those groups to participate in the wider village community-based and ensure collective and coordinated strategies of sustainable management.

Natural resource conservation , in the long run, requires less effort than the rehabilitation of degraded landscapes.

In many areas government policies have discouraged communities from conserving cropland, forest, and water resources. Ultimately, greater effort will be spent to rehabilitate the resources than would have been to prevent its decline in the first place. There is both a need to reform policies and to promote environmental awareness at all levels. USAID project experience in Nepal has demonstrated that destructive environmental processes can be reversed. New programs should be expanded to areas where resources are threatened but not yet degraded.

Soil and water conservation sites should be targeted to sub-watersheds.

Implementation of projects in large target areas become unwieldy to manage and integration between agencies can become lost. RCUP and Rapti project Phase I were large multisectoral projects which targeted large watersheds. Coordination of efforts over such large areas impeded both projects. Based on the final two years of RCUP, Rapti Phase II broke down its operations into

small sub-watershed units. NGOs likewise target small environmental units which are more desirable though not always more practical target areas than political units. Evidence suggest that the sub-watershed provides a workable unit which often coincides with the natural grouping of the local population.

Farmers are willing to conduct soil and water conservation practices if they can take advantage of the improved agricultural land for embarking on new economic enterprises.

Many Nepalese farmers face a no-win situation. They rely on subsistence crops whose productivity is limited by the quantity of organic fertilizer that can be produced. This fertilizer is, in turn, limited by resources which are becoming scarcer and scarcer, particularly as the farm size steadily decreases with each generation. When farmers see an opportunity to break the subsistence cycle they do so. Natural resource management projects should be prepared to provide more technical/ institutional support to cover this expected development.

Natural resource conservation efforts require a long term commitment in order to achieve lasting results.

Donor agencies should be prepared to devote up to ten years and over to a project. With longer time frames it is desirable at an early stage to build in flexibility by setting up monitoring and evaluation systems to make corrections in the project content and direction if warranted. The Rapti project was able to redesign at midterm and therefore improve its performance. It was in part successful because it covered 10 years and allowed for change in project orientation from top-down to bottom-up. Success in Narayanpur was in part due to an extended project commitment. Farmers began to have genuine interest in land conservation practices only after six years of project involvement.

7. OUTSTANDING ISSUES

The evaluation team identified four issues in natural resource management and sustainable agriculture that arose from the experience in Nepal.

Can community development be driven from the sale of natural resources from public lands?

This issue raises several interrelated questions: is villager interest in user groups sustainable, will management of resources produce substantial revenues, will villagers choose to invest these revenues in ways that improve the productivity of their farmlands. User group formation to protect community resources is greatly expanding. Developing and monitoring use of an improved resource base can only be extrapolated from areas where pressures on the environment have not yet undermined indigenous management practices. These experiences demonstrate communal management of forest resources works in Nepal; other communities have shown that villagers will respond to the opportunities for community based resource management. As the beneficiaries learn to manage their resources for greatest sustained yield, potential funds accruing from the sale of products can be placed in bank accounts already established by the user groups. Such earnings could be used to fund soil and water conservation activities of benefit to the users. There is at least some indication of willingness to use communal funds for social projects. The team observed that community forest, agriculture, and women's user groups levied fees and established bank accounts to deposit their earnings. Some of these initial earnings have gone to support community activities such as support to local schools. With greater levels of income, the users might or might not chose to spend their funds on land productivity conservation activities of benefit to all. The limited income to date from these community activities leaves open the question of how much local development can be sustainable funded from what is essentially local vegetation.

While organic matter from public forests contributes to soil fertility on private farmlands, it is not yet clear what level of fodder and forest litter can be sustainable transferred from forest to fields.

This evaluation judged the direct and indirect transfer of nutrients and organic matter from public lands to croplands to be an essential component of sustainable intensifying crop production in the Middle Hills. The nutrient recycling linkage from livestock to the forest is curtailed by stall feeding and protection of open grazing in the forest. In the long run this net loss to forest systems may reduce the rate of forest biomass production and may be

unsustainable.

Similarly, Malla (1993) predicted forests will become more a source of hardwood (fuelwood and construction) and less one of providing both hardwood and fodder. Whether the natural regenerative properties of the forest soil can sustain the probable shift to fuelwood only remains to be seen. He further predicted greater need for lumber than fuelwood from forests in the future as electrification and alternatives to wood stoves emerge. This may place greater importance on the production of fodder and wood on private croplands either in agroforestry systems or on abandoned terraces.

Food self-sufficiency may not be a realistic goal in some resource-poor farming regions.

The goal of the 7th Five-Year Plan (1985-90) was to make the Hills self-sufficient in food grains (NPC 1986). However, farmers in many of the project areas have gradually begun to replace cultivation of cereals with more commercial crops particularly on rain fed lands in the Middle Hills. Improved infrastructure and GON services have increased the income earning potential of agricultural enterprises for hill farmers. The issue for national planning agencies is to corroborate these findings on a national scale. If this is indeed a national trend, then Nepal will require a larger level of cereal grain production from the Terai.

Decentralization policies and new forms of local administration leave open the question of conflict resolution.

Customary hierarchies and divisions are different from the functionally defined participation within the generally more democratic user group. Over time contradictions and conflict are bound to appear. User groups will need to learn arbitration skills when two user groups claim the same resource or dissension within a user group develops. In Narayanpur user groups in adjacent VDCs claim the same public lands. The issue becomes who has authority to resolve the claims. Fair arbitration will ensure continuation of the farmers' interest in protecting public lands. The UMN site teaches arbitration techniques to user group members. The legitimate role of outside authorities depends on unresolved policy issues of concern at the national level.

APPENDIX A

EVALUATION PROCEDURES

This evaluation is one component of a larger CDIE assessment of environmental programs in the agriculture sector. CDIE's assessments of environmental programs are aimed at answering two central questions: "Has USAID made a difference?" and, if so "How well did it do it?" The central operating hypothesis of the environmental assessments is that USAID,through the right mix of program strategies, can impact on local conditions and practices to produce favorable long-lasting changes in the bio-physical environment and on the socio-economic welfare of cooperating countries. This Appendix describes the process used to test this hypothesis in the context of the sustainable agriculture program in Nepal.

Impact - How much?

The aim of the assessment is to establish plausible linkages between USAID program strategies or activities and their impact on the human population; impact manifested as benefits resulting from improved environmental quality and better natural resource management. In answering the first question, "Did USAID make a difference?", the assessment has attempted to document: What happened or can be expected to happen? How is impact manifested? and, Where is impact is detected?

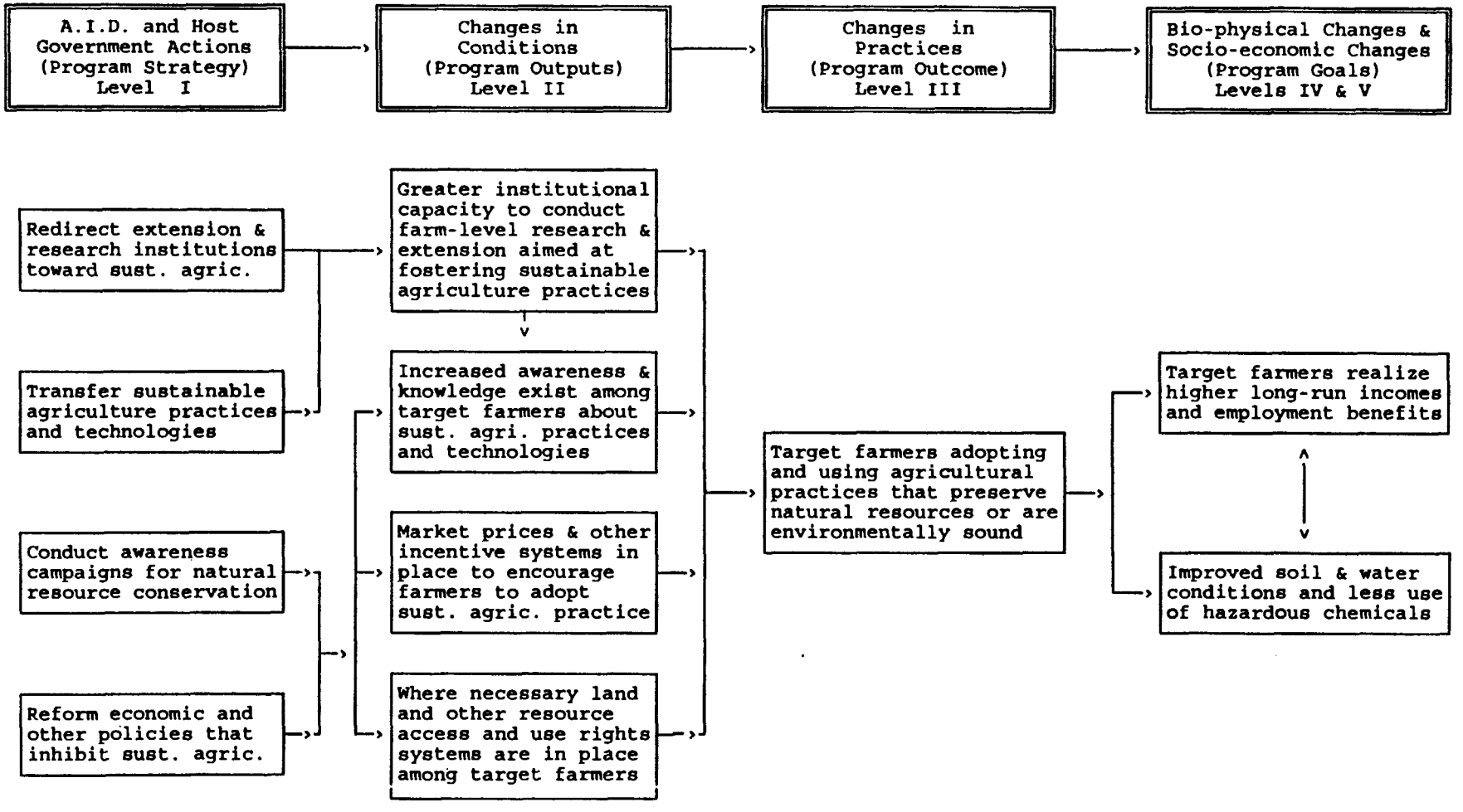
The evaluation has gathered and examined "impact" information to determine whether the strategic development objectives of USAID's ... Unintended, as well as intended, impacts of USAID environment and natural resources management projects and programs were also important as were differential impacts among subgroups -- e.g., women, small farmers or landless cultivators. This evaluation examines the relationships between environmental impact and program investment using a five-level analytical framework (See Figure A-1.)

Working from the bottom of the framework, **Level I** describes the **"program strategies"** that USAID and the Nepal government employed to implement sustainable agriculture programs.

At **Level II**, **"program outputs"** are the conditions that have resulted from these implementing these strategies.

The **Level III "program outcomes"** resulting from changes in Level II conditions are the adoption of practices and technologies by target farmers.

Figure A-1: Conceptual Framework for A.I.D. Sustainable Agriculture Programs



Level IV and V "program goals" constitute the biophysical and socio-economic changes expected to result from the adoption of Level III program outcomes or practices. Level IV and Level V goals can be viewed as mutually supportive; each contributes to the sustainability of the other (and in many respects each flowing from the other.)

For the purposes of the evaluation, **Level IV "bio-physical goals"** are the specific environmental objectives of the program being assessed. Level IV indicators measure environmental conditions and biophysical changes that contribute to producing the strategic objective.

Level V "socio-economic goals" represent the development goals and are generally associated with sustainable increases in income, profits, remunerative employment, overall well-being, or production. While access to income data is difficult, the continued involvement of beneficiaries in the program can be used as a "vote with their feet" proxy indicators of improved farm incomes and profits, at least at the time of the evaluation.

Performance Scales: How well?

In answering the second question, "How well?", CDIE's primary concern is the **efficiency, effectiveness, sustainability** and **replicability** of the Nepal sustainable agriculture program.

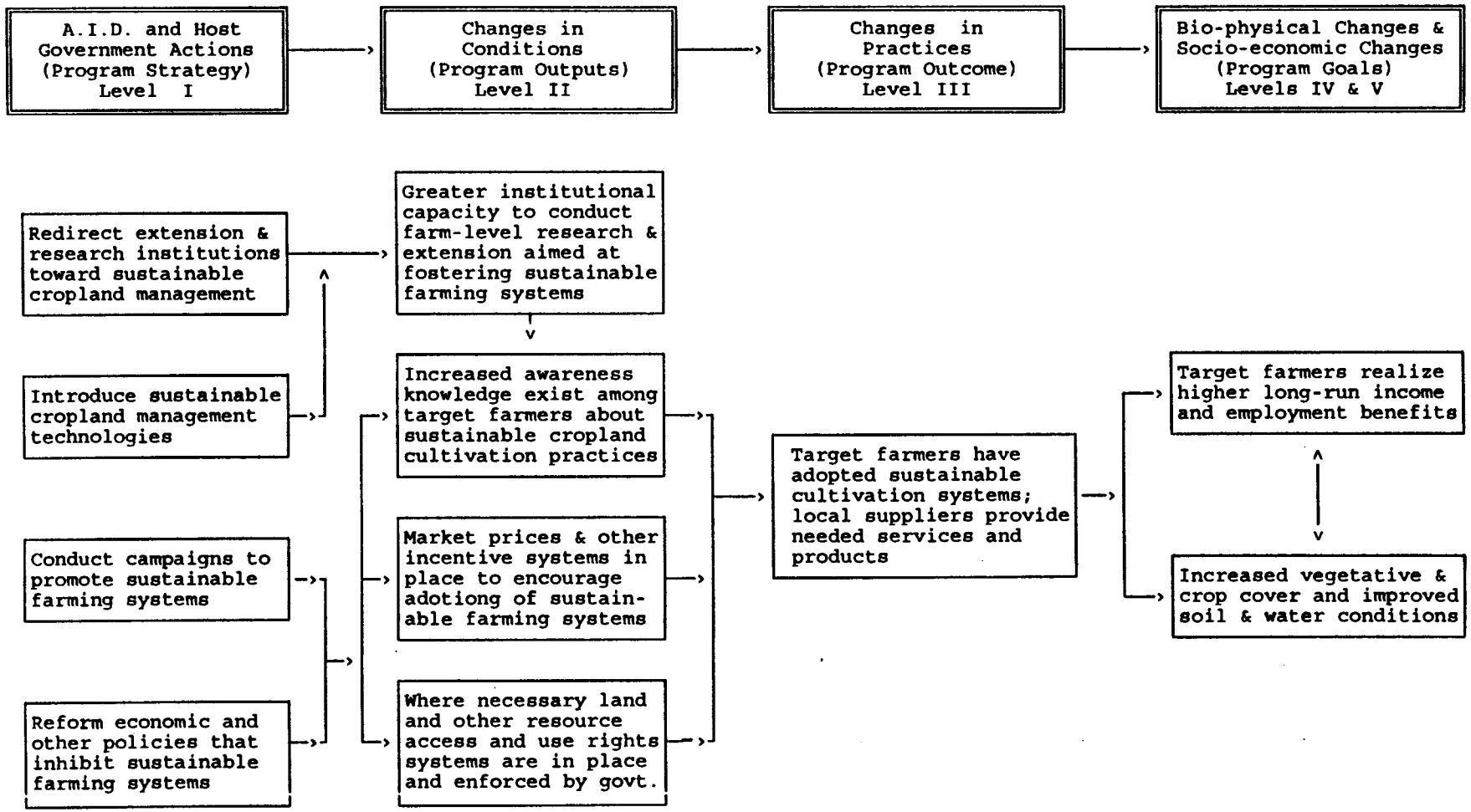
Where data exist, the evaluation measures program **efficiency** by using monetary estimates of the flow of benefits to calculate an economic rate of return for those USAID and host government program investments to which benefits can reasonably be attributed. Because benefits occur in the form of a flow of benefits into the extended future, the value of benefits must be annualized and adjusted to net out all costs incurred. Rate of return estimates can then be compared to those possible from USAID investments in alternative programs in Nepal to assess their relative development impact.

To assess program **effectiveness**, the evaluation examines how well USAID sponsored techniques, services, or products are reaching intended target groups and whether there is equity or bias in access and participation by target groups in program activities. Examples of effectiveness indicators include trends in the per unit costs of delivering services by newly created public agencies; the make-up of target participant groups according to resource endowments -- e.g., small or large farmers --gender or socio-political status.

The examination of **sustainability** is important at all program levels (See Figure A-1). For example, will new (Level II) conditions created with USAID assistance continue or will they be reversed? Will target participants continue to employ newly introduced (Level III) practices? Will new (Level IV) production systems thrive over the long-run? Will increased (Level V)

applied to these discussions to ensure team consensus on key points related to the performance of programs supported by A.I.D. In addition, the team developed a roster of key technical, institutional, social and economic indicators for evaluating program impact at each site. The team members used this roster to strengthen their consensus on the assessment of field site. The consensus building format and the key indicators ranking format are attached in the following pages.

Figure A-2: Conceptual Framework for A.I.D. Cropland Management Programs



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NEPAL FIELD STUDY TEAM CONSENSUS FORM

SUSTAINABLE AGRICULTURE ASSESSMENT FINDINGS

A. Institution building

1. DCSWM - Evidence of an increased ability by DCSWM personnel to implement resource management.
2. User Groups - Evidence of an ability by user groups to implement resource management.
3. NGO's - Evidence of an increased ability by NGO's to assist in the implementation of resource management.

B. Awareness, Education and Advocacy

1. Evidence of educational/awareness programs being carried out in the project areas.
2. Evidence of an increased level of awareness of resource management by villagers.
3. Evidence of villager advocacy for extension of resource management.

C. Impact on Practices - A description of resource management practices.

1. User group organization.
2. Methods of protection.
3. Methods of harvest and product distribution.
4. Description of sanctions.

D. Socio-economic impacts

1. Evidence of increased benefits to the community.
2. Evidence of increased benefits to individual user group members.
3. Evidence of development activity funded through the sale of community forest products.

E. Program effectiveness

1. Evidence of equitability (cast, tribal, proximity) in the management of the forest.
2. Evidence of the addressing of WID concerns in the management of the forest.

E. Program Sustainability

1. Description of the external inputs provided in establishing and managing resources.
2. Description of the external inputs that are perceived to be necessary to future resource management.
3. Team's assessment of the sustainability of the resource management efforts.
4. Continuation of DCSWM inputs.
5. Continuation of NGO inputs.
6. Sustainability of the Users group (economic and institutional).
7. Sustainability of the resource under management.

G. Replicability

1. Evidence of program replication beyond project input sponsored areas.
2. Evidence of increased participation of villages within project sponsored areas.

H. Lessons learned/Outstanding Issues

What is the level of technical support available to the user group (e.g., from Line Departments, form project)?

Economic Indicators

__ Changes in land use/resource use patterns.

Extent to which project inputs have affected existing land use/resource use patterns.

__ Benefits/Costs.

How do the benefits of project/HMG inputs compare to the cost of the project inputs?

__ Cost effectiveness.

Extent to which project/HMG inputs incorporated low cost local resources.

__ Changing employment patterns.

Extent to which local employment opportunities have improved as a result to project/HMG inputs.

__ Improved markets.

Extent to which project/HMG inputs have improved marketing opportunities for beneficiaries.

__ Sustainability.

Extent to which project/HMG benefits are likely to continue when project inputs are completed.

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APPENDIX B

HILL FARMING SYSTEMS IN NEPAL

Country setting

Nepal is a landlocked mountainous country with a population estimated at 18 million. Its divided into five geographic regions: Far Western, Midwestern, Western, Central (with Kathmandu), and Eastern (see Map). Politically it is divided into 12 regions and 75 districts. Political units equivalent to towns are called Village Development Committees (VDCs), formerly these sub-district administrative units were known as *panchayats*. Each VDC is divided into nine wards. VDCs are grouped into larger units called Ilakas.

Since it emerged from relative isolation in 1949, Nepal has embarked on a series of broad-based development programs supported by increasing flows of external assistance. The current operating budget of the GON is 60% donor funded. But, as a recent World Bank report (World Bank 1992) reviewing twenty-five years of natural resource management in Nepal notes: the country's development policies have largely been ineffective; economic growth has declined; and poverty, especially in rural areas, is pervasive. In 1988 Nepal's per capita income was approximately $180, little higher (in real dollar terms) than in 1961. In the World Bank rankings, Nepal is among the poorest of the low-income countries and 76% of the population is illiterate.

Poverty is reflected not only in income, but also in other standard of living and quality of life indicators (Pearce, et al. 1990). The population density of 5.1/ha of arable land is one of the highest in the world, indicating the land is very scarce. Rural population densities reach over 1500m2 of arable land or 15/ha. This density is similar to central Java but 50% higher than Bangladesh (Blaikie and Brookfield 1987). Life expectancy at birth is 47 years, compared to 61 for the average of low-income countries. Daily food consumption is around 2,000 calories per capita, which is 14% below the low-income country average. Energy consumption is among the lowest in the world. About 87% of the country's total energy need is derived from wood (World Bank 1992). Only 23% of the total population has access to piped water.

The economic development that outside donors thought would happen quickly has not (Skerry et al., 1992). Nepal is not blessed with abundant economic resources. There are only limited quantities of minerals, the level of education is low, infrastsurcure is weak, non-trade entreprenurial skills are poorly developed. The former Rana/Panchayat governments were not intereste in market economy led development but rather wherer influenced by Indian socialism precepts of a benevelent government leading the way. The leaders over the past century have been more interested in control than in

increasing economic wealth.

The failure of Nepal's development policies is tied to a number of factors: 1) Nepal remains at an early stage of development, its management and administrative systems are extremely weak; 2) the country's land is unstable, so erosion is severe; 3) the country's geography and lack of infrastructure make transport, communications, and marketing difficult; 4) Nepal's economy is dominated by agriculture, which accounts for 90 percent of employment and 50 percent of gross domestic product (GDP), a condition which places constraints on economic diversification; and 5) population is growing rapidly, by 2.7 percent per annum, and is expected to double in 30 years.

Natural resource management in Nepal has revolved around conserving its land, forest and water resources to maintain their ecological functions while intensifying agriculture and forestry production. The centuries of isolation helped to make the people independent of external influences and more dependent on local resources. Significant losses and damage to forest cover and topsoils underscore the urgency for developing practical resource conservation measures.

People

Nepal is in a transition zone between Hindu ethnic groups from the Indian lowlands and Tibetan groups from China. The Hindu group is divided into castes with Brahamins and Chhetris as the higher castes and occupational low castes of Sarkis, Kawar, and Dami. The Tibetan groups is ethnically of Tibeto-Burman origin. Some of the main ethnic groups are Tamang, Magar, Newars, and Gurung.

Ethnic groups differ in diet, farming practices, methods of cooking, alcohol consumption, and mobility. Hindus are vegetarian with a close association with rice culture. They do not eat cows and do not drink alcohol and cook on a stove. Their agriculture is sedentary. The Tibeto-Burman cultures however can eat cows and drink alcohol and cook on hearths. They are closely associated with livestock and seasonally migrate to better pasture land (transhumance), down slope in the winter and upslope in the summer. Most of the farmers are land owners as opposed to the Terai and Siwalik zones where a large segment of farmers are tenants.

Land forms

Nepal is composed of a succession of mountain ranges running east to west increasing in height from south to north forming five physiographic zones, differing in slope, soil type, and rainfall (Pearce, et al. 1990, Carson 1992) (see Map). Over 86% of Nepal is characterized by steep slopes.

Monsoonal rainfall advances from the SE across India from the Bay of Bengal and deposits most rain at the base of the Himalayas. There is also a declining rainfall gradient between Eastern and FarWestern Nepal.

The relatively flat and tropical Terai is formed from rich alluvial deposits on the Gangetic Plain at the base of the Himalayas along the Indian border and is the grain bowl of Nepal with extensive cultivation of rice in the monsoon season followed by wheat, mustard, and pigeon pea in the dry season. The Terai ranges from 60-300m above sea level and its water table is within a few meters of the soil surface -- ideal for rice culture. The Terai is leveled with bunded ricefields, therefore erosion rates are low. Historically the Terai was covered by a dense forest with abundant wildlife. Malaria was rampant providing a barrier to the British East India Company and others intending to colonize Nepal from the west. The Himalayas provided the barrier on the other sides. Only the Tharu tribe could tolerate malaria in the Terai which until recently was sparsely settled. After malaria was eradicated in the 1950s, the Terai was rapidly settled from the people migrating from the hills clearing large forested areas for agriculture. The majority of the population is Hindu. The lack of mountains in the Terai facilitated road construction so that it is open to markets. The Terai has historically experienced high rates of deforestation, 2.1% per annum.

The Siwaliks are a transition zone of low rolling hills (300-1000m asl) of recent geological origin with highly erodible sandstone and shale soils. This landform is not terraced and its soils are thin thus forcing agriculture to the valley basins. Barley and millet are cultivated in the Siwaliks aside from the crops cultivated in the Terai. Hindu farmers predominate the Siwalik region. The Siwaliks suffer high deforestation rates of 0.8% per annum.

The Middle Hills have soils well suited to terracing and its slopes are extensively built up with loose rock walls to hold the soil. The bedrock is predominantly hard metamorphosed schist. The climate in most of the area permits two croppings per year. Hindu farmers tend to occupy the lower elevations while Tibeto-Burman ethnic groups are more common at higher elevations (Iijima 19).

Three landforms are evident in the Middle Hills which extend to 2,000 m elevation. Farmers have dammed rivers and built canals along the valley slopes to irrigate rice lands on the lower valley slopes called khet lands (Johnson, et al. 1982, Smadja 1992). The tradition of terracing in sloping hillsides has provided protection against soil erosion. Level terraces in Nepal are among the most impressive and intensive in the world. They are monuments to the industry, resourcefulness, and self-reliance of Nepali farmers in steepland areas. Rainfed terraces above the irrigation canals are called bari land where corn and millet are normally grown.

Agricultural land above the rock terraces is also formed into broad outward sloping terraces in the *bari* land are demarcated by contour hedgerows of native vegetation (Zurick 1990). These terraces are not levelled (on purpose) as they are highly fragile and would slip if high rates of rainwater infiltration occurred. Therefore they are highly rilled. In the Middle Hills the proportion of cropland irrigated is moderate to small but there are large areas in bari land. Pressure to develop more land in the Middle Hills for agriculture has forced farmers to cultivate slopes greater than 30 degrees. There are small stands of intact forest and large sections of degraded tropical forest and shrubland. Deforestation rates are low (1-2% per 20 years) but forest stands are thinned. The livestock herds are small with a trend toward reduction in size with cattle, buffaloes, and goats most abundant. Stall feeding is common and grazing is performed near the household with no transhumance. Fertilizer is from organic sources of farm yard manure composted with grass bedding and forest-floor litter.

The two other physiographic regions are the High Hills and Himals which occupy the highest mountain areas and inland valleys toward China. The High Hills have the same characteristics as the Middle Hills except the main crops are barley, millet, corn, potato, and buckwheat. The High Hills are characterized with small summer-irrigated fields in ridge-valley complexes with infertile rainfed fields and sizeable stands of forest. Livestock fertilize the terraces before planting afterwhich they are herded to the forest to graze.

The Himals up to 4200m occupy elevations where yaks are common and livestock herds large; crops are buckwheat and rainfall is low. Farmers take herds of grazing livestock to these upper pastures during the summer months. Crops in the High Hills tend to be grown on the alluvial fans along river valleys. Farm communities are isolated without roads and the nearest markets are reached by walks of 3 to 8 days. Potatoes, barley, and naked barley are the mainstay of production.

Livestock herds are larger in the High Hills and Himals where grazing crop production and forest growth in limited. Forests give way to grasslands at the highest elevations where there is an increasing demand on the forest to meet fodder needs (as rice and wheat straw are limited).

Natural resource management

Erosion rates in the Himalayas are high even under the best management conditions due to the heavy rainfall and naturally steep slopes. In the 1970s to mid 1980s it was believed that Nepal was on the throes of ecological disaster which exacerbated flooding in India and Bangladesh. It was postulated that the high rates of population increase caused extreme deforestation of public lands in a Tragedy of the Commons scenario leading to heavy erosion which

undermined the natural resource base. This in turn led to a downward spiral of increased poverty and starvation (Ives and Messerli 1989).

A World Bank report (World Bank 1977) led people to believe that there would be no more forests in Nepal by 1993. This scenario was termed the Theory of Environmental Degradation. But after in-depth inquiry was made in the 1980s, little evidence has emerged to connect deforestation in Nepal to increased flooding in India and Bangladesh. However, the Theory of Environmental Degradation has prompted intensive inquiry into the status of Nepal's natural resource base. Explanations of the causes and effects of deforestation have varied dramatically. Since 1980, this hypothesis has been increasingly rejected as grossly oversimplified (Hofer 1993). Nepal's land base is indeed fragile but is not self destructing.

Deforestation was formerly believed to be the result of the clearing more agricultural land and need for fuelwood. After greater study (Bajracharya 1983a, 1983b), it was determined that land clearing for agriculture was an important cause but that farmers cut trees more for fodder than for fuelwood. Because they prevent reproduction of trees, fodder lopping and livestock grazing and browsing degrade forests more than fuelwood cutting.

Conversion of forest to agriculture has short term soil fertility benefits in terms of increases in pH and exchangeable bases but in the long run organic carbon, total nitrogen, and exchangeable Mg will decline (Burton, et al. 1989). The Universal Soil Loss Equation relates soil erosion to rainfall intensity, soil type, ground cover, steepness and length of the slope. The steep slopes of the Himalayas reaching over 9000m increase greatly erosion potential. Total rainfall and rainfall intensity are greatest in the Terai and Siwalik zones, decreasing with elevation.

Erosion removes topsoil which contains essential, hard-to-replace soil nutrients (particularly phosphorus) and organic matter which buffer acidic soils. Erosion is accelerated by hard rain drops which loosen the soil and by low soil infiltration rates. Rainfall intensity can be ameliorated by vegetation covering the soil surface. Surface runoff can be minimized by ground litter, dense root mass, and infiltration from soils high in organic matter. Soils with low infiltration rates have less water retention leading to crop water stress. On steep slopes, however, high infiltration rates can result in landslides.

Nepal farmers manage their land to achieve a balance between crop productivity and soil/water conservation. They are knowledgeable about the consequences of their actions regarding natural resource management and have a great deal of experience in understanding the causes of erosion, both natural and man-made (Zurick 1990). Also, the teachings of Hinduism and Buddhism mandate

respect for nature. Middle Hills farmers know that building up terraces can prevent slippage of steep land but are helpless to stop landslides which they often attribute to supernatural causes (Carter 1992). Food is a chronic problem particularly in the Hills and farmers have had to capitalize on any available opportunity to increase food supply, even at the cost of deforestation (Bajaracharya 1983b).

Farmland continues to decline in size with each generation as inheritance law in Nepal dictate that the estate will be divided equally among all male heirs (Karki 1988). But the lack of arable land has forced farmers to cultivate marginal lands which ecologically should be forested or left as permanent grasslands. The factors in natural ecosystems which minimize erosion include 1) vegetative cover to stop the force of raindrop splashing, 2) vegetative litter to slow surface runoff, 3) root mass to hold soil in place, and 4) high soil organic content to increase infiltration rates to slow surface water flow, except in landslide prone soils.

Deforestation has a negative effect on all four soil erosion factors and sets up a cycle of ever increasing land degradation. Loss of trees removes a vegetative barrier to raindrops and reduces litter and rootmass to increase surface runoff. The loss of forest vegetation also decreases the soil organic matter. In addition, loss of vegetative cover causes the soil temperature to rise leading to oxidation of soil organic matter. Grasses typically replace forests and become grazing areas for livestock. The weight of trampling livestock on the soil further hardens reducing water infiltration and increasing runoff rates. Compaction values which are doubled or tripled as a result of forest utilization.

Fleming (1978) estimated landslide occurrences for various levels of ground cover removal. If ground cover were removed 20%, landslide occurrence would increase five-fold over natural rates. Soil erosion rates have been estimated for various landforms in Nepal and range from 5-10t/ha per annum in forested lands (the rate increases if the forests are grazed by animals) (Fleming 1978). These rates can be contrasted by those in the US where the Soil Conservation Service has set tolerable levels to 2-11t/ha/yr, where a natural forest in the East erodes at 0.1-0.2t/ha/yr. Maximum limits of acceptable soil loss in Nepal have been set at 10-20t/ha/yr. Soil losses (t/ha/yr) have been estimated for a number of landforms in Nepal: Terai ricefields 5-15, well managed rock terraced land 10, poorly managed rock terraces 20-100, degraded land 10-200, grazing land 35.

The development of a well-vegetated and protected soil surface is likely to decrease the incidence of overland flow from short-distance, high-intensity rainfall events, which occur several time each monsoon season in the Middle Hills (Gilmour, et al. 1987). While this is likely to have little impact on downstream flooding, it does have an important local effect in reducing

surface soil erosion (but not mass soil movement from slippage leading to landslides). This reduction in soil erosion, with the obvious consequences for maintenance and improvement of site productivity is prrobably one of the major site benefits to accure from improved protection associated with afforestation.

Farming Systems

Nepal, having one of the densest ratios of human population to arable land, has evolved highly complex farming systems with biomass and nutrient cycling linkages between forest, livestock, and crop subsystems (Figure 1). Without the continued flow of energy and nutrients from the forests and grasslands the agricultural base whould soon degrade and the system collapse.(Moench and Bandyopadhyay 1985). In much of the densely populated regions the usage of forest products exceeds the ability of the forests ato provide the products on a sustainable basis. This has given rise to a situation where the denstiy and quality of forests has steadily declining (Gilmour et al 1987). The far majority of farmers do not use chemical fertilizers and dependency on external input supplies is almost non-existent. Because of the closed system, created by centuries of isolation and inaccessibility, there are strong linkages among the three components of the farming system.

Dissection of the mountains by rivers has created numerous micro-niches in the landscape to which the farmers match crops. Rice can be double cropped to 1000m and will grow only until 2000m. Maize can be cultivated to 2500m. Forest trees can grow to 4000m and grazing extends to 5000m. North-facing slopes are more moist and cool in contrast to south-facing slopes which receive greater radiation inputs and have a longer growing season. East facing slopes, during the monsoon, have greatest exposure to the sun. North facing slopes particularly at higher elevations may not even be cropped and are left as forest because the growing conditions for crops are so poor. The large local variation in growing conditions means that the strong agronomic treatment by site interaction leads to difficulty in extrapolating recommendations in extension programs (Whiteman 1985).

Livestock

Nepalese farmers manage one of the largest densities of livestock in the world. Livestock are preferred under small farm conditions and in environments where crop production is difficult. Livestock provide meat, milk, manure, skins, and draft, threshing, and transport power. Livestock is raised primarily for manure. Male buffaloes and goats are sold for cash. In areas with trails only, goats and sheep are animals of burden. Rice and wheat are threshed by trampling hoofs of buffaloes and cows. In 1986 there were 0.5 head of livestock per capita composed of 6.4M cattle, 4.9M goats, 2.8M buffalo, and 0.8M sheep. The current growth rate of livestock

(3.2%) exceeds that of people (2.7%). Livestock allow greater food production on limited land as the herds can be fed from fodder produced on marginal lands and public forest. Livestock are estimated to consume 3.6-4.3 t/yr freshweight per head (Mahat, et al. 1987). Livestock are also the savings bank of the farmer who can sell livestock when crops fail. Animals, however, require much time to tend and fetch feed at a high social cost. Children typically tend livestock and, as this is a full time job, are denied education opportunity. Women gather fodder for the livestock, and feed and care for them while penned in the homestead. In the Hills the current stocking rate is estimated to be nine times the carrying capacity of the forest, but livestock raising is very profitable (Shrestha and Evans 1984).

Penning at night is a means of security but more importantly is a way of collecting the farm yard manure, an essential ingredient of organic fertilizer for croplands. Farm yard manure is extended by mixing it with bedding material, crop residues, and compost made from forest leaves either dry or green. Bedding is made from grasses or dry forest leaves. Crop productivity would decline rapidly without the 50 basketloads of organic matter/ropani that are carried to the agricultural land, mostly by women, for each crop (10-20t/ha). Crop residues are not burned as they are in many Asian countries but are recycled either as animal feed or fertilizer. Organic fertilizer has advantages over purchased inorganic sources in that it is readily available and no cash is required. The organic matter buffers acid soils, makes soils friable to increase aeration and infiltration, and increases water retention. Farmers have learned, however, to add a small quantity of urea to the compost which aides microbes in breaking down the plant material. The compost material in turn absorbs the urea preventing its being leached. Organic fertilizer is given first priority to seedbeds and cash crops, then khet, and finally to rainfed land.

Wandering livestock deposit manure in the forest or fallow farmland but they exacerbate erosion by compacting the soil while walking, eating protective vegetation to prevent natural forest regeneration, and destroying bunds and terrace structures while clamoring for food. Stall feeding of livestock offers greater benefit in soil and water conservation. As more forests are being protected through community forestry efforts, farmers will increasingly plant fodder trees on their land as well as pen their animals in stalls and feed them by cut and carry. Socially this frees time of the children who then can attend school, but increases the workload of women who care for the animals in the stalls, fetch the fodder and bedding, and haul the fertilizer to the fragmented fields. Goats and buffaloes are more favored than cows and sheep under stall conditions. In fact improved breeds of both are available which thrive under stall feeding whereas the local breeds fair better in open grazing. Cows are kept as draft animals and for farm yard manure, but otherwise they have no value

as religious reasons prevent them from sale as meat. Stall feeding increases the chance of diseases which in turn requires preventative health care. There are few livestock technicians or veterinarians to serve the public, so these services are generally lacking. One study showed 250 livestock per veterinarian in Nepal compared to 3-4 in developed countries and 20-40 in Ethiopia, India, and Kenya (Handrill 1989).

Forests

Forests cover 38% of Nepal. The forest land deceased 24% in the Terai from 1964-78. In recent years Landsat photos showed Nepal's forests in the Middle Hills have not decreased in area more than 1-2%, but the forests have been greatly thinned. Despite the direct commercial value of forests, their greatest value is as providers of essential inputs into the farming system, particularly in the Hills. The traqditional attitude of the people towards the foest is that it is common free property.

The forest provides the mineral nutrients and energy which are essential for the survival of the farming system. The product that first becomes limiting in most areas is leaf litter from forests. Edible tree leaves make up a high proportion of fodder fed to animals, particularly during the winter months when ground forage is in short supply. Rice and wheat straw alone give less crude protein (<6-8%) than is required for animal maintenance. Tree fodder produces over 13% crude protein. Forest leaves are also raked up and used in compost pits. About half of the raked leaves go for compost and the balance for bedding. Timber is used for house construction and manufacturing farm implements. Firewood remains the major form of energy for cooking and heating.

Estimates made of the amount of productive, unmanaged forest required to sustain the subsistence farming needs of 1 ha of agricultural land vary from 1.3 to 2.8ha (Gilmour and Fisher 1992). Even in heavily populated districts, the ratio of forest to agricultural land does not, at first glance, seem to be limiting. In populated areas the forest:cultivated land ratio varies between 2.0 to 2.9. These ratios are not particularly low when expressed on a district basis. But much of the forest is concentrated in large contiguous areas some distance from the main pockets of cultivation and settlement. These pockets are virtually inaccessible except to those farmers within about a four hour walk of the forest. By contrast most of the shrubland is located close to the heavily populated areas and is the result of heavy utilization of previous standing forests.

The use of leaf material greatly exceeds the use of woody material. One estimate (Gilmour and Fisher 1992) is that total fodder usage is 3 t/person/yr, which is 7.5 times greater than fuel biomass use. From 200 to 700 kg of fuelwood are used per person each year. From 15-25t/yr of fodder are needed, and 5-11t/yr

come from the forest while 4-20t/yr come from trees planted on farmlands. The sustainability of the hill farming system places a heavy demand on the forests, and most farmers complain of difficulty in meeting their needs of fuelwood, fodder, and animal bedding material. More and more farmers are planting multi-purpose trees on their own land at the expense of cropland showing that fodder and firewood availability are genuine problems in daily life. Over 100 species of fodder-producing trees have been documented in Nepal. Farmers plant a number of multi-purpose trees to obtain a mixture of fodder types for better animal nutrition (as each tree species has different nutrient contents), ensuring a constant supply (as trees differ harvest periods per year), species of livestock (different livestock species perform better with certain fodder types), and whether livestock is lactating or pregnant (Carter 1992).

Fodders are classed as "cold/wet" or "warm/dry", and the consistency of the manure generally determines which class to feed. Each tree species has different requirements and attributes. Trees not only differ in nutrition but also best age of leaf and season for harvest, lopping tolerances, and methods to attain a desired shape (tall in forest and broad on farmland). Forests can be managed for different purposes. For example, pruning to a height of 1.3m can mean an 82% increase in grass and herbs for fodder. But extensive lopping increases grass in a forest, but causes the soil to dry up and soil harden that ultimately affects the health of the tree. Irregular spacing of replanting will give a maximum mixture of species. Regrowth after coppicing is best if the coppice is thinned to a single shoot (a method called singling). The GON, in its traditional role as law enforcers, inhibits management.

As the forests come under more protection, farmers will plant trees on their own farmland. In the Middle Hills, terrace risers would seem to be a place to plant them, however, the decision to do so can be complex. On khet lands, risers tend to be barren as rice is highly intolerant of shade. In addition, the risers are scraped before planting each year to obtain organic matter from weeds as well as to expose rodent burrows. Planting a riser also will attract wandering livestock which may destroy the rice. But crops such as millet, corn, and pulses are more shade tolerant. Season of planting, aspect, farm size, availability of farm yard manure, and soil fertility are some considerations of planting trees on risers or terraces. There is a tradeoff between shade and fodder yield assuming that other fodder sources are far from the farm. If fodder trees are grown on the riser, their leaves will ultimately be fed to livestock to produce more farm yard manure which can more than compensate for the yield reduction due to shade.

Crop Agriculture

Agriculture is dominated by subsistence cereal crops. Fruit trees and vegetables generally are not part of the common diet, nor

are they considered as cash crops. They are considered as luxuries that are often given as offerings to Hindu or Buddhist gods. Farmers are under social pressure to give fruits and vegetables to anyone who asks and must accept heavy theft from the field.

Most of the agriculture is rainfed as only 15% of arable land is irrigible, and of that about 64% has already been developed (Pearce, et al. 1990). The farmers have responded to the highly complex physical environment by having highly fragmented land holdings. Khet is prime land, cleared of all trees and grass to promote maximum production.

Crop yields have stagnated in Nepal and most of the yield increases have been due to expanding agricultural areas through deforestation. For example the 9.5% increase in food grain production from 1970-75 was due mainly (8.8% increase) to expanded area under cultivation (Bajracharya 1983a).

Farming has remained sustainable over thousands of years because the source of fertility is from organic sources. But agricultural production have bas been stagnant principally because of limitations to increasing soil fertility levels which in most societies undergoing similar changes fill with chemical fertilizer. Therefore yields have been sustainable for a lower population than is now apparent in Nepal. Most nutrients applied to the soil consist of compost and manure. Nutrient application per hectare is about 35 kilograms is very low. The same figures are 51kg in Bangladesh and 71kg in Sri Lanka.

Adoption of new high yielding varieties of wheat and rice is limited because they are semi-dwarf types with a low ratio of straw to grain. Farmers prefer traditional tall plant types as they want the straw after harvest, but breeders in looking for high yielding plant types and release almost no tall varieties. It is also doubtful that these varieties would yield well as farmers cannot afford to raise the amount of fertilizer per hectare from organic sources or purchase inorganic sources. Currently there is a trend toward inorganic fertizer as markets for cash crops are increasing.

Nepal's current constraints in entering a market oriented agricultural economy are: 1) lack of improved access (roads), 2) limited internal market, 3) lack of a strong institutional capability to support such an investment strategy, and 4) lack of adequate investment resources.

APPENDIX C

TABLE 1 CHARACTERISTICS OF THE NINE SITES VISITED

Character	1 grass seed	2 goat raisers	3 taungya	4 water tank	5 Pyuthan	6 women's forest	7 SCF	8 UMN	9 CARE
SITE DESCRIPTION									
1. Ecological zone	Siwalik	Siwalik	Siwalik	Middle Hills	Middle Hills	Middle Hills	Middle Hills	Middle Hills	Middle-High Hills
2. Slope	Slight	Slight	Flat	Steep	Steep	Steep	Steep	Steep	Steep
3. Vegetative cover	Scattered forest	Scattered forest	High	High	High	Moderate	Scattered forest	Scattered forest	Sparce forest
4. Community forest	19 ha			250 ha protected for 16 years	350 ha protected for 61 years	35ha, 7.5 planted, handed over 1992	13ha, 110 households, handed over		None
5. Ethnic makeup	Brahmin, Chhetri	Tharu, low caste Hindu	Tharu, low caste Hindu	Matwali, Vishwakarma	Chhetri, Magar	Kawar, Chhetri	Chhetri, Sarki	Brahmin, Chhetri	Chhetri
PROBLEMS									
1. Soil erosion	High	High	High	Moderate	High	Low	Low	Moderate	Moderate
2. Soil fertility degradaation	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
3. Water scarcity	High	Moderate	Moderate	High	Low	High	Low		Moderate
4. Food deficit/outmigration	Moderate	Moderate	High	Moderate	Low	Moderate	Moderate	Low	High
5. Declining yields	High	High	High	Moderate	Low	Moderate	Moderate	Moderate	Moderate
6. Fodder scarcity	High	High	High	Low	Low	High	High	High	High
7. Fuelwood scarcity	High	High	High	Low	Low	Low	Low	Low	Low
FARMER PERCEPTION/WILL									
1. Institutional support	Moderate (DSCO)	Moderate (DFO)	High (DFO<CDB)	Moderate (DSCO, SFDC)	High (LDO,DFO,PCRW,UNDP)	High (FR,WDO)	High (DFO,DADO,WDO)	High (UMN)	Moderate (CARE)
2. Formation of user group	High	High	None	High	High	High	High	High	Moderate

Character	1 grass seed	2 goat raisers	3 taungya	4 water tank	5 Pyuthan	6 women's forest	7 SCF	8 UMN	9 CARE
3. Education/awareness	Moderate	Moderate	Low	High	High	Moderate	High	High	Moderate
CONSERVATION TECHNOLOGIES									
1. Afforestation/protection	High	High	High	High	High	High	High	High	Low
2. Fodder planting	High	High	Moderate	High	High	High	High	High	Low
3. Stall feeding	High	Moderate	N/A	Moderate	Moderate	Moderate	Moderate	High	Low
4. Water conservation	High	Moderate	High	High	High	Moderate	Moderate	High	High
5. Soil conservation	High	Moderate	Moderate	High	High	High	High	High	Moderate
IMPLEMENTATION OF CONSERVATION TECHNOLOGIES									
1. Motivated technical staff	High	High	Low	High	High	Moderate	High	High	High
2. Planating material availability	High	High	Low	High	High	High	High	High	High
3. User group effectiveness/equitabilit y	High	High	N/A	High	High	High	Moderate	High	High
4. User group funding	High	High	N/A	Low	High	High	High	High	Moderate
5. Rights to resources	High	High	Low	Low	High	High	Moderate	High	Moderate
6. Adoption of practives	High								
7. Area covered	35ha								
AGRO-ECONOMIC ENTERPRISES									
1. Cash enterprise development	High (fodder seed)	Moderate (goats)	High (cotton)	High (vegetables)	High (livestock)	High (citrus, milk)	High (fruit,vegetables)	High (vegetables)	Moderate (vegetables)
2. Technology backstopping	Low	Low	Low	Moderate	High	Low	High	High	Moderate
3. Credit sources	Low	Low	High	High	High	Low	Moderate	High	Low
4. Market development	High	High	High	Moderate	High	High	High	High	Moderate

Character	1 grass seed	2 goat raisers	3 taungya	4 water tank	5 Pyuthan	6 women's forest	7 SCF	8 UMN	9 CARE
BENEFITS									
1. Economic	High	Moderate	High	High	High	High	High	High	Moderate
2. Social	Moderate	Low	High	Low	Low	Moderate	Moderate	High	Low
SUSTAINABILITY/REPLICABILITY									
1. Sustaina ble	High	High	Low	High	High	High	High	High	Moderate
2. Replicable	High	N/A	Low	High	High	High	High	High	Moderate
PROGRAM EFFECTIVENESS									
1. Effectiveness	High		Low	Good	High	High	High	High	Moderate

APPENDIX D

PERSONS TRAINED BY RCUP

The most significant and lasting impact of RCUP Project has been through the training of manpower pertinent to agriculture, soil conservation and forest management. Many of them are working in various capacity within the govt. agencies and outside.

Estimated Distribution of Long and Short-Term Participants Training by HMG Line Agencies

Agency	Time and Place	Project Years					
		Yr.1	Yr.2	Yr.3	Yr.4	Yr.5	Total
Institute of Renewable Natural Resources	Long Term (US)	6	2	3	2	3	16
	Long Term (India)	0	5	5	0	0	10
	Short Term (US)	2	4	4	4	4	18
Department of Soil and Water Conservation	Long Term (US)	2	3	3	3	3	14
	Long Term (India)	4	14	6	4	0	28
	Short Term (US)	3	4	4	4	4	19
Department of Forest	Long Term (US)	0	2	3	2	2	9
	Long Term (India)	4	4	4	4	0	16
	Short Term (US)	0	1	2	2	2	7
Department of Agriculture	Long Term (US)	0	2	2	2	2	8
	Long Term (India)	7	7	5	5	5	29
	Short Term (US)	0	3	3	2	0	8
Department of Local Development	Long Term (US)	0	1	1	2	2	6
	Long Term (India)	3	1	2	2	2	10
	Short Term (US)	1	1	1	1	1	5
Department of Livestock Dev. & Animal Health	Long Term (US)	1	2	2	2	2	9
	Long Term (India)	0	2	4	1	0	7
	Short Term (US)	0	2	2	2	2	8
Dept.of Irrigation, Hydrology & Meteorology	Long Term (US)	0	1	1	1	1	4
	Long Term (India)	3	3	1	1	1	9
	Short Term (US)	0	1	1	1	1	4
Dept. of Water Supply and Sewerage	Long Term (US)	0	1	0	0	0	1
	Long Term (India)	2	3	1	1	1	8
	Short Term (US)	1	1	1	1	1	5
Ministry of Forest Training	Long Term (US)	0	1	0	0	0	1
	Long Term (India)	0	0	0	0	0	0
	Short Term (US)	2	2	2	2	2	10
Other Agencies	Long Term (US)	0	1	0	0	0	1
	Long Term (India)	0	0	0	0	0	0
	Short Term (US)	2	2	2	2	2	10
Total	Long Term (US)	10	15	15	15	15	70
	Long Term (India)	23	39	28	18	9	117
	Short Term (US)	10	21	22	21	19	93

The following list, by no means exhaustive, illustrates the contribution being made in different sectors by persons trained under RCUP.

No.	Name	Current Institution/Position
1.	Mohan Wagley	Chief Planning Division, Department of Soil Conservation.
2.	Lal Chandra Pradhan	Senior Officer, DSCO.
3.	Ganapti Ojha	Senior trainer, Cooperative Training Center, KTM.
4.	Purna Man Shakya	Agricultural Training Centre, Bhairahawa.
5.	Damodar Neupane	Small Animal Promotion centre (PVO), Makwanpur.
6.	Jeet Bahadur Gurung	Agriculture Department.
7.	Monohar Shrestha	Dept. of Community Forestry.
8.	Karma B. Vohara	Agricultural Research Centre, Lumle.
9.	Sudip Bhattarai	Regional Office of National Planning Commission, Dhankuta.
10.	Purusottam Mainali	Ministry of Local Development, KTM.
11.	Ram Babu Paneru	Pakhribas Research Centre, Dhankuta.
12.	Juddha P. Bajracharya	Ratna Feed Industry (Pvt.) Ltd.,KTM
13.	Devi Prasad Poudel	Daroundi Watershed Management Area, Gorkha.
14.	Rajendra Lamichhane	Department of Soil Conservation, KTM.

A group of 18 persons were sent for higher eduction who served after the return at the Institute of Forest (IOF) campuses at Pokhara and Hetauda.

APPENDIX E

PLANT SPECIES

Common name/s	Scientific name
Stylo	Stylosanthes guianesis
Molasses	Melinisis minutiflora
Napier	Pennisetum purpureum
Setaria	Setaria anceps
Chiuri	Bassia butyracea
Sissoo	Dalbergia sissoo
Bakaino	Melia azedarach
Catechu/khayar	Acacia catechu
Masala/eucalyptus	Eucalyptus
Ipil-ipil	Leucaena leucocephala
Dina nath	
Sal	Shorea robusta
Khar	Andropogon pumilus
Asuro	
Badio	
Ritha	
Tanki	
Kutmero	
Thuti	
Champ	
Larkuri	
Bakaino	
Paspati	
Lopsi	
Vemal	
Bohemia	
Bima	
Quercus native oak	
Ficus	
Chilauni	
Banjh	
Utis repalensis	

APPENDIX F

PERSONS CONTACTED

Government of Nepal

Ministry of Forests and Soil Conservation

Dipenda Purush Dhakal, Acting Secretary, Babar Mahal
Amrit Joshi, Department of Soil and Water Conservation
Mohn Wagley, Chief Planning Div, Department of Soil and Water Conservation
Damodar Parajuli, Director General, Department of Forests Tirtha Maskey, Director General, Department of National Parks/Wildlife

Ministry of Agriculture

Bindeshwori P. Sinha, Secretary
Jagadish P. Gautam, Director General, Department of Agriculture

National Planning Commission

Ram Yadav, Member

Nepal Agricultural Research Council (NARC)

Bishnu Gyawali, Rice-Wheat Project

USAID/Nepal

Jim Gingerich, USAID/Nepal
Batuk Upadhya, USAID/Nepal
Fred Pollock, USAID/Nepal
N. Regmi, USAID/Nepal
John Mitchell, AETP (Chemonics)

Miscellaneous Individuals/Kathmandu

Badri Nath Kayastha, Executive Director, No-Frills Consultants, PO Box 3445 (PI)
Gerald Gill, Economist, Winrock International, APROSC
Jessie Dubin, Plant Pathologist, CIMMYT

Project Sites/Outside Kathmandu

Rapti Project

Rapti Project Staff:
Ram Dayal Prasad Yadav, District Soil Conservation Officer, Dang (GON)

Mahup Dungana, Chief Devres/New Era
Khrishna Bahadur, Planning Economist, New Era
Somnath Acharjya, District Soil Conservation Officer, Dang (GON)
Salik Ram Chaudhary, District Forest Officer, Dang (GON)
Dr. Chaudhary, Senior Adviser for Agriculture, Dang (GON)
Mohamad Naseer Ansari, Ranger, Dang
Amik Regmi, District Forest Officer, Salyan (GON)
Mr. Mandal, District Soil Conservation Officer, Salyan (GON)
M. Mohammad, District Agricultural Development Officer, Salyan (GON)

Rapti Project Beneficiaries:
Num Kant Dahal, Chairman, Water Users Group, Narayanpur
Harsaram Rant, Assistant Chairman, Water Users Group, Narayanpur
Meth Lal Ghimeri, Treasurer, Water Users Group, Narayanpur
Dumbar Sharma, Adviser Water Users Group, Narayanpur
Birbahado Basnet, Member Water Users Group, Narayanpur
Mekhlal, Previous Vice Chairman, Water Users Group, Narayanpur
B. Sharma, Chairman, Youth Group, Narayanpur
Shaligram Chaudhary, Farmer, Agroforestry, Satbariya
Khem Nath Yogi, Adviser, Shiva Shkakti Goat Raising Group, Satbariya
M.K. Pal Yogi, Chairman, Shiva Shkakti Goat Raising Group, Satbariya
Shyam Budathoki, Women's committee, Mulpani, Salyan
Hari Prasad, Women's committee, Mulpani, Salyan
Maya Kham, Women's committee, Mulpani, Salyan
Goma Vishwakarma, Women's committee, Mulpani, Salyan
S. Salim, District Chairman Congress Party, Salyan

Pyuthan: see forestry report

RCUP/Save the Children Federation (SCF), Gorkha

SCF Project Staff:
Project Manager
Agriculturalist
Program Officer

SCF Project Beneficiaries:
Mrs. Chini Maya, Chairperson, Women's Group
Mrs. Kanilu, Community Nursery Caretaker,
Mrs. Ram Naye, Member Women's Group
Mrs. Suntali, Member Women's Group
Mrs. San, Member Women's Group

United Missions Nepal (UMN) - Nepal Resource Management Project (NMNP), Naubise, Dhading

UMN Project Staff:
Duman S. Thapa, Project Manager, Kathmandu
Mikka ?, Development Officer, Naubise

Shalik Ram Neupane, Forestry Officer, Naubise
Bishnu Tripathi, Agriculturalist, Naubise

UMN Project Beneficiaries:
Dharma Kunwar Luintel, Chairman, Forest User Group,
Narayan Rupakheti, Treasurer, Forest User Group
Mrs. Kuma Rupakheti, Womens Committee

CARE Remote Areas Basic Needs Project, Bajura

CARE Project Staff:
Arun Kumal Shrivastava, Development Assistant, Bajura
H. Luintel, Agriculturalist, Bajura
B.L. Tamang, Logistics, Bajura
Usha Rai, Communitiy Health Worker, Bajura
Tilu Giri, Agroforestry, Bajura
Susum Shahi, Community Health Worker, Bajura
M. Thalkali, Community Health Worker, Bajura
Nirmal Gyawali, Office Assistant, Bajura
Sashindra Yadav, Ranger, Bajura (GON)
Maniram Banjare, Ranger, Bajura (GON)

CARE Project Beneficiaries:
Nanda Lal Regmi, Chairman Community Development Committee, Daiya, Bajura
Purna Bista, Leader Farmer, Agricultural User Group, Kotila, Bajura
Dhana Lal Bohva, Drinking Water User Group, Kotila, Bajura
Gori Sarki, Kitchen Garden User Group, Jagannath, Bajura
Lila Sarki, Womens Savings User Group, Jagannath, Bajura
Pareu Bista, member Apple Growers User Group, Jagannath, Bajura
Deva Thapa, member Apple Growers User Group, Jagannath, Bajura