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AGENCY FOR INTERNATIONAL DEVELOPMENT

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VOLUME II (F)

RESOURCE CONSERVATION AND UTILIZATION
PROJECT
PROJECT NUMBER 367-0132

APPENDIX L

ECONOMIC ANALYSIS

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L. ECONOMIC ANALYSIS

1. Introduction

As stated in sections of the Project Paper and throughout the Appendices, the RCUP represents an attempt to bring about the dynamic balance between input supplies and output demands with respect to residents of selected hill areas in Nepal. Currently that balance does not exist. Output demands far exceed the "carrying capacity" of the land, forests, water supplies and other available resources. The activities being proposed in the Project Paper comprise the best judgement of the Design Team regarding how to increase input supplies or to decrease output demands in an economically and technically efficient manner, thereby moving towards attainment of the desired balance.

The main purpose of this Appendix of the Project Paper is to estimate the net economic benefits anticipated from the proposed collection of activities. Before proceeding with such estimates, an overall analytical framework will be presented to identify the interrelationships between the different activities recommended for RCUP in the various Appendices. It will also describe the overall production-consumption system which RCUP is attempting to influence. Following the analytical framework will be Section 3, the summary of net economic benefits for each of the major RCUP interventions being proposed. The tables at the end of this section contain the details of estimated costs of inputs and benefits from outputs for each major project activity.

2. Analytical Framework

The RCUP includes two major categories of activities. One category concerns site specific aspects of the project: the particular interventions implemented at Kulekhani, Gorka and Mustang/Myagdi. These activities are described in separate Appendices, which include estimates of their financial costs. The other category concerns institutional development aspects of the project: the planning, supervision, and monitoring done by RCUP central staff; participant training outside Nepal; diploma/certificate training at the Institute of Renewable Natural Resources; and in-service training in the Training Wing of the Ministry of Forests. A detailed description of these institutional development activities is provided in the "Training Support", Appendix along with their estimated financial costs.

This Section 2 will present the conceptual bases for estimating the economic benefits which might be claimed to be generated by each major category of RCUP activities. It will also present the conceptual bases for eliminating any significant distortions which are believed to exist in the market prices of inputs or outputs. The application of these conceptual bases to the calculations of net economic benefits will be presented in Section 3.

(a) Site Specific Aspects:

The site specific aspects of RCUP are concerned with a wide spectrum of soil, water, and forest conservation and utilization activities. These will be applied within the context of the agricultural-ecological system which is prevalent in the Nepalese hills. It will be instructive to understand how that system operates before attempting to indicate how benefits from RCUP activities will be estimated.

Presented as Figure 1 on the next page is a diagram which shows (in simplified form) the major flows of inputs and outputs with respect to household supply and demand functions in the agricultural-ecological system which is found in the Nepalese hill country. The diagram shows Population as creating demands for Household Food, Drinking Water, Household Energy, Household Materials and Imported Goods and Services. Population also provides Labor Supply to work with three broad categories of assets - Land/Forest, Water, and Livestock - to produce enough to satisfy household demands. Since imports/exports are negligible, it is essentially a self-contained system with respect to each household except that, when households cluster into a village (as most do) there are certain commonly owned and used facilities (pastures, sometimes a school, trails, water-supplies).

Imported Goods and Services and Exported Food Output represent, typically, very overall proportions of total consumption and production. It is basically a subsistence economy with negligible impacts to the market economy outside the immediate environment. This fact complicates the task of RCUP in creating incentives for village households to modify their behavior with respect to soil, water, and forest conservation practices.

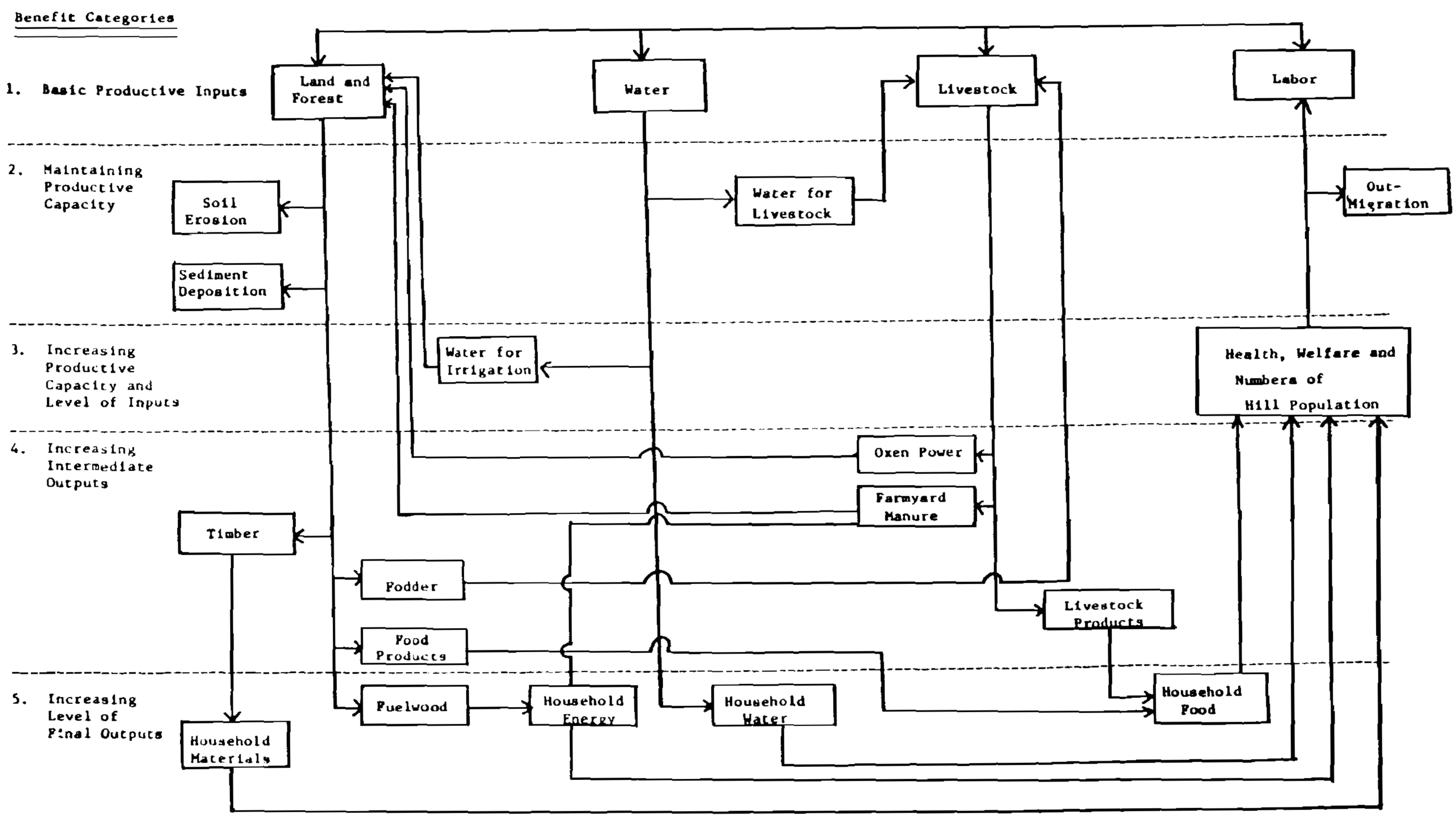

Figure 1. Economic Interactions within the Nepalese Hill Country Agricultural Sector

Note that the diagram depicts all of the well known characteristics of hill living.1/

-- Land assets (one of the basic productive inputs) are allocated between farming, pastures and forests. These are essentially competing uses of land. Current poor conservation practices cause soil erosion and sediment deposition. Conversely, good conservation practices can reduce these phenomena, thereby increasing outputs which in turn generate increased income (cash and in-kind).

-- Household energy consists of fuelwood and dung, which are almost perfect substitutes. When forests are far from the village, there is greater substitution of dung for firewood. Both types of fuel are usually gathered freely instead of being purchased in a market.

-- Diminished food output results from substituting dung for fuelwood, since less organic fertilizer is available for application to crop production.

-- Household water supplies are usually obtained via labor inputs. During the dry season in particular, considerable amounts of labor inputs are required to bring drinking and bathing water to the household site.

RCUP activities can influence this system in various ways, but rarely through market prices of inputs or outputs. The reason is that the agricultural-ecological system is subsistence oriented. Rather, the focus must be on RCUP activities which increase the quantity or quality of the three main categories of basic productive inputs (land/forest, water, livestock), enhance labor skills, improve farming practices, or save labor time. RCUP activities will attempt to influence all of these factors. The focus throughout will be to improve the overall welfare of rural households. Although this objective is frequently synonomous with efforts to raise incomes, it also encompasses in the context of RCUP a variety of social objectives. These social considerations will include time savings for women

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1/ The diagram is an extension of the original work in Mahesh Banskota's Ph.D. dissertation at Cornell University (1979) entitled "The Nepalese Hill Agro-Ecosystem: A Simulation Analysis of Alternative Policies for Food Production and Environmental Change". Imports and exports represent a very small proportion of total consumption and production and thus are excluded as an economic component in the agriculture sector.

and children, raising health standards through better supplies of drinking water, and increasing by means of extension education the skill levels of all household members who are economically active.

The main categories of benefits which are most likely to be generated by RCUP activities have been listed in Thorud, et al., 1977. Adding two others there are eight categories which appear to span the spectrum of RCUP activities. Each is presented below, along with a discussion of the conceptual bases for measuring that type of anticipated economic benefits:

i. Increased soil fertility due to reduced soil erosion and sediment deposition on crop land, giving increased crop yields and forage off-take from pastures, and increased milk, meat, and manure output from improved livestock.

This category of benefits will be derived from the improved watershed management activities proposed in Appendix D. The quantification of these benefits can be described with the help of the supply/demand diagram shown in Figure 2:

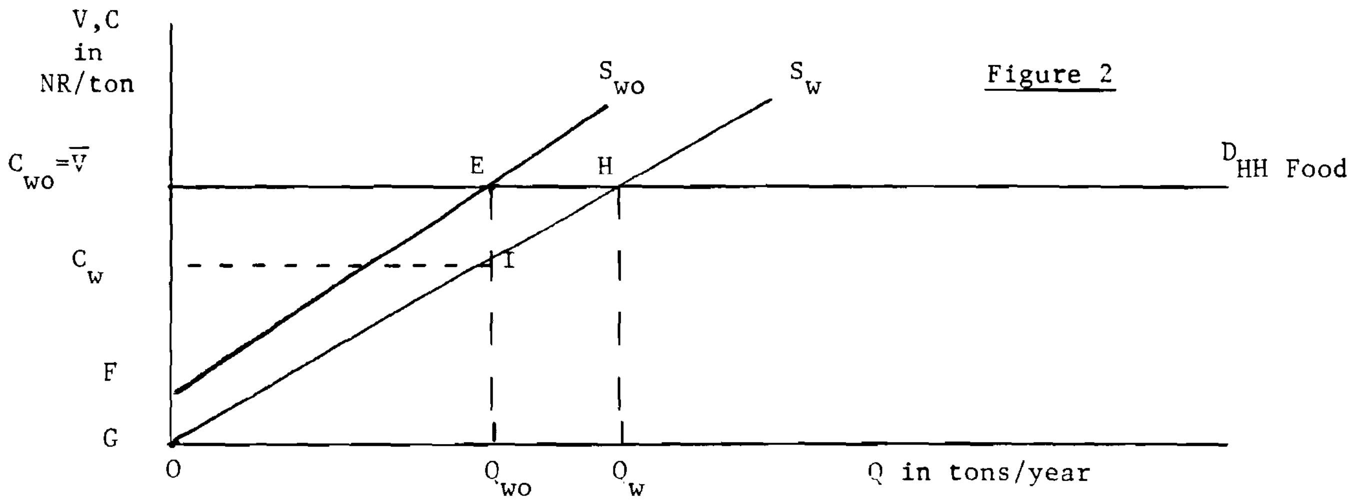


Figure 2

The vertical axis represents both value (V) and cost (C) per unit of output (Q) while the horizontal axis represents the Quantity of Output (Q) produced annually. The horizontal line D denotes the household demand function[1/] for food crops (e.g. rice) being produced by the household. The upward sloping line S_{wo} denotes the household supply function for rice, which is characterized by rising unit costs as output increases. The existing situation without RCUP is represented by output Q_{wo}/year of rice which is valued by the household at $\overline{V}$ per unit (ton) of rice output. A rational household, in terms of economic logic, would push rice output up to Q_{wo} since at this level incremental production costs, C_{wo}, just equal $\overline{V}$. Beyond Q_{wo}, they would exceed $\overline{V}$. The total value to the household of the existing output is equivalent to the area $\overline{V}$ E Q_{wo} O. The production cost -- in terms of labor inputs, manure, seeds, and any purchased inputs -- is equivalent to the area O F E Q_{wo}, representing the area beneath the supply function. The slope of the supply function, S_{wo}, traces the incremental costs of producing greater quantities of rice per year.

The RCUP improved watershed management activities should shift the supply function downward, as diagrammed by the move from S_{wo} to S_w, the supply function with RCUP. This shift will come about through increased soil fertility (which means reduced application of manure and other inputs to produce a given amount of output) and water supplies. Such a shift represents lower incremental costs for producing the initial quantity of rice, Q_{wo}, and induces the household to expand rice output up to a new level Q_w. At that level of expanded output, the incremental production cost once again equals $\overline{V}$, so there will be no economic incentive to expand rice output beyond Q_w (until additional changes occur). The resultant net economic benefits are represented by sum of areas GFEI and EHI. The former area represents net decrease in production costs accruing to the "without RCUP" level of costs accruing to the "without RCUP" level of output, and is more easily measured by the rectangle $C_{wo}C_wIE$ or $(C_{wo} - C_w)\ Q_{wo}$. The latter area represents the net benefits generated by increased output, and is equivalent in value to $1/2\ (C_{wo} - C_w)\ (Q_w - Q_{wo})$. Thus, the total value of net economic benefits can be expressed symbolically as

1/ See Banskota, 1979, pp. 1-16, for evidence which is consistent with a demand function for food consumption which is highly price elastic. Generally, in a subsistence economy, even significant increase in output will not affect market price.

$$(1)\ B_{sf,K} = \sum_{t=o}^{T} \frac{(\Delta C \cdot Q_{wo} + \frac{1}{2} \Delta C \cdot \Delta Q)\ K,t}{(1 + d)^{t}}$$

where $B_{sf,K}$ = the present value of the stream of annual returns for crop K from improved soil fertility (due to reduced erosion), ΔC = the reduction in production costs per unit of output, and ΔQ = the increase in quantity produced. T represents the terminal year for RCUP. Summing over all affected agricultural output types, K, and all project years, t = 0 to T) yields the total present value of net economic benefits attributable to RCUP watershed management activities.

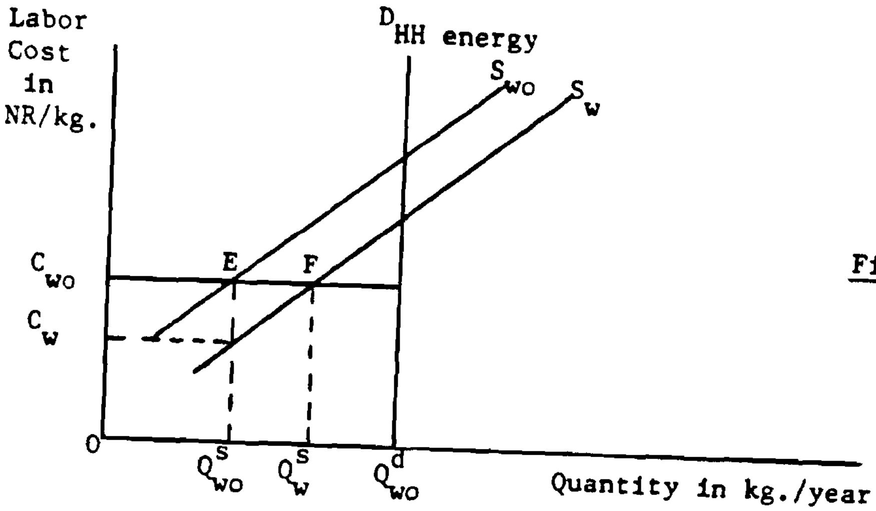
Note that the above methodology will almost certainly result in a downwardly biased estimate of net benefits. The reason is that it assumes no further loss of soil fertility if the RCUP is not implemented. Additional erosion will undoubtedly occur if no conservation activity is undertaken, which means that the true measure of economic benefits will exceed the approximation presented as Equation (1). Thus an additive component must be included in the numerator to account for addition losses in "without project" output which would result in the absence of a RCUP-type program. Section 3 will present operational estimates of this component of benefits.

ii. <u>Increased yields owing to improved seeds and cultural practices including small scale irrigation.</u>

Conceptually the estimation of net economic benefits for improved farming technology is identical to the above discussion for impropved watershed management. The impact of improved technology will be to shift the supply function downward, thereby reducing production costs per unit of output. Equation (1) will serve, therefore, as the conceptual basis for measuring net economic benefits for both of these categories of benefits.

iii. <u>Increased timber, fuelwood, and fodder output from forests with less labor effort required to harvest and transport them to the household</u>.

The conceptual basis of quantifying this category of net economic benefits is shown in the following diagram:



<u>Figure 3</u>

Figure 3 shows a vertical household demand function, D, for household energy consumption in the Nepalses hills. This representation is consistent with testimony from the literature that subsistence households tend to consume an approximately constant amount of household energy per capita per year 1/. When fuelwood is scarce, farmyard manure or dung tends to be substituted as the energy source for household cooking and heating.

Similar to the interpretation for Figure 2, the pre-RCUP situation is represented by point E at which $Q_{wo}{}^S$ of fuelwood is being harvested and consumed at labor cost of C_{wo} for the last kg of fuelwood gathered. The incremental cost of harvesting additional

1/ See Appendix F for the literature containing testimony regarding the constancy of per capita energy consumption in subsistence-level households in the Nepalese hills.

quantities of fuelwood beyond $Q_{wo}{}^{S}$ is perceived by the household as too high relative to the labor cost of gathering dung. Consequently, the initial equilibrium situation is characterized by $Q^{d} - Q_{wo}{}^{s}$ of dung being consumed along with $Q_{wo}{}^{s}$ of fuelwood in order to satisfy household energy demand.

The RCUP will seek to increase the supply of fuelwood by improved management of existing forests as well as afforestation. They will both have the same impact on Figure 3: the original supply function, S_{wo}, will be shifted downward, as represented by S_{w}, since the labor time for harvesting and transporting fuelwood will be reduced. This result should induce a new equilibrium at point H, where $Q_{s}{}^{s}$ of fuelwood and $Q^{d} - Q_{w}{}^{s}$ of dung are being gathered and used.

The net economic benefits associated with these increased fuelwood supplies can be estimated based on Equation (1) above. Using that approach, C would represent the reduction in the average labor time cost (of gathering $Q_{wo}{}^{s}$ of fuelwood) which could be assigned to RCUP.

Alternatively, the net economic benefits could be quantified by the value of dung which has been released for use as fertilizer. This approach has been utilized in the World Bank's <u>Nepal Forestry Sector Review</u> and in the APROSC <u>Feasibility Study</u> for the Mahakali Hills Project. For that measure the following equation would apply:

$$(2) \qquad B_{fs} = \sum_{t=0}^{T} \frac{(V_{FYM} \cdot \Delta\, FYM)_t}{(1 + d)^t}$$

where B_{fs} = the present value of the stream of annual returns from increased fuelwood supplies, T = the economic life of the new forest, V_{FYM} = the unit value of farmyard manure or dung in terms of incremental output of foods crops, and Δ FYM = the quantity of farmyard manure which will be released for use as fertilizer. These unit values will be estimated in Section 3 below.

Turning now to an evaluation of increased supplies of fodder, if it is used entirely as animal feed, increased consumption of fodder will result in increased output of milk and farmyard manure. Consequently the net benefits can be evaluated by using Equation (2). Of course for fodder, the numerator in that equation must be re-defined to read V_F F, where V_F = the unit value of fodder in terms of incremental output of milk and F = the quantity of fodder consumed by livestock.

Another important product of the forestry sector is increased availability of timber for building materials. The output of timber will be valued in terms of Equation (1). In this instance, the benefits from timber output can be estimated via its market price, since this is one type of RCUP output which is not tied to the subsistence economy.

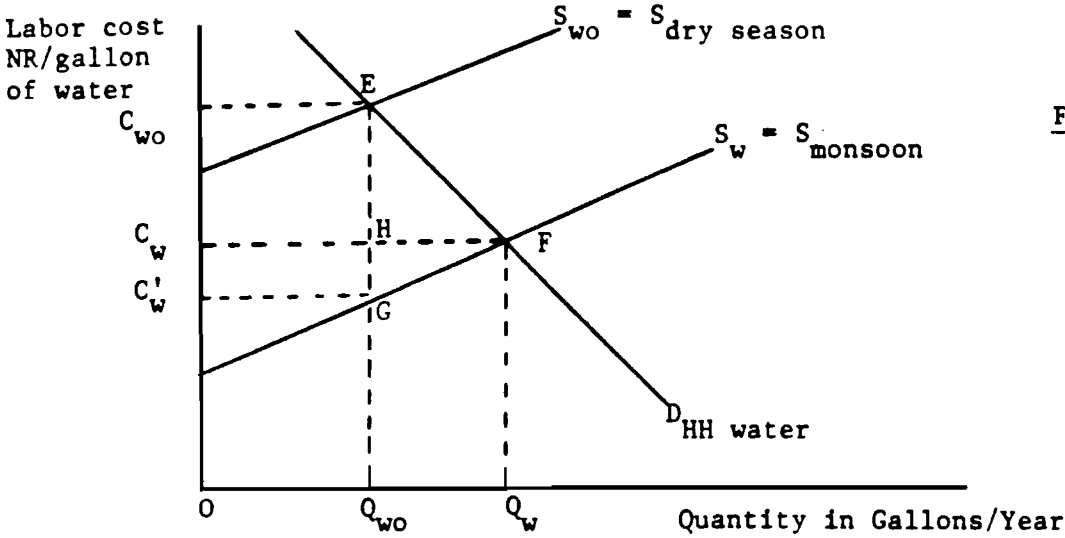
iv. <u>Decreased demand for fuelwood as household energy due to improved efficiency of cooking and heating</u>.

Most of the previous studies of resource conservation and utilization in Nepal concentrate on increasing the supply of fuelwood. The complementary approach of seeking ways to curb the demand for fuelwood is rarely given much attention. Appendix F focuses on several possibilities for reducing the demand for fuelwood, the most practical of which seems to be increased thermal efficiency of stoves.

In the context of Figure 3 reduced fuelwood demand would be equivalent to shifting the vertical D function to the left. Thus, the original Q^d of total household energy demand would be reduced to $Q_w{}^d < Q^d$. The resultant net economic benefits could then be quantified using Equation (2) above.

v. <u>Improved drinking and bathing water supplies, requiring less labor effort to transport it to the household</u>.

Figure 4 illustrates the likely consequences of more accessible water supplies for household use:



<u>Figure 4</u>

The household demand function for water, D, is drawn with a gentle slope downward to the right in order to suggest the significant responsiveness of water consumption to changes in the labor cost of supplying it. When many hours of labor time must be allocatd to obtaining water supplies, consumption is restricted to drinking and other critical life-support uses. This situation is illustrated by point E in Figure 4, where Q_{wo} of water is being consumed by household members at the labor supply cost of C_{wo}. Point E can be viewed as representing dry season consumption of water without the improvements anticipated through RCUP.

During the monsoon period, or when piped water is supplied to the village by means of RCUP activities, water becomes much more plentiful. This situation is shown in Figure 4 by the downward shift of the original supply function to S_w. The labor cost of obtaining water declines significantly; a new equilibrium situation is reached at point F, where Q_w of water is being consumed at the labor supply of C_w. Note that is only the original quantity, Q_{wo}, were supplied and consumed in this new "water abundance" situtation, the labor supply cost would be only $C_w{}^1$. The resultant net economic benefits are represented by the sum of areas C_{wo} C_w' GE and EGF. The former area represents the net gains due to reduced costs of supplying the dry season quantity of water, and is equivalent in value to $(C_{wo} - C_w')\ Q_{wo}$. The latter area represents the net benefits attibutable to increased supplies, and is equivalent in value to $1/2(C_{wo} - C_w')\ (Q_w - Q_w - Q_{wo})$. Thus the total value of net economic benefits can be expressed symbolically as

$$(3) \quad B_{w,h} = \sum_{t=o}^{T} \frac{(\Delta C^* \cdot Q_{wo} + \tfrac{1}{2} \Delta C^* \cdot \Delta Q)_{h,t}}{(1 + d)^t}$$

where $B_{w,h}$ = the present value of the stream of annual returns to increased water supplies for household h, $\Delta C^* = C_{wo} - C'_w$ which is the reduction in water supply costs on the original or dry season quantity supplied and consumed. T denotes the terminal year for RCUP. Summing over all affected households, h, yields the total present value of net economic benefits, attributable to RCUP for supplies to rural households.

Note a special feature of the analysis of water supply benefits. That is the area EHF in Figure 4 represents benefits from increased "consumer surplus", the term economists use to denote benefits accruing to consumers when the price falls significantly. This component of net benefits is not included in the preceeding Equations (1) and (2) since the characteristics of their underlying demand functions are different from that shown in Figure 4.

vi. Improved health and nutrition status of hill residents due to improved food output and drinking water supplies.

This category of net benefits will be quite difficult to quantify. There will no doubt be some improvements in health and nutrition status due to these RCUP activities. Even though some measures of decreased morbidity and mortality will be obtained from baseline and follow-up surveys of RCUP-affected households, it will be difficult to determine how much of the observed changes might be associated with RCUP, and to translate medical measures of improved health and nutritional status into measures of net economic benefits. For these reasons this category of RCUP benefits will not be quantified in Section 3.

vii. Reduced siltation of reservoirs and damage to irrigation systems caused by high silt content and flows of rivers and streams.

Another difficult-to-measure category of net benefits, yet there is some hope for quantification. Estimates have been made of the extent to which siltation may be shortening the economic lifespan of major reservoirs, such as the Kulekhani Dam. To the extent that RCUP watershed management activities will decrease the siltation rate, they obviously will increase the number of years over which hydropower, water supplies and other benefits can be made available. Even if these benefits could be measured precisely, however, they will not be realized until 40 years or so into the future. This means that the net present value of such benefits is unlikely to prove large relative to the other categories of benefits discussed above. As a consequence, this category of RCUP benefits will not be quantified.

viii. Improved population distribution between the hills and the Terai.

As a result of RCUP, there will probably be some population redistribution. If the activities described above prove to be economically viable, there will be changes in the overall quality of life for the target populations. If the changes are perceived by villagers as gains relative to other areas, then out-migration will tend to be reduced. If not, the opposite result will be expected. Whichever, if the migration movements are voluntary, there will tend to be a net improvement in population distribution vis-a-vis available economic opportunities. Population redistribution will also shift the burden of providing social services from the sending to the receiving areas. All of these factors make the estimation of net economic benefits (or costs) due to improved population distribution quite problematic. Furthermore, such benefits or costs are likely to be small relative to the other categories of net benefits. For these reasons, therefore, this category of RCUP benefits will not be quantified.

(b) Institutional Development Aspects:

The entire list of activities described in Appendix K represents an investment in the human capital of Nepal. The returns on that investment will be realized in two ways:

i. Participant and In-Service Training.

The training of professional Nepali staff, whether in-service or long-term, will be realized in terms of the marginal products received from applying their improved skills to RCUP or related activities over the remaining professional careers of the persons trained. To the extent that their skills are applied to RCUP activities, the resultant gains in efficiency will be measured already in the various site-specific activities described above. Since most of the individuals trained by RCUP will be employed on RCUP work, this component of institutional development benefits should not be evaluated again.

ii. Training at the Institute of Renewable Natural Resources.

In addition, there are net savings from training Nepali students at the Institute of Renewable Natural Resources instead of overseas. This category of institutional development benefits will almost certainly be small relative to benefits generated by other components of the RCUP and, therefore, it will not be evaluated.

(c) Pricing and Other Issues and Assumptions in Evaluating Net Benefits:

There are several issues which directly effect the magnitude of the costs and benefits which need to be addressed at the conceptual level before proceding with the empirical economic analysis.

i. The value of labor released by project activities.

APROSC's Feasibility Study of Integrated Rural Development Project for Mahakali Hills (Nov. 1978), Annex 23, provides a rather detailed system for valuing labor according to season and class of laborer. The market wage rate of 7 rupees per man day is used as a benchmark for peak season hired labor, i.e., assumed as a time of full employment.1/ Various lower rates are employed for off season employment-including the opportunity costs associated with migration during the slack period. However, the generalities of the labor release estimates, plus the opportunity costs which should be added for the volunteer labor implicit in the project design, makes their detailed methodology too complex for this project.

The methodology to be used therefore will be to estimate the total time released due to the specific project activity, e.g., the decrease in travel time to gather fuel and fodder or provide the families potable water supply. However, it will then be necessary to delineate alternative opportunity costs for labor estimates during the "peak demand for labor" season and for the remainder of the year.

Most sources indicate the peak season lasts for approximately four months of the year. Only during this one third of the year would the opportunity cost of labor equal the market rate of 7 rupees. Thus the

1/ Wage rate of RS 7 per man day is also employed in the World Bank's Nepal Forestry Sector Review (Rpt. No. 1952 - NEP) Aug. 1978.

calculation of benefits from the release of labor in the peak period is the appropriate opportunity cost—assumed in this study to be 7 rupees per day with allowances for a higher market rate in some of the project areas.

The difficulty comes in attempting to determine the opportunity cost during the eight months of non-peak labor demands. A recent study by the Nepalese National Planning Commission (Sept. 1978) entitled _A Survey of Employment Income Distribution and Consumption Patterns in Nepal_ reports the unutilized days for rural workers in Nepal is 57% of total working days (187 out of 323) for males and 69% for females (223 out of 324). (p. 70-71). It is likely, however, that workers earn some wages during this "unutilized period." We will make the assumption that the opportunity cost for labor during off-peak periods should be valued at about NR 2.50. Thus, the opportunity cost of labor will be valued at NR 4.4 per day (0.57 x NR.25) + (0.43 x NR.7) throughout the year. The procedure to be followed will be to total all labor released, but only claim NR 4.4 per day as the opportunity cost of the released labor. We feel that this procedure will produce a conservation estimate in valuing any benefits due to the differential between wages actually paid and the social opportunity cost of unskilled labor.

ii. _Changes in market prices associated with increased production._

On the basis of (1) an agricultural economy that is at a subsistence level and lacking a formal marketing structure and (2) the contribution of the increase in production in the project area will be a relatively small percentage of total production, the assumption follows that _project output will not effect the "market price" of the commodities being produced_. This conclusion is consistent with the supply/demand analyses presented above.

iii. _Inflation rate used to adjust costs_.

The common assumption is that inflation effects both costs and benefits and thus neutral in terms of relative prices. However for financial analysis it is necessary to add a reasonable "inflation factor" to the project costs.

An inflation rate of 12% per annum will be used in the financial analysis, since that would appear to be the minimum rate which would be realistic based on the recent experiences of both Nepal and the United States. It should be emphasized here, however, that no inflation adjustment is done in this economic analysis due to there being no evidence that inflation will not affect both benefits and costs in a neutral manner with respect to relative prices.

iv. Discount rate for project benefits and costs.

Although virtually impossible to develop a defensible argument favoring a specific value for the opportunity cost of capital, a 15% discount rate seems appropriate since it is conservatively high and will avoid overstating economic benefits. However, sensitivity analysis will be conducted to determine the extent to which higher discount rates might reduce the net present value of the benefits-costs to zero or lower.

v. Allowance for physical contingencies.

As with the discount rate, a specific percentage added for contingencies is difficult to defend. However many of the soil conservation production practices being recommended have been tested in alternative locations. Thus an estimate of 10% for contigencies was assumed. It might be noted that two recent studies for Nepal by the World Bank and the FAO used a 10% contingency factor.

vi. Rupees-to-dollars conversion.

Throughout the analysis the official exchange rate of NR 11.90 per U.S. dollar was assumed. Again, sensitivity analysis will be carried out to determine the effects of higher values of the opportunity cost of capital or estimated net economic benefits.

vii. Distortions in market prices of inputs and outputs.

A common procedure in benefit-cost analyses is to correct for any observed differences between market prices of inputs or outputs and their estimated social opportunity costs. The procedure outlined above regarding the valuation of labor inputs is a good example. It will be followed in valuing not only time savings, but also the cost of unskilled labor inputs included in both capital and recurrent costs of RCUP.

Any significant taxes or subsidies will also receive appropriate attention. For example, the market prices of timber is government-controlled. Since the official government price is believed (according to APROSC specialists) to represent a subsidy of about 33% compared to the estimated unsubsidized price, benefits from increased timber output will be evaluated at a price which is 50% higher than the official government price.

3. Quantification of Net Economic Benefits

The "Program Guide for RCUP Output" represents a summary of all the categories of programs being undertaken as part of RCUP: (1) Inventory and Monitoring, (2) Watershed Management, (3) Forest Management, (4) Energy, (5) Irrigation, (6) Drinking Water, (7) Community Livestock - Range - Pasture Management, (8) Agronomy, Extension, and Research, (9) Horticulture, (10) Fisheries Development, (11) Training, and (12) Building Starts.

The estimated financial costs for each of these program categories have been estimated in the "Financial Analyses". The task of this section of the Project Paper is to convert the financial costs to economic costs, and to calculate the associated economic benefits.

The estimated financial costs for each of these program categories have been estimated in Part 2.C, "Financial Analyses". The task of this section of the Project Paper is to convert the financial costs to economic costs, and to calculate the associated economic benefits.

To attain this latter objective, some program categories will be combined, such as (5) Irrigation and (8) Agronomy, for analytical convenience due to complementarities with respect to benefits and costs. Others, such as (1) Inventory and Monitoring and (11) Training, will be considered to be components of the jointly incurred costs of RCUP, which costs are to be justified by the combined net benefits from all other program categories. The details are presented below.

(a) Program Category 3., Forest Management

The "Program Guide for RCUP Output" (hereafter referred to as the RCUP Guide) specifies two major types of activities for forestry programs. First is the application of improved management techniques to existing forests, consisting of Program Categories 3.J.(1), management of 67,584 hectares of National Forest, and 3.J.(2), management of 14,013 hectares of Panchayat Protected Forest. Their combined land areas of 81,597 hectares represents

78% of the total 104,126 hectares included in the entire Program Category 3. As will be demonstrated below, it is only these forest management activities which generate immediate flows of economic benefits; the others must be largely deferred until newly planted trees have matured.

The second type of activity is the establishment of new forest plantations, consisting of Program Categories 3.B.(1), Panchayat Forest Establishment - Fuelwood (3,132 hectares); 3.B.(2), Panchayat Forest Establishment - Fodder (3,125 hectares); 3.C, Distribution of Community and Individual Plantings (3,464 million saplings, equivalent to approximately 4,245 hectares); 3.E, Lease Forest Establishment (322 hectares); 3.F, Private Forest Establishment (1,000 hectares); and 3.G, National Forest Plantation Establishment (10,555 hectares). Their combined land area is 22,379 hectares, which represents 21% of the total land area[1/] in Program Category 3. Each of these program categories is characterized by a lengthy gestation period before fodder, fuelwood or timber can be harvested.

Within the context of Figure 1, these forestry programs should contribute several types of benefits. First is the value of fodder, fuelwood, and timber harvested. The bases for quantifying such benefits are presented in Table 1.

Anticipated yields and estimated net economic benefits per hectare are given for both the "without project" and "with project" situations.

A special problem in valuing these harvests is created by the 15-year planning horizon for the RCUP. Since the bulk of the harvest from Program Categories 3.B, 3.C, 3.E, 3.F, and 3.G will be realized after the fifteenth year, the increase in land value treated as a result of RCUP could be used to quantify the net economic value of improvements to the affected forest land as of the end of year 15. This net increase in land value has, however been excluded as a component of net economic benefits.

1/ The remaining 1% is represented by Program Category 3.L, Research Trial Plots, which includes the equivalent of 150 hectares.

Another special problem is posed by the loss in current (without project) forage production from land converted from pasture or range to new forest plantations. Table II provides the bases for estimating these "negative" benefits, as noted in Table I.

A second type of benefits comes in the form of decreased soil erosion on managed forest lands (Program Category 3.J) and lands proposed for new forest plantations. Table I summarizes the procedure for quanti- fying these benefits. Table III contains the raw data and literature references underlying the procedure.

A third type of benefits is increased crop yields "downstream" of the areas subjected to improve forest management and new plantations due to decreased sediment deposition. Eroded soil will deposit itself and cause various types of damages. The reduction in these damages can be claimed as benefits to RCUP. There are three major locations where eroded soil is deposited: (1) areas close to where the soil becomes displaced and where the terrain slope is reduced; (2) within the drainage and stream channels; (3) in deltas, impoundments, and major river ways. Laban reports that 33% of the sediment will be in the third category. Assuming that eroded soil occurs in the project area according to the above, then it can be assumed that about 1/3 will be deposited near the eroded site, 1/3 deposited in drainage and stream channels within the catchment area and 1/3 will pass beyond the catchment area.1/ Table IV (the Forest Improvement column) derives estimates of the value of reduced crop damage due to decreased sediment deposition.

The values estimated for total economic benefits from all forestry program categories are presented in summary form on page 1 of Table V for Project Years 1-15. The values of total economic costs, several measures of economic efficiency, and some sensitivity analysis are presented on page 2 of Table V. Evaluated at a conservatively high 15% discount rate, the stream of economic benefits and costs yields the following measures of economic efficiency:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years, 1-15
Net Present Value (Benefits-Costs), in millions of NR	22.8	38.7	84.3	145.8
Benefit/Cost Ratio	1.6	2.3	6.4	2.7

1/ Laban, Peter, Field measurement on erosion and sedimentation in Nepal, Sep. 78 IWM/WP/05

The sensitivity analysis, which shows how responsive the net present values of benefits and costs are to changes in important assumptions, indicates that the net present values remain positive and the B/C ratios exceed unity even under quite adverse changes. Consequently, this component of RCUP would appear to be quite a viable, set of programs. This conclusion is underlined by the fact that conservative assumptions were employed throughout the analysis: benefits have been deliberately biased downward, and costs have been deliberately biased upward.

(b) Program Category 7., Community Livestock-Range-Pasture

Included in the RCUP guide are many types of programs for improving the management of ranges, pastures, and livestock. The overall objective is more economically efficient production of milk, meat, eggs, wool, hides, and other animal products, most of which will be consumed by hill residents. Perhaps the most critical component in the complementary set of inputs designed to increase the productivity of livestock is increased quantity and quality of animal feed. Appendices Ia, Ib, and Ic make this point persuasively. For this reason, Program Categories 7.A-7.H are concerned with improved management of existing ranges and pastures which are commonly used by communities in the RCUP project sites. Table II presents estimated increase in forage yields for ranges and pastures in the "with RCUP" and "without RCUP" situations.

A companion set of programs concerns improvement in livestock management, including the introduction of improved animals, castration of unproductive males, delivery of a variety of animal health services, and the provision of necessary equipment and credit. These improvements are the forms of Program Categories 7.I-7.P. Table VI shows the estimated impact of such programs on the production parameters for livestock. The modest improvements forecast for the production parameters are judged to be quite realistic.

From the viewpoint of the agricultural-ecological system depicted in Figure 1, the RCUP intervention to upgrade the management of ranges and pastures promises three impacts. Its primary impact will be to increase the quantity of forage for livestock feed (an "intermediate output"). Its two secondary impacts will be (a) reduction of crop losses from existing soil erosion and sediment deposition ("maintaining productive capacity"), and (b) labor time savings due to decreased herding and hand-harvesting time when forage production increases (equivalent to an increase in available labor inputs). The complementary RCUP intervention to improve the quality and quantity of livestock promises to (a) increase the intermediate outputs of farmyard manure and animal power, and (b) increase the final output of livestock products destined to be consumer goods.

The procedures for estimating most of these economic benefits are quite straightforward:

-- The economic value of the incremental forage production from improved pasture management, with vs. without RCUP, is estimated to be NR 1875/ha./yr. based on the data and references provided in Table II. For range management, the comparable figure would be NR 1001/ha./yr.[1/] These values, when multiplied by the relevant number of hectares reported in the RCUP Guide for pasture and range,[2/] respectively, result in the economic benefits reported for increased forage yields in Table VIII.

-- Increased crop yields due to reduced soil loss and sediment deposition "downstream" from the improved pastures and ranges are also estimated in Table VIII. The same procedures were followed in making such estimates as were reported above for forest programs.

-- Decreased labor time for herding and hand-harvesting of forage is estimated based on Table VII.

-- Increased yields of final products are based on the production parameters presented in Table VI with increase in output being valued at prices reported in the communities within the RCUP project areas. The large increments reported for yields deriving the 2nd and 3rd five-year periods are due to increased availability of feed from improved pastures and ranges and from the increased fodder yields reported earlier from forestry programs.

1/ This estimate is based on a weighted average of the incremental yields reported in Table II for improved range management. The weights are based on the proportion of total range land being improved (5,141 ha.) that is comprised of steppe (1,705 ha., which would be "Mustang - Cool Temperate" in Table II) versus all other (3,436 ha., which would be "Mustang-Subalpine Meadows"). The resultant weighted-average of 2.67 MTDW/ha./yr. x NR375/MT value for forage = NR 1001/ha./yr.

2/ However, care must be taken in making such estimates to allow for the appropriate "establishment periods" specified in Table II before improved yields can be realized.

-- Increased yield of farmyard manure has been estimated proportionate to the increased amounts of feed to livestock. The value of farmyard manure has been estimated to be NR40/MT, which price is consistent with that estimated in the APROSC/World Bank Feasibility Study of Integrated Rural Development Project for Mahakali Hills (Volume III, Annex 7, Appendix 5).

It is important to note that the operating costs for the programs include the cost of forage and fodder for livestock feed. The prices used are the same as those estimated for forage and fodder. Thus operating costs presented in Table VIII are significantly higher than the operating costs reported in the financial analysis of Part 3.C. This procedure prevents double-counting of benefits, which would occur if no value were assigned to livestock feed for fodder and forage.

The estimate of total economic benefits and total economic costs are presented in Table VIII. Evaluated at a conservatively high 15% discount rate, the stream of economic benefits and costs yields the following measures of economic efficiency:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benefit-Costs) in millions of NR	(13.8)	21.1	27.9	35.2
Benefit/Cost Ratio	0.6	1.4	1.6	1.3
If Costs Increased by 10% and Benefits Decrease by 10%				
Net Present Value (Benefit-Costs) in millions of NR	(19.4)	9.1	15.3	5.0
Benefit/Cost Ratio	0.5	1.2	1.3	1.0

This component of the RCUP would seem to be economically viable, based on the efficiency measures reported above, since both benefits and costs have been estimated in a conservative manner. For example, omitted from the due estimation of benefits were (i) the potential for increased milk yields due to decreased livestock trailing and grazing (due to the increase in vegetation production on ranges and pastures as a result of RCUP), (ii) increased output of wool and hides, and (iii) increased availability of animal power for land preparation. On the cost side, reductions could legitimately be claimed for the excess of market wages paid versus opportunity cost of unskilled labor for capital costs. On balance, therefore, the community livestock-range-pasture component of RCUP promises to generate an acceptable level and timing of benefits relative to costs.

(c) Program Categories 5 and 8: Irrigation and Agronomy

The RCUP Guide lists for Program Category 8 the hectares to be committed to improved varieties of seven types of crops: paddy, wheat, maize, millet, barley, pulses, and potatoes. Additional hectares planted with local varieties will be subjected to improved farming practices. These hectares also involve five other crops (oilseeds, sugarcane, ghaiya paddy, buckwheat, and naked barley) as well as the original seven. A summary of the total land area which will receive new varieties, new practices, or both is presented in Table XI.

In the context of the agricultural-ecological system diagrammed as Figure 1, the objective of these programs is obviously to increase the output of food for consumption by hill residents. In the long-run, even within the 15 year time horizon of RCUP, these programs could lead to marketable surpluses. If trails and, for some communities, roads could be improved, such surpluses might become significant generators of cash income to hill residents.

Note from Table XI that paddy, maize, and millet represent together 75.7% of the entire hectares to receive improved varieties/practices. Another 15.4% of the total is represented by wheat, all of which will be grown in the higher, dryer altitudes of the Mustang area. Thus, over 91% of the attention in Program Category 8 will be given to four crops. Three of these crops (paddy, maize, and millet) are the current staple food crops of Nepali hill residents. All of the proposed crops are being grown now in the project sites.

A summary of the with vs. without RCUP yields, cost of production, and gross and net values of production is presented in Table XII. Note that the reported costs of production represent the on-farm costs only. The various project provided inputs must be added to arrive at total costs for this program category. Using detailed worksheets prepared by APROSC specialists, the information reported in Tables XI and XII is combined and summarized on page one of Table XIII, where the net economic benefits (equivalent to net value of production in Table XII) are shown for each of the twelve crops.

The economic costs (additional to on-farm costs) are summarized on page two of Table XIII. A major component of these project provided in-puts is represented by the capital costs of irrigation facilities, as can be seen in the financial analysis of Part 3.C. Largely because of the inclusion of these irrigation facilities, the foreign currency component of costs for Program Categories 5 and 8 combined represents a significant percentage of total program costs (24%) although not as high as the average for the entire RCUP (30%).

The economic efficiency measures presented on page two of Table XIII reveal that Program Categories 5 and 8 comprise an economically justifiable set of activities as can be seen from the table below:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benefits-Costs) in millions of NR	25.1	50.5	39.4	115.0
Benefit/Cost Ratio	1.8	5.0	7.0	3.3
If Costs Increase by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in millions of NR	16.4	42.9	34.2	93.5
Benefit/Cost Ratio	1.5	4.1	5.8	2.7

It is interesting to observe the potential impact of a significant increase in the NR/$ foreign exchange rate. Although foreign currency does comprise approximately one-fourth of total program costs, as noted above, increases in outputs of most food products are analytically equivalent to either an export (paddy, for example) or an import substitute. Consequently, a higher NR/$ valuation on foreign currency will increase the economic attractiveness of Program Categories 5 and 8.

Taking a look now at Program Category 5 separate from Program Catetegory 8, Tables IX and X contain information, respectively, on estimated cropping intensity increases and resultant income increases due to irrigation inputs. From page two of Table X, the weighted-average increase in net value of production, with vs. without RCUP, is estimated to be NR 1520/ha. irrigated. As shown in the RCUP Guide, this gain is associated with 1,142 hectares of currently rainfed land which is shifted into irrigated land following the time pattern outlined in the RCUP Guide for Program Category 5. The resultant stream of net benefits is summarized below along with the usual measures of economic efficiency:

Net Present Values at 15% Disc. Factor	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Economic Benefits (excel. farm costs)1/	2,824	7,901	3,950	14,675
Economic Costs (project provided)2/	(11,969)	(250)	(125)	(12,344)
Net Economic Benefits	(9,145)	7,651	3,825	2,331
Benefit/Cost Ratio	0.24	31.6	31.6	1.2

It is apparent that Program Category 5 promises very high returns to the RCUP investment in irrigation facilities. Even if unanticipated maintenance costs occur during Project Years 6-15, this component of RCUP promises to be highly efficient economically.

(d) Program Category 9., Horticulture

The RCUP Guide lists three program categories: 9.A, sapling distribution; 9.B, kitchen garden vegetable production; and 9.C, fruit nursery establishment. This analysis will estimate economic benefits only for program category 9.A. Although this decision will still include the benefits from Program Category 9.C (since the fruit nursery is a necessary input for achieving the forecasted yield increases), it will bias downward the estimate of overall economic benefits due to the exclusion of net benefits from increased production of vegetables from "kitchen gardens". Such benefits, however, are believed to be quite small relative to those generated by Program Category 9.A.

1/ Equals NPV of NR 1520/ha. times hectares estimated in footnote 1/.

2/ See Part 3.C, the financial analysis, for details. The operating costs for the second and third 5-year periods may be assumed by the hill communities.

Regarding their place in the agricultural-ecological system shown in Figure 1, the primary objective of horticulture programs is to increase the output of food products for hill residents. Their potential long-run impact might also include marketable surpluses, as indicated earlier for agronomy/irrigation programs. If so, the horticulture programs might eventually provide significant increases in cash income to producers in the RCUP areas.

Expectations with respect to yield improvements are presented in Table XIV for each of the twenty-two types of fruit being affected by RCUP programs. The forecast time paths for attaining the full expectation regarding yield increases are shown in Table XV. Detailed worksheets have been prepared by APROSC technicians showing the proposed land area committed to horticulture in each of the four RCUP sites, the on-farm production costs, and net value of production (gross value less on-farm costs). The resultant estimates of net economic benefits, without RCUP, are presented in Table XVI.

The estimates of economic costs are also summarized in Table XVI. The opportunity costs of family labor was added to the costs of project provided inputs to obtain costs for this program category. Other on-farm production costs were deducted from the gross value of increased yields of fruit crops in arriving at net benefits.

When evaluated at a conservatively high 15% discount rate, the resultant stream of economic benefits and costs yields the following measures of economic efficiency, based on Table XVI:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benefits-Cost) in millions of NR	(6.4)	3.1	30.7	27.4
Benefit/Cost Ratio	0.3	1.8	18.1	3.6
If Costs Increases by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in millions of NR	(7.6)	1.7	27.1	21.2
Benefit/Cost Ratio	0.1	1.4	14.7	2.8

The pronouncement of economic viability for the horticulture component of RCUP rests with predicted high returns during Project Years 11-15. This should not be surprising, since this program category is concerned largely with tree crops which mature in yields several years after planting. Table XV reports on the dynamics of yield improvement from the year of planting to the year of full bearing which, for most fruit, is over 10 years after planting. Since the projected yield improvements are quite realistic in light of current performance in Nepal, it seems that investment in this program category should be justified by the potential net benefits.

(e) Program Category 2., Watershed Management

Many types of activities are listed on the RCUP Guide under watershed management. Although the economic costs of all these activities are involved in the analysis, the economic benefits are estimated only for five program categories: 2.A, terrace improvement; 2.B, trail improvement; 2.D, major improvement; 2.D, major gully control on range lands; 2.E, land slide rehabilitation; and 2.I, road slope stabilization. These program categories are all directed toward maintaining the productive capacity of the land and forest and water resources, in the context of Figure 1.

Each of the program categories pose special problems for the estimation of economic benefits. They are discussed individually below:

2.A. Terrace Improvement--The RCUP Guide describes the time pattern of terrace improvement activities. The total of 1,330 hectares involved will be distributed as follows: Kulelehani, 430 ha.; Gorkha, 600 ha.; Myagdi, 310 ha. The areas selected for project implementation are terraced areas where crop yields are declining and where small landslides, and sheet and gully erosion are occurring. Four kinds of benefits can be realized from improving such terraces:

i. Crop Improvement1/

The current crop production for the above three areas is estimated at an average gross value of NR 2500/ha/yr.2/ It is assumed that

1/ This proposal is for 1330 hectares and does not consider the other 51,000 hectares of cropland in the 4 catchment areas. Additional crop improvement benefits should be realized on the other crop land through an Extension Soil Conservation Program. This should amount to a 12 to 15% increase for the 15 year or perhaps a 1%/yr.

2/ APROSC staff estimates a without project net average crop return of NR 875/ha/yr or 355 of the gross.

the specific proposed project areas are yielding 75% of average terraced area and thus a gross value of production of NR 1875/ha/yr will be used for the without project situation.

With project it is assumed that the improved terrace lands will reach at least the average yield of the well managed surrounding areas, which is considered as NR 5997/ha/yr gross value.1/ It is further assumed that 50% of this with-project increase on the project lands can be attributed to terrace improvement.2/. The gross value difference of NR 2061/ha/yr can be considered a benefit for the proposed terrace improvement.

ii. Reduced Soil Loss3/

It is estimated that 90% of the project implementation will be on sloping terraces that have a soil loss of 40 MT/ha/yr. which can be reduced to 13 MT/ha/yr with the project. The remaining 10% of the project will be on level terraces where the soil loss is currently 12 MT/ha/yr. and which can be reduced to 6 MT/ha/yr.

Without project it is estimated that crop yields will be reduced by 1%/yr. Assuming that the current average annual gross value of production differential (with vs. without RCUP) is NR 1875, then the economic value of reduced soil loss would be NR 19/ha/yr.

iii. Decreased Labor Requirements3/

The regrading and retreading of the terrace will decrease the labor required for maintenance. It is estimated that the labor requirements will be reduced by 25%, and that terrace operation will require the same amount of time. If 10 man days per year are needed to maintain 1 hectare of terraces, then the project would save 2.5 man days/ha/yr. At 4.4 ruppees man-day total savings are calculated to be NR 11.0/ha/yr.

iv. Decreased Sediment Deposition

See Table IV for the approach to estimating reduced crop losses for this type of benefit. Since the terrace improvement will be done on the sloping terrace, a benefit of NR 12.07/ha./yr. can be identified from Table IV.

1/ APROSC staff estimate.

2/ Based on the judgement of specialists from the U.S. Soil Conservation Service who were assigned to the RCUP design phase July-August 1979.

3/ These assumptions are based on the judgement of the SCS specialists referenced earlier and discussions with APROSC technicians.

2.B. Trail Improvement--The proposed activity includes 25 km. of trail improvements in each of the three 5-year periods, as presented in The RCUP Guide. Initially, 12.5 km. of trail drainage will be undertaken in Myagdi, plus another 12.5 km. of trail drainage, regrading/rerouting, and artificial revegetation in Kulekhani. In the Kulekhani area assume that the regrading, rerouting and artificial revegetation is applied on the same length as the old trail, or 12.5 Km. If the average width is 1.5 m, the total area then would be 1.875 ha. In the Myagdi area assume that the proposed drainage treatment is on one half the trail area; then the area is 0.94 ha. Thus, it is estimated that a total area of 2.82 ha. will be treated over each of the three 5-year project periods. Two kinds of benefits will be generated:

i. Reduced Land Loss

The trail land value is approximately NR 40,000/ha. if 2.82 ha. would be lost without RCUP during each 5-year period, then the reduction loss of land value would total NR 112,800/5-year period.

ii. Decreased Labor Requirements

Regrading and rerouting will reduce labor and energy requirements for both humans and animals. It is estimated that about 100 people travel the existing trail each day in the Kulekhani area and that they spend 2/3 of a day on the 12.5 Km. trail. Based on knowledge about the trail, it is likely that project treatment will reduce labor requirements by 10%. Thus, the expected benefits at NR 4.4/day would be NR 11,000/yr. Assuming two other reroutings are undertaken, total benefits are forecast at NR 33,000/year.

iii. Reduced Sediment Deposition

See Table IV, which estimates benefits from this source to be NR 66.67/ha./year.

2.D. Major Gully Control on Range Land, and 2.E. Landslide Rehabilitation

The range denudation control activities (Program Category 2.D) involve 10,000/m of gully repair and 25 ha. of artificial revegetation in both Gorkha and Kulekhani, and 10,000/m. of gully repair and 50 ha. of artificial revegetation in Myagdi. The landslide rehabilitation work concerns 15 ha. of artificial revegetation in Kulekhani. Two main types of benefits can be anticipated:

i. Reduced Land Loss

Land loss and landslides in the critical areas covered under range denudation control will continue at rapid rates without RCUP. Existing gullies will expand, landslides be triggered, and new gullies developed. Landslides vary considerably in the amount of potential soil erosion and loss of productive land, ranging from lands becoming completely barren with high rates of soil erosion to lands continuing in production with slight to moderate erosion rates.

Assuming that the 10,000/m of gullies in each of the three range denudation areas have an average width of 15/m, then the total treatment area is 135 ha. of gullies with an average erosion rate of 200 MT/ha/yr. With an average soil denisty of 1.45 tons/cu.m., the lost soil volume would be 138 cu.m/ha/yr. If one meter average depth is eroded from gully edges, then each hectare would lose 38 sq.m. or 1.38% of the land would be lost each year. For the 135 ha. project area this would amount to 1.86 ha/yr. and for the 15-year period it would be about 28 ha. It is estimated that the average land value is NR 40,000/ha before the soil loss occurs and is valued at Nr 10,000/ha after. Thus NR 30,000/ha can be attributed to the land that would have been lost, or NR 55,800/yr.

ii. Reduced Sediment Deposition

See Table IV, which estimates benefits from this source to be NR 84.92/ha/year.

2.I. Road Stabilization--The activities in this program category are hyrdoseeding 24 ha., planting 25 ha., and drainage of 4.0 Km. of road in the Kulekhani area. An estimated soil loss of 150 MT/ha/yr is presently occuring. With the project the soil loss can be reduced to 12 MT/ha/yr.

Considering the 50 ha project area, 6900 MT/yr. will be prevented from being lost. Assume that 33%[1/] or 2277MT/yr reaches the Kulekhani reservoir. Expected benefits are unknown at this time; however, the sediment deposition in the Kulekhani reservoir will reduce the storage capacity and shorten its storage life. By reducing sediment yield to future reservoir sites, the project will make possible less-costly future reservoir designs.

1/ Laban, Peter, op. cit.

A further assumption can be made that 33% of the road sediment is dropped on the cropland and will reduce crop production.1/ If the deposition has an average depth of .05M on the cropland then 3.14 ha per year will be covered. It is assumed that 50% of the crop will be damaged. If the average annual gross crop value is NR 3500/ha/yr, then the crop loss for the 3.14 ha is NR 5500/yr.

The remaining 34% of the sediment will be deposited in the channel before it reaches the reservoir and may cause flooding or channel meandering. It is assumed that a 12 meter wide strip along the channel will sustain crop production damages each year. This would equal 1 ha per year or NR 3500/ha. loss annually that will be avoided by carrying out this component of watershed management.

A summary of the economic benefits discussed above is presented on page one of Table XVII. Their associated economic costs are summarized on page two of Table XVII, as are the resultant measures of economic efficiency which are reported below:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benefits-Costs) in millions of NR	(22.4)	(0.2)	0.9	(21.7)
Benefit/Cost Ratio	0	0.9	1.7	0.2
If Costs Increase by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in million of NR	(24.8)	(0.6)	0.5	(24.9)
Benefit/Cost Ratio	0	0.7	1.4	0.1

The very low benefit/cost ratio for this activity is primarily due to the inclusion of a significant amount of very costly structural work to protect critical areas, but to which few benefits can be directly attributed. The 900 hectares of terrace improvement, which accounts for about 60% of the benefits but less than 20% of the cost of this program, is the only activity with a positive benefit/cost ratio. The other major activities within this program area are important to the success of the project but provide few direct benefits. As shown on page one of Table XVII, some erosion and sediment control benefits were claimed, but the amounts are insignificant.

1/ Laban, Peter, op.cit.

On the basis of this economic analysis, some of the expensive structural procedures recommended for gully control and stream training may need to be re-examined. Alternative approaches, might be more cost-effective, although no comparisons can be made without additional data.

It should be noted that a recent report to Department of Soil and Water Conservation in HMG also questions expenditures for check dams.1/ Additionally the study reports on a number of check dams used for gully control and found the internal rates of return to be in the -3 to -13 percent range. Technical experts will need to examine the alternative approaches to the problem.

An alternative hypothesis focuses on likely complementarities between Program Categories 2, 5, 7, 8, and 9. Thus, it may be the case that significant contributing inputs for generating the positive net benefits reported for the other program categories are the watershed management activities included in Program Category 2. If so, then all or a large part of the economic costs of watershed management should be added into the impacted other program categories. This hypothesis clearly deserves further attention before deciding to curtail any watershed management investments.

(f) Program Category 6., Drinking Water

The RCUP Guide indicates the numbers of drinking water projects to be undertaken. As Figure 1 suggests, such projects are likely to have a favorable impact on the health of hill residents as well as to produce significant labor time savings. However, the analysis here is limited to estimating the net benefits in labor time savings from carrying the daily water supply to individual households.

Table XVIII presents anticipated economic benefits, economic costs, economic efficiency measures, and sensitivity analysis, as summarized below:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benfits-Costs) in millions of NR	(4.0)	4.8	3.4	4.2
Benefit/Cost Ratio	0.4	4.8	137.7	1.5
If Costs Increases by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in millions of NR	(5.0)	4.1	3.1	2.2
Benefit/Cost Ratio	0.3	3.9	110.7	1.2

1/ See A. Van Gelder "Comments on Soil and Water Erosion Control of the Department of Soil and Water Conservation" Report to DSWC, Ministry of Forestry.

Even though net benefits are biased downward due to the omission of health-related benefits, the investments in improved drinking water facilities appear to be justifiable economically based on labor time savings alone. The extremely high benefit/cost ratios reported for the third 5-year period of RCUP are the result of no capital costs being incurred during those project years. The more relevant ratios are those reported for the entire fifteen-year RCUP time horizon.

(g) Program Category 4., Energy

The energy component, as described in the RCUP Guide, is comprised of a variety of activities, the central objectives of which are to reduce the consumption of fuelwood. The main short-run strategy is to induce hill residents to become more efficient in their use of fuelwood by introducing improvements in existing stoves. The longer-run strategy involves a variety of experiments which are intended to provide alternatives to fuelwood as an energy source: solar cooking and water heating, bio-gas, and micro-hydro plants. Referring once again to Figure 1, this program category seeks to increase the efficiency of household energy consumption.

The stove improvement strategy (Program Category 4.A) focuses on the distribution of 590 new, more efficient (relative to existing stoves) wood-burning stoves. The RCUP Guide presents the numbers of new stoves expected to be in use over the initial 15 years of RCUP. Note that these numbers are conservatively low compared to the estimates contained in the Energy Appendix. According to that Appendix, each improved stove is expected to reduce fuelwood consumption by 50%, for the average-size household of six persons in the Nepali hills. At the value of NR 333/MT, these fuelwood savings are equivalent to the economic benefits shown for stove improvement in Table XIX. The associated economic costs of the new stoves are presented in that same table along with the economic efficiency measures and sensitivity analysis (using a 15% discount factor) as summarized below:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benefits-Costs) in millions of NR	0.2	0.3	0.2	0.7
Benefit/Cost Ratio	10.4	30.5	62.8	22.8

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
If Costs Increase by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in millions of NR	0.1	0.3	0.2	0.6
Benefit/Cost Ratio	8.5	25.0	56.5	18.9

The most obvious conclusion from those summary statistics is that stove improvements promise very high net economic benefits. In fact the large benefit/cost ratios suggest that this component of the energy program should probably be expanded beyond the levels outlined in the RCUP Guide. Of course, an operational decision in that direction should await empirical evidence that there is sufficient consumer acceptance of the new stoves to justify expansion. However, such large B/C ratios may easily justify significant subsidies to stimulate hill residents to adopt this innovation.

A different conclusion emerges with respect to the solar cooking and water heating experiments. These activities also will produce saplings in fuelwood consumption. The energy specialist on the design team has estimated that one solar cooker should save approximately one-third of the annual fuelwood consumption for a typical household in the Nepali hills. This estimate is equivalent to 0.6 MT/year of fuelwood for each household which uses a solar cooker.1/ Regarding the water being heating activity, the energy specialist estimates that approximately 4.5 MT/year of fuelwood can be saved for each 200 liter unit put into service.2/ Applying these estimates valued at NR 333/MT of fuelwood used throughout this analysis, to the numbers of solar cookers and water heating units listed in the RCUP Guide

1/ See the Energy Appendix, pp 6 and 43, for the estimate that a family of six uses approximately 600 kg/person/year, which equals 3.6 MT/year total household consumption. A one-third saving for half the number of days per year (allowing for cloud-cover) amounts to 0.6 MT/year per solar cooker.

2/ This estimate is based on an average of 25 Kg. of fuelwood per day being required to heat a 200 liter water storage tank to 60°C in two hours. Assuming, as in note 2/, that the unit will be operational for only half of the total days/year, the resultant savings amount to 4.5 MT/year of fuelwood for each water heating unit.

results in the forecast economic benefits presented in Table XX. Also shown in that table are the associated economic costs, the economic efficiency measures, and the sensitivity analysis, all of which are summarized below:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
If Costs Increase by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in millions of NR	(0.2)	0.1	-	0.1
Benefit/Cost Ratio	0.3	∞	∞	0.7
If Costs Increase by 10% and Benefits Decrease by 10%				
Net present Value (Benefits-Costs) in millions of NR	(0.1)	0.1	-	-
Benefit/Cost Ratio	0.2	∞	∞	0.6

Clearly, the solar demonstration program category must depend on empirical evidence from the early experiments in order to justify its continuation and expansion. While it would seem that the solar alternative to fuelwood should be explored, the RCUP ought to avoid major commitments of resources into this program category until field trials have produced the evidence of enough economic benefits to justify the economic costs.

Bio-gas units, Program Category 4.C, have been operating in Nepal since the early 1960's, according to the Energy Appendix (p.28). In fact a bio-gas newsletter has been started in Nepal. One of these newsletters (Letter No. 3, Winter 1978) contains estimates of economic benefits and costs for the standard 100 cu.ft. bio-gas units which will be installed at selected sites in the RCUP areas. Since these referenced estimates find that economic benefits are approximately equal to economic costs for the 100 cu.ft. units, this program category will not be analyzed further in this Project Paper.

The micro-hydro plants, bridges, and multi-purpose impoundment (Program Categories 4.D, 4.E, and 4.F) represent activities which need further specification as to site and design before any analysis of economic benefits and costs can be undertaken. These activities, therefore, might be viewed as experimental, the economic viability of which remains to be determined in the implementation phase of RCUP.

(h) Summary, All RCUP Programs

In addition to the program categories analyzed above, the RCUP Guide lists such activities as inventory and monitoring (Program Category 1), fisheries development (Program Category 10), training (Program Category 11), and building starts (Program Category 12). Benefits are not estimated for any of these program categories on grounds that they represent jointly incurred costs which yield benefits to all other program categories (applicable to Program Categories 1 and 11), that their costs and benefits are already subsumed by other activities (applicable to Program Category 12), or that they are experimental and research oriented (applicable to Program Category 10). However, their costs are included in the total RCUP economic costs, as should the costs of the RCUP Central Staff. Thus, the summation of the economic benefits from the other program categories must at least equal the total of all RCUP economic costs in order for the project to be judged economically viable.

A summary of economic benefits and costs (in U.S. dollars) from all program categories is presented in Table XXI. The first page of that table summarizes the economic benefits which have been estimated in the foregoing tables for each program category. Page two of Table XXI shows the estimated economic costs for each program category. Note that these cost estimates include a contingency factor of 10%/year. Page three of Table XXI presents the economic efficiency measures and sensitivity analysis for the RCUP as a whole. These summary indicators are given below:

	Total, Years 1-5	Total, Years 6-10	Total, Years 11-15	Total, Years 1-15
Using Estimates Reported Above				
Net Present Value (Benefits-Costs) in millions of U.S. $	(12.6)	11.4	13.0	11.5
Benefit/Cost Ratio	0.5	2.6	4.8	1.3
If Costs Increase by 10% and Benefits Decrease by 10%				
Net Present Value (Benefits-Costs) in millions of U.S. $	(16.2)	8.8	11.0	3.7
Benefit/Cost Ratio	0.4	2.2	3.9	1.1

These efficiency measures suggest that the collection of RCUP activities will be able to generate sufficient economic benefits to justify committing to RCUP the economic costs listed on page two of Table XXI. This conclusion is strengthened by the reminder that throughout this economic analysis (a) deliberate downward biases have been imparted to the estimates of benefits (e.g., some benefit components being omitted entirely and conservative estimation procedures being followed in every case), while (b) deliberate upward biases have been built into the estimates of costs (including a final 10%/year contingency factor). Detailed examination of the assumptions employed in this analysis, and in the various technical Appendices on which it is based, will support this judgement.

TABLE I

Bases for Estimating Net Economic Benefits from Forestry Programs

A. Fodder and Forage

Fodder will be produced mainly from two program categories: #5, Panchayat Forest Plantation Establishment-Fodder, and #8, Community/ Individual Plantings. However, Program Categories #6 (Private Forest Establishment) and #7 (Lease Forest Establishment) will also be assumed to produce fodder on the same expectations as Program Category #8. Forage, however, will be produced during Project Years 1-3 from all new plantations being established (program categories 3-7). Details are presented below, based on APROSC worksheets.

1. Fodder from Program Category 5 (Panchayat Forest Plantation Establishment-Fodder)

Plantings of fodder trees = 816 per ha. At a survival rate of 0.85, the number of surviving trees 816/ha. x 0.85 694 trees/ha.

(a) "with project" fodder benefits from lower region (Kulekhani and Gorkha):

i. for Plantation Establishment Years 6-9, 694 trees/ha. x 25 kg./tree/yr. yields 17,350 kgGW/ha./yr. At NR 3/25kgGw, the resultant gross benefits equal NR 2082/ha./yr.

ii. for Plantation Establishment Years 10 and beyond, 694 trees/ha. x 50 kg./tree/yr yields 34,700 kgGW/ha./yr. At NR 3/25 kgGW the resultant gross benefits equal NR 4164/ha./yr.

(b) "with project" fodder benefits from upper region (Myagdi and Mustang):

i. for Plantation Establishment Years 9-14, same as 1.(a)i.

ii. for Plantation Establishment Years 15 and beyond, same as 1.(a)ii.

(c) "without project" fodder/forage benefits from all project areas:. Current fodder/forage productions is estimated to be 7,000 kgGW/ha./yr (mostly gross forage). Without the RCUP, these quantities (on average) would be produced in all Panchayat Forest and National Plantation areas. Thus, the "with project" gross benefits should be reduced in all project years by the economic value of the 7,000 kgGW/ha./yr. of

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

fodder/forage which would have been produced anyway. Since this current fodder/forage production is mostly gross, its value is estimated at NR 1.5/20 kgGW, which is equivalent to NR 525/ha./yr.

2. Fodder from Program Categories 6-8 (Community/Individual, Other Private, and Lease Plantings)

For the number of seedlings distributed (see Program Guide for RCUP Output), half will be fodder trees. For these fodder trees, a survival rate of 0.6 should be assumed. Based on an average of 816 fodder trees planted/ha., the number of surviving trees 816/ha. x 0.6 490 trees/ha. only half of the total hectares for Program Category #8 will be fodder trees, Since the number of surviving fodder trees/ha. of community/ individual, other private, and lease plantings equals 0.5 x 490 or 245 trees/ha.

(a) "with project" fodder benefits from lower region (Kulekhani and Gorkha):

i. for Establishment Years 6-9, 245 trees/ha. x 25 kg./tree/yr. yields 6,125 kgGW/ha./yr. At NR 3/25 kgGw, the resultant gross benefits equal NR 735/ha.yr.

ii. for Establishment Years 10 and beyond, 245 trees/ha. x 50 kg./tree/yr. yields 12,250 kgGW/ha./yr. At NR 3/25 kgGw, the resultant gross benefits equal NR 1470/ha./yr.

(b) "with project" fodder benefits from upper region (Myagdi and Mustang):

i. for Establishment Years 9-14, same as 2.(a)i.

ii. for Establishment Years 15 and beyond, same as 2.(a)ii.

(c) "without project" fodder/forage benefits from all project areas: Current fodder/forage production is assumed to be unaffected by this program category, since these community/individual plantings will be widely scattered throughout the RCUP areas.

3. Forage from Program Categories 3-7 (All New Plantations)

(a) "With project" forage benefits will be realized as estimated below during Project Years 1-3:

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

i. for lower region, 500 kgGW/ha./yr. will be produced which, at NR 1.5/20 kgGW, is valued at NR 37.50/ha./yr.

ii. for upper region, 250 kgGW/ha./yr. will be produced which, at NR 1.5/20 kgGW, is valued at NR 18.75/ha./yr.

(b) "Without project" forage benefits are assumed to be the same as those indicated in 1.(c) above, i.e. 7,000 kgGW/ha./yr. for all project years, valued at NR 525/ha./yr.

B. Fuelwood and Timber

Fuelwood and/or timber will be produced from Program Categories 1-4 and 6-8. Details are presented below based on APROSC worksheets:

1. From Program Categories 1-2

These two program categories will provide improved management for the existing National Forests and Panchayat Protected Forests in the RCUP areas. Therefore, it is the incremental yield of fuelwood and timber, with vs. without the RCUP, which is relevant.

(a) Net increase in fuelwood/timber benefits with RCUP from the lower region. (Kulekhani and Gorkha):

i. Current growing stock average $60m^3$/ha., and current average annual growth without RCUP = 2%;

ii. Incremental average annual growth with RCUP = 3%, or .03/yr. x $60m^3$/ha. = $1.8m^3$/ha./yr.;

iii. Wastage factor in timber harvesting= 40%;

iv. Timber yield = $1.8m^3$/ha./yr. x 0.6 = $1.08m^3$/ha./yr. which yield is harvested each year. The current (subsidized) government price (at stump) is equivalent to NR 141.24/m^3. APROSC estimates[1/] that the unsubsized price should be about 50% higher. Thus, at an estimated unsubsidized price of NR 211.86/m^3, the net benefits from timber harvesting equal NR 229/ha./yr.

1/ Based on government prices in Kathmandur being NR 30/cu. ft.versus NR 55/cu. ft., in the private sector.

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

v. Fuelwood Yield = 2.0 times the estimated timber yield, or approximately $2.16m^3$/ha./yr., which is equivalent to 0.7 metric tons[2/]/m^3 x 2.16 m^3/ha./yr. = 1.51 MTGW/ha./yr., which yield, when valued at NR 10/30 kgDW, results in net benefits equal to NR 503/ha./yr.[1/]

(b) Net increase in fuelwood/timber benefits with RCUP from the upper region (Myagdi and Mustang):

i. Current growing stock averages $60m^3$/ha., and current average annual growth without RCUP = 2%;

ii. Incremental average annual growth with RCUP = 2%, or 0.02/yr. x $60m^3$/ha. = 1.2 m^3/ha./yr.;

iii. Wastage factor in timber harvesting= 25%;

iv. Timber yield = $1.2m^3$/ha./yr. x 0.75 = $0.9m^3$/ha./yr., which yield is harvested each year. As with the estimates for the lower region, at an estimated unsubsidized price of NR 211.86/m^3, the net benefits from timber harvesting equal NR 191/ha./yr.

v. Fuelwood Yield = 1.75 times the estimated timber yield, or approximately $1.575m^3$/ha./yr., which is equivalent to 0.7 metric tons/m^3 x 1.575 m^3/ha./yr. = 1.10 MTGW/ha./yr. which yield, when valued at NR 10/30 kgDW, results in net benefits equal to NR 286/ha./yr.

2. From Program Category 3

The National Forest Plantation Establishment will be a newly planted forest, so its entire yield can be attributed to RCUP, as estimated below:

(a) Total increase in fuelwood/timber benefits from the lower region are based on the following:

i. Age at harvest (average diameter of 40cm) = 50 years;

ii. Expected timber yield = $12m^3$/ha./yr., which yield, when valued at the estimated unsubsidized price of NR 217.86/m^3, results in net benefits equal to NR 2542/ha./yr.

1/ Based on fuelwood being 900 kg/m^3 GW versus 700 kg/m^3 DW.

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

iii. Expected fuelwood yield = 2.0 times the timber yield, or 24.0 m^3/ha./yr. which is equivalent to 0.7 metric tons/m^3/x 24m^3/ha./yr. = 16.8 MTGW/ha./yr. <u>When valued at NR 10/30 kgDW, the resultant net benefits equal NR 4368/ha./yr.</u>

(b) Total increase in fuelwood/timber benefits from the upper region are based on the following:

i. Age at harvest (average diameter of 40cm) = 70 years;

ii. Expected timber yield = 9m^3/ha./yr., which yield <u>when valued at the estimated unsubsidized price of NR 211.86/m^3, results in net benefits equal to NR 1907/ha./yr.</u>

iii. Expected fueldwood yield = 1.75 times the timber yield, or 15.75 m^3/ha./yr., which is equivalent to 0.7 metric tons/m^3 x 15.75 m^3/ha./yr. = 11.0 MTGW/ha./yr. <u>When valued at NR 10/30 kgDW, the resultant net benefits equal NR 2860/ha./yr.</u>

3. <u>From Program Category 4</u>

The Panchayat Forest Plantation Establishment - Fuelwood will be a newly planted forest, so its entire yield can be attributed to RCUP, as estimated below:

(a) Total Increase in fuelwood benefits from lower region:

Age (Years)	Expected Diam. (Cm)	Trees (Numbers)	Yield (Tons/ha.) 1/ GW	DW	Net Benefits (NR/ha.) 2/
0	0	2500	0	0	0
8	8	1250	10	8	2,664
14	15	625	25	19	6,327
20	25	625	60	46	15,318

1/ Based on DW = 0.78 GW.

2/ Based on market value of NR 10/30 kgDW or NR333/MTDW.

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

(b) Total increase in fuelwood benefits from upper region:

Age (Years)	Expected Diam. (cm)	Trees (Numbers)	Yield (Tons/ha.) GW	Yield (Tons/ha.) DW	Net Benefits (NR/ha.)
0	0	2500	0	0	0
11	8	1250	10	8	2,664
18	15	625	25	19	6,327
25	25	625	60	46	15,318

The above estimates of benefits should be applied separately to each year of planting.

4. From Program Categories 6, 7, and 8

Each of these program categories represents some type of private planting. Since they will be new, their entire yield of fuelwood (no timber) can be attributed to RCUP. For the number of seedlings distributed (see Program Guide for RCUP Output), half will be fuelwood trees. For these fuelwood trees, a survival rate of 0.6 should be assumed. Based on an average of 816 fuelwood trees planted/ha., the number of surviving trees = 816/ha. x 0.6 = 490 trees/ha. Since only half of the total hectares for Program Category #8 will be fuelwood trees, the number of surviving fuelwood trees/ha. of community/individual or other private plantings equals 0.5 x 490 or 245 trees/ha.

(a) Total increase in fuelwood yields from lower region equals 245 trees/ha. x 150 kg./tree = 36,750 kgGW/ha. at the end of 20 years. At a price of NR 10/30 kgDW, the resultant net benefits = NR 8208/ha. at harvest.

(b) Total increase in fuelwood yields from upper region equals 245 trees/ha. x 150 kg./tree = 36,750 kgGW/ha. at the end of 25 years. At a price of NR 10/30 kgDW, the resultant net benefits = NR 8208/ha. at harvest.

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

C. Decreased Soil Loss

Soil loss on unmanaged forest lands and lands proposed for forest planting is estimated at 32MT/ha/yr. With an improved forest program the soil loss from erosion will be reduced at 6MT/ha/yr.

It is assumed that without project the continued soil depletion will reduce forage fuel and timber production 1%/year. For the managed national forests and panchayat protected forests, it is estimated that production loss without the project is occurring at the rate of 0.2% of the current production per year.

D. Decreased Losses From Soil Deposition

See Table 9 for estimates of net benefits from this source.

E. Benefits due to Divergence between Market Wages and the Social Opportunity Cost of Labor

The market wage rate of NR 7/day is used as the appropriate payment for unskilled labor employed on the RCUP. However, this rate represents peak-season hired labor, where the peak season is defined as a 4-month period. For the remaining 8-month period, a zero opportunity cost of labor will be assumed (see the discussion in the Analytical Framework for justification of this assumption.

The quantity of unskilled labor employed on the RCUP is estimated below, based on APROSC worksheets for the Myagdi project area:

	Percentage Unskilled Labor by Cost Categories					
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Avg. Yr. 1-5
Capital Costs	29.5	36.7	30.1	35.6	43.4	35.3
Operating Costs	13.7	28.4	40.9	49.3	53.1	43.9
Total Costs	21.4	32.6	33.7	42.6	49.1	39.5

The forestry sector specialists on the APROSC staff believe that the above averages for Project Years 1-5 will be acceptable estimates for the other three project areas. Thus, forestry capital costs for all areas of RCUP will

TABLE I (continued)

Bases for Estimating Net Economic Benefits from Forestry Programs

be assumed to be comprised of 35% unskilled labor, while the comparable figure for operating costs will be 44%. These estimates are judged to be downward biased, since the APROSC worksheets reveal a slightly rising trend in the percentage of unskilled labor costs in total costs through Project Years 6-15.

What this means is that the difference between the market wage of NR 7/day and the social opportunity cost of NR 2.5/day (based on a zero social opportunity cost for approximately 8 months per year in rural areas) can be claimed as a benefit to RCUP. Consequently, 13% of capital costs ($\frac{7.0-4.4}{7.0}$ x 35%) and 16% of operating costs ($\frac{7.0-4.4}{7.0}$ x 44%) for the forestry sector of RCUP can be claimed as project benefits (due to payment of wages in excess of the social opportunity cost of labor).

F. Decreased Labor Requirements for Harvesting Fodder, Fuelwood, and Timber

During Project Years 1-15, it is not clear that significant time savings will be generated in harvesting fodder, fuelwood, and timber from the newly established plantations. The reason is that, during the growing period, rural residents will be forced to do such harvesting in slightly more distant locations (unlike the immediate gains in additional forage output which will be achieved from the better management of existing pastures and ranges). Consequently, zero net benefits will be assumed from this source for all forestry programs.

TABLE II

Forage Production for Pasture and Range Programs

Project Area	Without Project		With Project	
	MTDW/ha./yr.1/	NR/ha./yr.2/	MTDW/ha./yr.1/	NR/ha./yr.2/
Pasture:				
Kulekhani Lower Gorka Lower Myagdi	1.2	450	6.23/	2325
Range:				
Mustang Subalpine meadows	3.0	1125	6.04/	1815
Mustang cool temperature	2.0	750	4.04/	1500
Upper Mustang	0.14	52	0.54/	180

From UNFAO/IBRD unpublished report, Trisuli Watershed Rural Development ›ject", Vol. III, July 1974. Although it is assumed that forage production will ıain the same for the next 15 years, it is recognized that unpalatable invader :cies will increase and will decrease usuable forage. This amount is difficult determine and not considered in benefits.

RCUP pasture livestock staff propose NR 2.5/20 KgGW. FAO and IBRD Reports, ;ed on livestock returns, range from NR 0.65 to 1.5/20 KgGW. Based on labor ıuirements, the value ranges from 2.0 x 5.0/20 KgGW. Therefore, the ıservatively low value of NR 1.5/20 KgGW was used to estimate the value of net ıefits, with dry weight estimated to be 20% of green weight.

An "established period" of 2 years will be required before obtaining improved ›lds from pasture. Thus, a lag of 2 years will be required before the areas licated in the RCUP Guide under Program Categories 7A, 7B, 7C, 7E, 7F, and 7G .1 produce this yield.

An "established period" of 3 years will be required before obtaining improved ›lds from ranges. Thus, a lag of 3 years will be required before the areas licated in the RCUP Guide under Program Category 7D will produce these yields.

TABLE III

Soil Erosion Estimates

Land Use	METRIC TONS/ha./yr.[1/]	
	Without Project	With Project
Range Land	35	7
Pasture	30	6
Trails	160	10
Critically Eroded Areas (Range denudation, land slides)	200	15
Forests	32	6
Terraces (Level)	12	8
Terraces (Sloping)	40	13
Roads	150	12

Estimates based on field observations of Kulekhani and Gorkha project areas plus eview of resource reports and studies, including G.P. Kandel, "Report on pended Sediment Measurement in Kathmandu Valley", unpublished UNFAO report, June, 8.

P. Leban, "Field Measurements on Erosion and Sedimentation in Nepal", ublished UNFAO report, September 1978; M.E. Stevens, "Land Use Pattern for ginal Land and Erosion", unpublished UNFAO report, March 1978; and D.B. Thorud, al., "Land Use Practices for the Conservation and Development of Nepali Soil and er Resources", unpublished UNFAO consultants' report, December, 1977.

TABLE IV

Estimated Crop Losses from Sediment Deposition

NALYTICAL CATEGORY	Land Use in Total RCUP Area Range Improvem't	Pasture Improvem't	Forest Improvem't	Sloping Terraces	Level Terraces	Critical Areas	Trail Improvem't
. EROSION:							
ı in Ha. 1/	5,141	14,559	104,126	1,210	120	120	3
sion without Project 2/	35	30	32	40	12	200	160
sion with Project 2/	7	6	6	13	8	15	10
sion duction 2/	28	24	26	27	4	185	150
sion duction 3/	143,940	349,416	2,707,276	32,670	480	22,220	450
ED. DEPOSIT: 4/							
range and pasture	15	15	15	15	0	15	15
cultivated land	18	18	18	18	33	18	18
stream channels	33	33	33	33	33	33	33
of project area	34	34	34	34	34	34	34
. DEPOSIT VOLUMES: 5/							
range and pasture	14,900	36,100	280,100	3,380	0	2,300	47
cultivated land	17,900	43,400	336,100	4,050	110	2,800	56
stream channels	32,800	79,500	616,100	7,440	110	5,100	102
P DAMAGE:							
range and pasture 6/	7.5	18.1	140.1	1.6	0	1.2	0.02
cultivated land 7/	5.8	86.8	672.2	8.1	0.3	5.6	0.11
m stream floods 8/	6.6	15.9	123.2	1.5	0.03	1.0	0.02

Footnotes: see next page.

TABLE IV (continued)

Estimated Crop Losses from Sediment Deposition

JALYTICAL :ATEGORY	Land Use in Total RCUP Area Range Improvem't	Pasture Improvem't	Forest Improvem't	Sloping Terraces	Level Terraces	Critical Areas	Trail Improvem't
;S VALUE OF :ODUCTION:							
'ange and ›asture 10/	1,080	1,080	1,080	1,080	1,080	1,080	1,080
:ultivated land 11/	2,500	2,500	2,500	2,500	2,500	2,500	2,500
looded land 12/	2,500	2,500	2,500	2,500	2,500	2,500	2,500
P. LOSSES FROM DEPOSITS:							
ange and sture	12,150	29,320	226,960	2,660	0	1,940	30
.ultivated nd	44,750	108,500	840,250	10,080	330	7,000	140
looded land	8,250	19,880	154,000	1,870	40	1,250	30
L LOSSES 13/	12.67	10.83	11.73	12.07	3.08	84.92	66.67

1/ Based on hectares specified in "Program Guide for RCUP Output".
2/ Metric tons per hectare per year based on Table II data.
3/ Total tons per year.
4/ Sediment deposition percentage distributions are based on P. Laban, "Field Measurements on Erosion and Sedimentation in Nepal", unpublished UNFAO report, September 1978.
5/ Cubic meter per year at 1.45 tons per cu.m. average density.
6/ Hectares per year at 0.20 m average deposition depth.
7/ Hectares per year at 0.05 m average deposition depth.
8/ Hectares per year with 1 m^3 sediment causing 2 m^2 flooding every two years.
9/ Gross value of production in NR/ha./yr. based on average value of annual output currently being realized in the RCUP project areas.
10/ NR/yr. at full crop loss first year and half crop loss second year.
11/ NR/yr. at half crop loss for one year.
12/ Full crop loss every two years (or half crop loss each year).
13/ NR/ha/yr. average

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TABLE V

Forest Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS ALL PROGRAM CATEGORIES	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15
A. Economic Benefits1/								
3.J. Management of National Forest								
and Parch. Protected Forest:								
-Fuelwood Harvest	-	-	14,164	28,304	29,147	71,615	145,735	145,735
Timber Harvest	-	-	7,487	14,961	15,407	37,855	77,036	77,036
-Fodder Harvest	-	-	-	-	-	-	-	-
-Total	-	-	21,651	43,265	44,554	109,470	222,771	221,771
3.G. National Forest Plantation Estab:								
-Fuelwood Harvest	-	-	-	-	-	-	-	-
-Timber Harvest	-	-	-	-	-	-	-	-
-Total	-	-	-	-	-	-	-	-
3.B. Panchayat Forest Plantation Estab:								
-Fuelwood Harvest	-	-	-	-	-	-	272	2,894
-Timber Harvest	-	-	-	-	-	-	-	-
-Fodder Harvest	-	-	-	-	-	-	1,491	14,104
-Total	-	-	-	-	-	-	1,763	16,998
3.C. Community/Individual Plantings,								
3.E. Lease Forest Establishment:								
3.F. Private Forest Establishment:	-	-	-	-	-	-	-	-
-Fuelwood Harvest	-	-	-	-	-	-	-	-
-Timber Harvest	-	-	-	-	-	-	-	-
-Fodder Harvest	-	-	-	-	-	-	1,518	10,079
-Total	-	-	-	-	-	-	1,518	10,079
Lost Forage Yield due to 3.B, 3.E, 3.F, 3.G	(13)	(196)	(553)	(1,112)	(1,783)	(3,657)	(20,556)	(39,486
Increased Output Yields due to:								
-Reduced Soil Loss	-	-	34	69	71	173	354	354
-Reduced Sediment Deposition	1	6	434	867	911	2,219	5,181	5,903
-Total	1	6	468	936	982	2,392	5,535	6,257
Total Benefits, All Program Categories	(12)	(190)	21,566	43,089	43,753	108,205	211,021	216,619

1/ The estimation of all economic benefits is based on applying the approaches outlined in TABLE I to the areas specified in th "Program Guide to RCUP Output".

TABLE V (continued)

Forest Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS ALL PROGRAM CATEGORIES	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
B. Economic Benefits									
Capital Costs	(2,560)	(5,892)	(8,213)	(7,473)	(6,998)	(31,136)	(37,057)	(33,466)	
Operating Costs	(2,452)	(3,623)	(5,679)	(8,051)	(9,377)	(29,182)	(56,121)	(61,456)	
Total Costs, All Program Categories	(5,012)	(9,515)	(13,892)	(15,524)	(16,375)	(60,318)	(93,178)	(94,922)	
C. Economic Efficiency Measures									
1. Undiscounted Benefits-Costs	(5,024)	(9,705)	7,674	27,567	27,378	47,888	117,843	121,697	
2. NPV (B-C), at 15% Disc. Factor:									
-NPV Benefits	(10)	(144)	14,212	24,690	21,789	60,537	69,215	35,526	165,278
-NPV Costs	(4,360)	(7,203)	(9,155)	(8,895)	(8,155)	(37,768)	(30,562)	(15,567)	(83,897
-NPV (B-C)	(4,370)	(7,347)	5,057	15,795	13,634	22,769	38,653	19,959	81,381
3. B/C Ratio, at 15% Disc. Factor	-	-	-	-	-	1.6	2.3	2.3	2.0
D. Sensitivity Analysis (@ 15% D.F.)									
1. Changes in NPV Benefits, if:									
(a) 10% decrease in total benefits	0	0	-1,421	-2,469	-2,179	-6,069	-6,921	-3,553	-16,573
(b) 33% decr. in yields or prod. prices 1/	0	0	-4,709	-8,181	-6,923	-19,813	-24,468	-13,522	-57,803
2. Changes in NPV Costs if:									
(a) 10% increase in total costs	+ 436	+ 721	+ 915	+ 889	+ 816	+ 3,777	+ 3,056	+ 1,557	+ 8,390
(b) 33% increase in NR/$ exchange rate	+ 245	+ 380	+ 393	+ 352	+ 296	+ 1,666	+ 908	+ 411	+ 2,985
(c) Op. Cost Labor is 60% mkt. wage	- 630	-1,019	-1,303	-1,294	-1,200	- 5,446	- 4,525	- 2,326	-12,297
3. B/C Ratio, at 15% Disc. Factor, if:									
(a) D.1 (a), D.2 (a) changes occur						1.3	1.9	1.9	1.6
(b) D.1(b), D.2(a), D.2(c) changes occur						1.1	1.5	1.5	1.3
(c) D.1 (b) and D.2 (c) changes occur						1.0	1.3	1.3	1.2

1/ Case D.1 (b) is relevant to the estimated HMG subsidy (to purchase) of approximately 50% of the government price of timber (se TABLE 1). The effect of a 33% drop in product prices is to deduct from net benefits to the value of the estimated subsidy.

TABLE VI

Livestock Programs: Estimated Impact of Project on Livestock Development

Production Parameters by Type of Activity	Without Project Year 0	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Average Second Five Years	Average Third Five Years
(1) Buffalo [1/]								
Herd size (000' heads)	51							
Mortality rate (%)	12	12	12	11	11	10	8	7
Off-take rate (%)	7	7	7	8	9	10	12	15
Meat production, kg/head	80	80	80	82	84	86	96	104
Production Parameters:								
Calving percentage [3/]	45	45	46	47	48	50	55	60
Milk female percentage	100	100	100	100	100	100	100	100
Milk yield - litre/day	2.2	2.2	2.25	2.25	2.3	2.4	2.75 [2/]	3.25 [3/]
Lactation length - days	300	300	300	300	300	300	300	300
(2) Cattle								
Herd size (000' heads)	128							
Mortality rate (%)	15	15	15	14	14	13	12	10
Off-take rate (%)	1	1	1	1.5	1.5	2	3	4
Production Parameters:								
Calving percentage [4/]	40	40	40	41	42	43	45	50
Milk female percentage	100	100	100	100	100	100	100	100
Milk yield - litre/day	0.8	0.8	0.81	0.82	0.83	0.84	0.92	1.0
Lactation length - days	240	240	240	240	240	240	240	240

1/ At present there are 16% youngstock male and 3% adult male. As soon as 16% youngstock male mature, total 15% out of total adult and youngstock population (i.e. 19%) will be slaughtered and the rest (4%) will be kept for breeding purposes.

2/ Increases from 2.4 to 3.0 over the period.

3/ Increases from 3.0 to 3.5 over the period.

4/ Out of total adult females.

TABLE VI (continued)

Livestock Programs: Estimated Impact of Project on Livestock Development

Production Parameters by Type of Activity	Without Project Year 0	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Average Second Five Years	Average Third Five Years
(3) Sheep 5/								
Flock size (000' heads)								
Mortality rate (%)	30	30	28	27	26	25	20	18
Production Parameters:								
Lambing percentage	60	60	62	65	68	70	80	90
Wool production - Kg/head 6/	0.55	0.55	0.58	0.6	0.65	0.7	0.85	1.0
Meat production (edible) - Kg/head, i.e. adult male	14	14	14	14	14.3	14.5	15	16
(4) Goat 5/								
Flock size (000' heads)								
Mortality rate (%)	30	30	28	27	26	25	20	18
Production Parameters:								
Kidding percentage	80	80	85	90	95	110	130	150
Meat production (edible) - Kg/head, i.e. adult male	15	15	16	16	16.5	17	18	20
(5) Poultry 7/								
Production Parameters:								
Egg production-number per bird per year	30	30	33	35	38	40	50	60
Meat production - Kg/bird (edible)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

5/ Out of total 15% adult male, 13% will go for slaughtering and the rest (2%) will be kept for breeding purposes every year, assuming growth rate is zero (national average) in case of sheep/goat.

6/ Kage sheep - 0.30 Kg/head. Baremal sheep - 0.80 Kg/head. Carcas weight - 65-70% of total live weight.

7/ Total 30# out of total 54% adult male and female will go for slaughtering (meat purposes).

TABLE VII

Labor Requirements for Livestock Forage Needs

Types of Labor for Pastures and Ranges	Without Project		With Project	
	Man-Days/L.U	NR/ha.	Man-Days/L.U	NR/ha.
Pastures:				
Forage Hand-Harvested	164 1/	132 2/	41 1/	33 2/
Herding While Grazing 3/	9.2	14	4.6	7.0
Ranges:				
Herding While Grazing 4/	4.6	7	2.3	3.5

1/ Estimated average harvested feed requirement of a worked livestock unit in 8,210 kgGW/yr. To harvest this amount requires 1642 hours of labor for unmanaged pastures, but only 410 for managed pastures. Assuming a 10-hour workday, this is equivalent to the man-days/livestock unit reported above.

2/ The total 14,559 ha. of pasture (see RCUP Guide) being improved can produce enough forage for 5,319 livestock units, based on the yields reported in Table II. Therefore, the man-days required to produce sufficient forage, assuming that 50% of total feed requirements are hand-harvesting, are equivalent to 30 without RCUP and 7.5 with RCUP. When valued at the opportunity cost of NR 4.4/man-day, this data result in the labor costs in NR/ha. shown above.

3/ Assuming that 50% of the time feeding requirements are provided by grazing, that one man can herd 10 livestock units, and that herding is practical in 50% of the total area, the resultant requirements in man-days and NR/ha. are shown estimated above.

4/ Based on Table II yields and the distribution of land between types of ranges, as reported in the RCUP Guide, the weighted-average productivity of ranges is estimated to be 50% of managed pastures.

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TABLE VIII

Community Livestock-Range-Pasture Management Programs: Summary of Economic Benefits and Costs, Years 1-15 (all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS, BY PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS	TOTAL, YEARS	TOTAL, YEARS
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	1-5	6-10	11-15
A. Economic Costs								
1. Range and Pasture Management:								
Increased Forage Yields[1/] due to								
-Range Mgmt. (Prog. Cat. 7D)	-	-	-	-	52	52	4,891	14,353
-Pasture Mgmt. (Prog. Cat. 7A-C, E-G)	-	-	3	199	638	840	26,812	84,960
-Total	-	-	3	199	690	892	31,703	99,313
Increased Crop Yields due to:								
-Reduced Soil Loss[2/]	-	-	-	1	2	3	76	238
-Reduced Sediment Deposition[3/]	-	-	-	1	5	6	217	673
-Total	-	-	-	2	7	9	293	911
Decreased Labor for Herding and Hand-Harvesting of Fodder[4/]								
-Range Management	-	-	-	-	3	3	259	760
-Pasture Management	-	-	-	11	36	47	1,516	4,803
-Total	-	-	-	11	39	50	1,775	5,563
Total Range and Pasture Benefits	-	-	3	212	736	951	33,771	105,787
2. Livestock Management:								
Increased Yields of Final Prod.[5/]								
-Milk	-	2,127	3,727	6,031	9,803	21,688	128,070	255,989
-Meat	-	1,332	1,450	1,712	1,974	6,468	13,705	19,552
-Eggs	-	236	410	659	843	2,148	8,043	11,968
-Total	-	3,695	5,587	8,402	12,620	30,304	149,818	287,509
Increased Yield of Farmyard Manure[6/]	-	524	1,102	1,801	2,664	6,091	30,275	75,210
Total Livestock Benefits	-	4,219	6,689	10,203	15,284	36,395	180,093	362,719
3. Total Benefits, All Program Categories	-	4,219	6,692	10,415	16,020	37,346	213,864	468,506

1/ Based on applying increased value of forage production due to RCUP (see TABLE II) to areas specified in RCUP Guide.

2/ based on the references given in Table III, without RCUP continued soil loss would reduce existing forage output by 1% per year.

3/ From TABLE IV, reduced sediment deposition losses with RCUP are estimated at NR 12.67/ha./yr. for ranges and NR 10.83/ha./yr. for pastures.

4/ See Text for bases of labor time savings estimates.

TABLE VIII (continued)

Community Livestock-Range-Pasture Management Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS, BY PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5				
B. Economic Costs									
Capital Costs	(1,178)	(4,495)	(2,055)	(2,480)	(3,403)	(13,611)	(11,038)	(12,954)	
Credit to Producers	-	(170)	(311)	(347)	(56)	(884)	-	-	
Operating Costs (excl. forage)	(616)	(1,683)	(2,849)	(4,015)	(5,029)	(14,192)	(13,551)	(14,286)	
Forage Costs 7/	(160)	(3,353)	(5,304)	(8,286)	(12,900)	(30,003)	(125,025)	(271,238)	
Total Costs, All Inputs	(1,954)	(9,701)	(10,519)	(15,128)	(21,388)	(58,690)	(149,614)	(298,478)	
C. Economic Efficiency Measures									
1. Undiscounted Benefits-Costs	(1,954)	(5,482)	(3,827)	(4,713)	(5,368)	(21,344)	64,250	170,028	212,934
2. NPV (B-C), at 15% Disc. Factor									
-NPV Benefits	-	3,194	4,410	5,967	7,978	21,549	70,147	76,834	168,530
-NPV Costs	(1,700)	(7,344)	(6,932)	(8,668)	(10,651)	(35,295)	(49,073)	(48,950)	(133,318)
-NPV (B-C)	(1,700)	(4,150)	(2,522)	(2,701)	(2,673)	(13,746)	21,074	27,884	35,212
3. B/C Ratio, at 15% Disc. Factor						0.6	1.4	1.6	1.3
4. Internal Rate of Return (%)									
D. Sensitivity Analysis (@ 15% D.F.)									
1. Changes in NPV Benefits if									
(a) 10% decrease in total benefits	0	-319	-441	-597	-798	-2,155	-7,015	-7,684	-16,854
(b) zero savings in labor time for herding and hand-harvesting	0	0	0	-6	-19	-25	-582	-912	-1,519
2. Changes in NPV Costs if									
(a) 10% increase in total costs	+170	+734	+693	+867	+1,065	+3,530	+4,907	+4,895	+13,332
(b) 33% incr. in NR/$ exclu. rate	+318	+84	+90	+79	+66	+637	+80	+65	+782
3. B/C Ratio, at 15% Disc. Factor, if D.1(a) and D.2(a) changes occur						0.5	1.2	1.3	1.0
4. Internal Rate of Return (%) if D.1(a) and D.2(a) changes occur									

7/ Includes value of increased forage due to RCUP in addition to costs report in financial analysis.

TABLE IX

Estimated Cropping Intensity Increases Due to Irrigation[1/]

ANALYTICAL CATEGORY	Kulekhani 2/	Kulekhani 3/	Gorkha 2/	Gorkha 3/	Myagdi 2/	Myagdi 3/	Mustang 2/	Mustang 3/	4-Area Total or Average
Type of Irrigation:									
Full	1.89	6	2.00	3.0	1.58	0.25	1.54	6.0	
Seasonal	1.80	10	1.66	6.0	1.55	0.8	1.40	0.7	
Rainfed	1.73	9	1.15	5.0	1.32	9.5	1.00	1.6	
Wtd. Avg.	1.80	-	1.38	-	1.34	-	1.33	-	
Area in Hectares:									
Cultivated 4/	7,780		27,166		11,696		5,113		51,755
Fully Irrig.	467		815		29		307		1,618
Seasonally Irrig.	778		1,630		94		35		2,537
Rainfed	700		1,358		1,111		82		3,251
Avg. Intensity Calc.									
Fully Irrig. 5/	882		1,630		46		472		3,030
Average 6/									1.87
Seasonal Irrig. 7/	1,400		2,706		145		50		4,301
Average 8/									1.70
Rainfed 9/	1,211		1,562		1,467		82		4,322
Average 6/									1.33

Summary: 1. Cropping intensity increase from rainfed to full irrigation = 1.87 - 1.33 = .54 increase.

2. Cropping intensity increase from rainfed to seasonal irrigation = 1.70 - 1.33 = .37 increase.

1/ Cropping intensity, precent irrigated, and cultivated area and irrigated area figures are without project.
2/ Cropping intensity, where one crop/yr. = 1.00 cropping intensity.
3/ Percent of cultivated area under irrigation.
4/ Excludes fruit crops.
5/ Percent cultivated area under full irrigation times cultivated area times cropping intensity.
6/ Total from line above divided by total hectares fully irrigated.
7/ Same area as for footnote 5 but with increased cropping intensity due to seasonal irrigation.
8/ Total from line above divided by total hectares seasonally irrigated.
9/ Same area as for footnote 5 but with increased cropping due to rainfed irrigation.
10/ Total from line above divided by total hectares rainfed.

TABLE X

Estimated Cropping and Income Changes on Cropland Due to Project-Provided Irrigation on Land that is Currently Rainfed

Project Region & Total Rainfed Land	Crop	% of Existing Rainfed Cropland		Net Value of Production (NR/ha.)		Weighted Average 2/ Net Value of Production (NR/ha.)	
		Without Project	With Project	Without 1/ Project	With Project 1/	Without Project	With 3/ Project
Myagdi 1,111 ha.	Corn	12.5	11.7	-394 4/	470	-49 4/	55
	Ghaiya	7.5	-	36	-	3	-
	Paddy	24	49.2	2811	3586	675	1764
32.4%	Wheat	4	16.6	200	1004	8	167
	Fallow	25	17.5	-	-	-	-
	Millet	11	-	166	208	18	-
	Pulses	11	-	550	652	60	-
	Other	5	5	67	563	3	28
	Total	100.0	100.0			718	
	Wtd. Avg.						2014
Mustang 82 ha.	Barley	-	30	3863	4501	-	1350
	Buckwheat	30	25	915	1181	275	295
	Wheat	-	15	803	1241	-	186
	Fallow	65	15	-	-	-	-
2.5%	Oilseeds	5	5	252	331	13	17
	Other	-	10	1047	1142	-	114
	Total	100.0	100.0				
	Wtd. Avg.					228	1962
Gorkha 1,358 ha.	Paddy	5	48.3	2385	3318	119	1603
	Ghaiya	15	-	36	-	5	-
	Wheat	5	30	200	481	10	144
	Fallow	22.5	5	-	-	-	-
41.8%	Corn	12.5	1.7	166	912	21	16
	Oilseeds	12.5	5	1051	1103	131	55
	Millet	15	-	107	-	16	-
	Barley	7.5	-	46	-	3	-
	Pulses	-	5	1557	1655	-	83
	Other	5	5	545	870	27	44
	Total	100.0	100.0				
	Wtd. Avg.					332	1945

Footnotes: see next page.

TABLE X (continued)

Estimated Cropping and Income Changes on Cropland Due to Project-Provided Irrigation on Land that is Currently Rainfed

Project Region & Total Rainfed Land	Crop	% of Existing Rainfed Cropland		Net Value of Production (NR/ha.)		Weighted Average[2] Net Value of Production (NR/ha.)	
		Without Project	With Project	Without[1] Project	With Project[1]	Without Project	With[3] Project
Kulekhani 700 ha.	Paddy	32.5	50	1889	2887	614	1443
	Fallow	20	5	-	-	-	-
	Wheat	5	25	24	694	1	174
21.5%	Oilseeds	17.5	5	1466	1509	257	75
	Corn	5	-	1070	-	54	-
	Millet	7.5	-	730	-	55	-
	Pulses	7.5	-	836	-	63	-
	Ghaiya	5	-	36	-	2	-
	Potato	-	15	4941	6886	-	1033
	Total	100.0	100.0				
	Wtd. Avg.					1046	2725
WEIGHTED AVERAGE FOR FOUR PROJECT AREAS						617	1520
						650	1477

Represents total N.V.P. due to all project inputs.

Equals sum of percentages of existing rainfed cropland times net value of production NR/ha.

With all inputs except irrigation remaining the same as without project.

Minus figure due to infestation of corn borer. Under current practices this loss is pected to continue.

TABLE XI

Agronomy Programs: Proposed Area Under Packages of Practices 1/
(all figures are in hectares)

CROPS	First Five Years, Cumulative Hectares					NON ACCUMULATED		
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yrs. 6-10	Yrs. 11-15	Yrs. 1-15
(1) Paddy	326	1300	2730	4570	6528	8020	9173	23721
(2) Wheat	241	966	2047	3419	4674	6008	6901	17583
(3) Maize	656	2748	5778	9638	13770	16808	19648	50226
(4) Millet	174	695	1515	2580	3748	4012	4353	12113
(5) Barley	8	32	81	148	234	381	537	1152
(6) Pulses	11	52	131	221	314	594	981	1889
(7) Potato	47	185	388	666	901	1305	1595	3801
(8) Oilseeds	-	15	33	119	169	402	518	1089
(9) Sugarcane	-	-	2	4	6	36	53	95
(10) Ghaiya	5	31	65	104	151	265	360	776
(11) Buckwheat	-	8	21	36	58	94	121	273
(12) Naked Barley	4	18	67	130	197	311	427	935
Total All Crops	1,472	6050	12,858	21,635	30,750	38,236	44,667	113,653

1/ Includes improved varieties under improved practices (chemical fertilization, plant protection measures, better crop management and improved land preparation) and local varieties of good qualities and improved practices.

TABLE XII

Agronomy Programs: Commodity Yields, Costs of Production, and Gross and Net Values of Production Changes in RCUP Areas.

odities	Commodity Yields (MT/ha.) 1/		Costs of Production (NR/ha.) 2/		Gross Value of 3/ Production (NR/ha.)		Net Value of Production (NR/ha.)	
CUP Areas	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
khani:								
dy	0.02	2.45	2589	3105	4040	4900	1451	1795
at	0.8	1.4	1393	2026	1723	3009	330	983
ze	1.2	1.68	2435	2635	2591	3536	156	901
let	1.05	1.15	814	1027	1625	1978	838	951
ley	0.68	0.8	828	947	1021	1204	193	257
seeds	0.58	0.6	868	891	2322	2399	1454	1508
arcane	5.3	5.55	4100	4200	6350	7150	2250	2950
ses	0.74	0.8	821	919	1926	2078	1007	1159
ato	5.4	7.6	4509	6574	8100	10800	3511	4226
iya Paddy	0.93	1.1	1528	1686	1660	2200	132	514
ha:								
dy	2.12	2.41	2327	2610	4240	4840	1913	2230
at	0.655	1.15	1275	1835	1408	2473	133	638
ze	0.933	1.31	2213	2412	2379	3340	166	928
let	0.8	0.9	1121	1208	1200	1350	79	142
ley	0.65	0.78	929	947	976	1169	47	222
seeds	0.5	0.525	949	1048	2000	2260	1051	1212
arcane	6.5	6.9	5441	5831	8125	8625	2684	2794
ses	0.8	0.81	1043	1286	2275	2779	1232	1493
ato	3.5	6.0	4318	6364	5250	8111	932	1747
iya Paddy	0.9	10.0	1554	1639	1800	2000	246	361
ed Barley	0.7	0.75	1228	1289	1400	1600	112	302
di:								
dy	1.98	2.45	3082	3666	5740	7104	2658	3438
at	0.67	0.938	2274	2766	2344	3284	70	518
ze	0.83	1.3	2815	3366	2490	3900	-325	534
let	0.77	0.86	1643	1790	1810	1998	166	208
ley	0.6	0.72	1433	1557	1500	1750	67	193
seeds	0.37	0.4	1268	1369	1702	1840	434	471
ses	0.51	0.6	1235	1448	1785	2100	550	652
ato	4.0	6.0	7300	8535	8000	9550	700	1015
iya Paddy	0.8	0.93	2189	2260	2200	2557	11	296
ed Barley	0.8	0.89	1916	2090	2000	2225	84	135
kwheat	0.72	0.8	1436	1557	1620	1800	184	243

tnotes: see next page.

TABLE XII (continued)

Agronomy Programs: Commodity Yields, Costs of Production, and Gross and Net Values of Production Changes in RCUP Areas.

odities CUP Areas	Commodity Yields (MT/ha.) 1/		Costs of Production (NR/ha.) 2/		Gross Value of Production (NR/ha.) 3/		Net Value of Production (NR/ha.)	
	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
ang:								
at	0.85	1.104	4093	5425	5055	6569	962	1144
ze	0.7	0.94	3000	3500	3385	4553	500	1053
ley	0.765	0.87	2776	2995	2907	3306	131	311
seeds	0.35	0.425	2181	2511	2537	3081	356	570
ses	0.43	0.52	2209	2615	2902	3510	693	895
ato	4.5	5.3	9752	10952	13500	15900	3748	4948
ed Barley	1.4	1.6	4866	5419	8260	9440	3394	4021
kwheat	0.8	0.925	3632	4129	3920	4532	288	403

umptions:

Yield increments (achieved by Year 5 of the RCUP) are mainly due to the conversion of areas n local varieties and local practices to improve varieties and improve practices.

Costs of production includes values of hired as well as family labour, plus other production ts such as bullocks, seeds and compost manures.

Prices for both with and without project situations are kept constant.

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TABLE XIII

Irrigation and Agronomy Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS, BY PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5			
A. Economic Benefits [1/]								
8.A. Improved Varieties and Practices for NET Increases in Yields of:								
(1) Paddy	699	2,209	2,909	3,858	4,389	14,064	48,093	77,722
(2) Wheat	458	1,081	1,787	2,502	3,326	9,154	17,325	25,289
(3) Maize	2,046	4,516	10,921	15,418	19,150	52,051	80,129	105,219
(4) Millet	119	242	387	500	612	1,860	5,926	9,568
(5) Barley	26	116	224	332	430	1,128	1,959	2,450
(6) Pulses	81	311	578	774	854	2,598	4,930	6,534
(7) Potatoes	373	1,092	1,988	2,517	3,254	9,224	20,425	30,816
(8) Oilseeds	59	142	221	267	673	1,362	4,417	6,633
(9) Sugarcane	(3)	8	16	16	26	63	781	1,313
(10) Ghaiya	28	46	59	87	105	325	1,083	1,609
(11) Buckwheat	-	35	48	52	66	201	523	800
(12) Naked Barley	38	73	126	526	680	1,443	7,139	11,902
Total, All Crops	3,924	9,871	19,264	26,849	33,565	93,473	192,730	279,855

1/ Estimated from TABLE XI (distributed across the four project sites by APROSC worksheets) multiplied by the appropriate increment in NET value of production from TABLE XII.

TABLE XIII (continued)

Irrigation and Agronomy Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS, BY PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5				
B. Economic Costs 2/									
Capital Costs	(4,331)	(6,024)	(5,801)	(4,404)	(3,203)	(23,763)	(3,569)	(394)	
Credit to Producers	(357)	(795)	(1,470)	(2,138)	(2,599)	(7,359)	(9,199)	(11,499)	
Operating Costs	(1,073)	(2,271)	(3,301)	(4,319)	(5,210)	(16,174)	(25,972)	(27,802)	
Total Costs, All Inputs	(5,761)	(9,090)	(10,572)	(10,861)	(11,012)	(47,296)	(38,740)	(39,695)	
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	(1,837)	781	8,692	15,988	22,553	46,177	153,990	240,160	
2. NPV (B-C), at 15% Disc. Factor									
-NPV Benefits	3,414	7,472	12,695	15,384	16,715	55,680	63,215	45,896	164,791
-NPV Costs	(5,012)	(6,881)	(6,967)	(6,223)	(5,484)	(30,567)	(12,707)	(6,510)	(49,784)
-NPV (B-C)	(1,598)	591	5,728	9,161	11,231	25,113	50,508	39,386	115,007
3. B/C Ratio, at 15% Disc. Factor						1.8	5.0	7.0	3.3
4. Internal Rate of Return (%)									
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if -									
(a) 10% dec. in total benefits	- 341	- 747	-1,270	-1,538	-1,672	-5,568	-6,321	-4,590	-16,479
2. Changes in NPV Costs if -									
(a) 10% incr. in total costs	+ 501	+ 688	+ 697	+ 622	+ 548	+3,056	+1,271	+ 651	+4,978
(b) 33% incr. in NR/$ exch.rate	+ 910	+ 945	+ 950	+ 628	+ 345	+3,778	+ 365	+ 136	+4,279
3. B/C Ratio, at 15% Disc. Factor if									
(a) changes D.1(a) & D.2(a) occur						1.5	4.1	5.8	2.7
4. Internal Rate of Return (%) if-									
(a) changes D.1(a) & D.2(a) occur									

2/ These costs represent project provided inputs. Farm costs have been deducted from the gross value of production to arrive at the net values of production reported on page one of this table.

TABLE XIV

Horticultural Programs: Commodity Yields by RCUP Areas
(all figures in MT/ha.) 1/

'YPE OF 'RUIT	KULEKHANI		GORKHA		MYAGDI		MUSTANG	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
ıpple	9.48	14.00	9.18	12.50	3.50	14.00	11.12	17.00
'ear	15.29	18.08	22.24	25.00	22.20	25.00	6.95	17.00
'each	6.32	14.00	16.32	20.00	7.01	20.00	23.60	24.00
'lum	12.46	14.00	15.51	16.50	8.30	18.00	2.36	12.00
Jalnut	3.43	4.00	4.68	-	2.30	4.00	2.00	4.00
.ime	15.63	18.00	19.37	20.00	6.50	20.00	-	-
)range	12.00	15.00	16.00	69.50	50.00	69.50	-	-
Iill Lemon	16.00	21.00	20.00	22.00	-	-	-	-
3anana	12.50	13.00	12.50	16.00	-	-	-	-
ıpricot	11.02	14.00	-	-	5.10	14.00	11.80	14.00
'ersimmon	-	10.00	-	-	-	-	-	-
.emon	12.00	18.00	-	-	-	16.00	-	-
'ineapple	-	-	5.00	15.00	-	-	-	-
'apaya	-	-	21.00	30.00	-	-	-	-
1ango	-	-	25.00	30.00	-	-	-	-
.itchi	-	-	8.74	10.00	-	-	-	-
Guava	-	-	3.67	10.00	-	-	-	-
'omogranate	-	-	7.50	8.00	-	-	-	-
Jackfruit	-	-	50.00	60.00	-	-	-	-
\lmond	-	-	-	-	-	2.00	1.18	3.50
Grape	-	-	-	-	-	-	0.80	2.00
)thers	7.00	9.00	40.50	45.00	5.60	13.00	10.01	13.50

/ Since actual experimental data are not available at present, the yields per ha. of ıe existing varieties of fruit has been calculated by the RCUP design team based upon ıformation obtained from horticultural farms and fruit growers in the particular ıtchment areas within which RCUP will operate. Proposed yields have been estimated ısed upon data from higher yielding local orchards where the farmers practice mproved methods of cultivation.

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TABLE XV

Horticulture Programs: Time Path for Yield Increments from the First Year of Bearing to the Full-Bearing Stage (all figures in percent of full bearing yield)

TYPES OF FRUIT	Percent of Full-Bearing Yield Attained in Each of Years 1-8 After Trees Begin Bearing Fruit							
	1	2	3	4	5	6	7	8
A. Apple,1/ Lime, 2/Guava 3/	14	21	50	79	86	93	100	
B. Pear,1/Peach,2/Apricot3/ Pomogranate 4/	14	39	82	89	96	100		
C. Plum, 2/Walnut,5/ Orange,4/ Mango,2/Litchi,2/Jackfruit6/	10	21	35	53	71	85	92	100
D. Almond,2/Lemon,3/Grape3/	13	28	66	88	100			
E. Banana,2/ Pineapple, 8/ Papaya 8/	100	84	69	53				

1/ Starts bearing fruit in 8th year after planting.
2/ Starts bearing fruit in 5th year after planting.
3/ Starts bearing fruit in 4th year after planting.
4/ Starts bearing fruit in 6th year after planting.
5/ Starts bearing fruit in 9th year after planting.
6/ Starts bearing fruit in 7th year after planting.
7/ Starts bearing fruit in 1st year after planting.
8/ Starts bearing fruit in 2nd year after planting.

General Note: Since actual experimental data are not available at present, the above rate has been estimated on the basis information obtained by the RCUP design team from horticulture farms, fruit growers, and personal experiences of field workers.

TABLE XVI

Horticulture Programs: Summary of Economic, Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
A. Economic Benefits									
Increased Output of Fruit Crops	2,258	2,050	2,026	1,819	1,600	9,753	32,935	210,050	
Foregone Output of Grain Crops	(2,391)	(2,391)	(2,391)	(2,391)	(2,391)	(11,955)	(11,955)	(11,955)	
Net Benefits with RCUP	(133)	(341)	(365)	(572)	(791)	(2,202)	20,980	198,095	
B. Economic Costs									
Capital Costs	(879)	(888)	(627)	(748)	(50)	(3,192)	(3,158)	(203)	
Operating Costs	(275)	(430)	(562)	(719)	(777)	(2,763)	(5,146)	(7,590)	
Op. Costs of Family Labor	(240)	(198)	(275)	(372)	(573)	(1,658)	(3,018)	(3,169)	
Total Costs, All Inputs	(1,394)	(1,516)	(1,464)	(1,839)	(1,400)	(7,613)	(11,322)	(10,962)	
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	(1,527)	(1,857)	(1,829)	(2,411)	(2,191)	(9,815)	9,658	187,133	186,976
2. NPV (B-C), at 15% Disc. Factor									
- NPV Benefits	(115)	(258)	(240)	(328)	(394)	(1,335)	6,881	32,488	38,034
- NPV Costs	(1,213)	(1,148)	(965)	(1,054)	(697)	(5,077)	(3,713)	(1,798)	(10,588)
- NPV (B-C)	(1,328)	(1,406)	(1,205)	(1,382)	(1,091)	(6,412)	3,168	30,690	27,446
3. B/C Ratio, at 15% Disc. Factor						0.3	1.8	18.1	3.6
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if - (a) 10% dec. in total benefits	- 197	- 155	- 134	- 104	- 80	- 670	-1,080	-3,445	- 5,195
2. Changes in NPV Costs if - (a) 10% incr. in total costs	+ 121	+ 115	+ 97	+ 105	+ 70	+ 508	+ 371	+ 180	+ 1,059
3. B/C Ratio, at 15% Disc. Factor if D.1 (a) and D.2 (a) changes occur						0.1	1.4	14.7	2.8

TABLE XVII

Watershed Management Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS ALL PROGRAM CATEGORIES	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15
A. Economic Benefits 1/								
2.A. Terrace Improvement:								
-Crop Improvement	21	82	165	247	371	886	5,410	11,336
-Reduced Soil Loss	-	1	2	2	3	8	50	104
-Decreased Labor	-	-	1	1	2	4	29	60
-Decreased Sediment Deposition	-	-	1	1	2	4	32	66
-Total	21	82	169	251	378	902	5,521	11,566
2.B. Trail Improvement:								
-Reduced Land Loss	22	22	23	23	23	113	113	113
-Decreased Labor	3	9	17	25	33	87	165	165
-Reduced Sediment Deposition 2/	-	-	-	-	-	-	-	-
-Total	25	31	40	48	56	200	278	278
2.D. Major Gully Control on Range Land								
2.E. Landslide Rehabilitation:								
-Reduced Land Loss	-	11	22	45	56	134	279	279
-Reduced Sediment Deposition 2/	-	-	-	-	-	-	-	-
-Total	-	11	22	45	56	134	279	279
2.I. Road Stabilization	3	6	10	13	16	48	80	80
Total Benefits, All Program Categories	49	131	241	357	506	1,284	6,158	12,203

1/ Based on the estimates presented in the text applied to the relevant number of hectares or kilometers (trails and roads) as derived from the information on watershed management in the RCUP Guide.

2/ Value of benefits is less than NR 500/yr.

TABLE XVII (continued)

Watershed Management Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
B. Economic Costs									
Capital Costs	(2,727)	(6,508)	(5,944)	(5,734)	(4,697)	(25,592)	(1,916)	(2,116)	
Operating Costs	(1,328)	(1,792)	(2,096)	(2,288)	(2,334)	(9,838)	(4,752)	(4,903)	
Total Costs, All Program Categories	(4,055)	(8,300)	(8,040)	(8,022)	(7,013)	(35,430)	(6,668)	(7,019)	
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	(4,006)	(8,169)	(7,799)	(7,665)	(6,507)	(34,146)	(510)	5,184	
2. NPV (B-C), at 15% Disc. Factor									
- NPV Benefits	43	99	159	205	252	758	2,020	2,001	4,770
- NPV Costs	(3,528)	(6,283)	(5,298)	(4,597)	(3,492)	(23,198)	(2,187)	(1,151)	(26,536)
- NPV (B-C)	(3,485)	(6,184)	(5,139)	(4,392)	(3,240)	(22,440)	(167)	850	(21,757)
3. B/C Ratio, at 15% Disc. Factor						0	0.9	1.7	0.2
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if -									
(a) 10% dec. in total benefits	- 4	- 10	- 16	- 21	- 25	- 76	- 202	- 200	- 478
2. Changes in NPV Costs if -									
(a) 10% incr. in total costs	+ 353	+ 628	+ 530	+ 460	+ 349	+2,320	+ 219	+ 115	+ 2,654
(b) Op Cost labor is 60% Mkt. Wage									
3. B/C Ratio, at 15% Disc. Factor if									
(a) D.1 (a) & D.2 (a) changes occur									
(b) D.2 (b) change occurs						0	0.7	1.4	0.1

TABLE XVIII

Drinking Water Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
A. Economic Benefits									
Labor Time Savings[1/]	-	-	916	1,987	2,808	5,711	18,683	20,992	
B. Economic Costs									
Capital Costs	(2,040)	(1,853)	(2,494)	(1,912)	(2,003)	(10,302)	(3,727)	(-)	
Operating Costs	(-)	(143)	(189)	(46)	(49)	(427)	(155)	(155)	
Total Costs, All Inputs	(2,040)	(1,996)	(2,683)	(1,958)	(2,052)	(10,729)	(3,882)	(155)	
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	(2,040)	(1,996)	(1,767)	29	756	(5,018)	14,801	20,837	
2. NPV (B-C), at 15% Disc. Factor									
- NPV Benefits	(-)	(-)	604	1,139	1,398	3,141	6,128	3,443	12,712
- NPV Costs	(1,775)	(1,511)	(1,768)	(1,122)	(1,022)	(7,198)	(1,273)	(25)	(8,496)
- NPV (B-C)	(1,775)	(1,511)	(1,164)	17	376	(4,057)	4,855	3,418	4,216
3. B/C Ratio, at 15% Disc. Factor						0.4	4.8	137.7	1.5
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if - (a) 10% dec. in total benefits	0	0	- 60	- 114	- 140	- 314	- 613	-344	-1,271
2. Changes in NPV Costs if - (a) 10% incr. in total costs	+ 178	+ 151	+ 177	+ 112	+ 102	+ 720	+ 127	+3	+850
3. B/C Ratio, at 15% Disc. Factor if D.1 (a) & D.2 (a) changes occur						0.3	3.9	110.7	1.2

1/ Estimated at NR 4.4/man-day average opportunity cost multiplied by time savings data obtained from APROSC Specialist.

TABLE XIX

Energy Programs - Stove Improvements: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
Fuelwood Savings	18	42	66	90	114	330	929	1,528	2,787
B. Economic Costs									
Capital Costs	(5)	(6)	(6)	(6)	(6)	(29)	(30)	(22)	(81)
Operating Costs	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Total Costs	(5)	(6)	(6)	(6)	(6)	(29)	(30)	(22)	(81)
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	13	36	60	84	108	301	899	1,506	2,706
2. NPV (B-C), at 15% Disc. Factor									
- NPV Benefits	15	32	43	51	57	198	305	251	754
- NPV Costs	(4)	(5)	(4)	(3)	(3)	(19)	(10)	(4)	(33)
- NPV (B-C)	11	27	39	48	54	179	295	247	721
3. B/C Ratio, at 15% Disc. Factor						10.4	30.5	62.8	22.8
4. Internal Rate of Return (%)						∞	∞	∞	∞
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if -									
(a) 10% dec. in total benefits						- 20	- 30	- 25	- 75
2. Changes in NPV Costs if -									
(a) 10% increase in total costs						+ 2	+ 1	0	+ 3
3. B/C Ratio, at 15% Disc. Factor if									
(a) D.1 (a) & D.2(a) changes occur						8.5	25.0	56.5	18.9
4. Internal Rate of Return (%) if-									
(a) D.1(a) & D.2(a) changes occur						∞	∞	∞	∞

TABLE XX

Energy Programs - Solar Cooking and Water Heating: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
A. Economic Benefits									
Fuelwood Savings from Cooking	-	1	1	2	4	8	20	20	48
Fuelwood Savings from Water Heating	-	4	13	32	67	116	202	202	520
Total Benefits	-	5	14	34	71	124	222	222	568
B. Economic Costs									
Capital Costs	(-)	(32)	(64)	(126)	(248)	(470)	(-)	(-)	(470)
Operating Costs	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Total Costs	(-)	(32)	(64)	(126)	(248)	(470)	(-)	(-)	(470)
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	-	(27)	(50)	(92)	(177)	(346)	(222)	222	98
2. NPV (B-C), at 15% Disc. Factor									
- NPV Benefits	-	4	9	19	35	67	73	36	176
- NPV Costs	(-)	(24)	(42)	(72)	(123)	(261)	(-)	(-)	(261)
- NPV (B-C)	-	(20)	(33)	(53)	(88)	(194)	(73)	(36)	(85)
3. B/C Ratio, at 15% Disc. Factor						0.3	∞	∞	0.7
4. Internal Rate of Return (%)									
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if -									
(a) 10% dec. in total benefits						- 7	- 7	- 4	-18
2. Changes in NPV Costs if -									
(a) 10% increase in total costs						+ 26	0	0	+26
3. B/C Ratio, at 15% Disc. Factor if									
(a) D.1 (a) & D.2(a) changes occur						0.2	∞	∞	0.6
4. Internal Rate of Return (%) if-									
(a) D.1(a) & D.2(a) changes occur									

TABLE XXI

All RCUP Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS BY PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5				
A. Economic Benefits 1/									
1. Inventory and Monitoring 2/	-	-	-	-	-	-	-	-	-
2. Watershed Management	4.1	11.0	20.3	30.0	42.5	107.9	517.5	1,025.5	1,650.9
3. Forest Management	(1.0)	(16.0)	1,812.3	3,620.9	3,676.7	9,092.9	17,732.9	18,203.3	45,029.1
4. Energy	1.5	4.0	6.7	10.4	15.5	38.1	96.7	147.1	281.9
5. Irrigation 3/	-	-	-	-	-	-	-	-	-
6. Drinking Water	-	-	77.0	167.0	236.0	480.0	1,570.0	1,764.0	3,814.0
7. Community Livestock-Range-Pasture Management	-	354.5	562.4	875.2	1,346.2	3,138.3	17,971.8	39,370.3	60,480.4
8. Agronomy, Extension, and Research 3/	329.7	829.5	1,618.8	2,256.2	2,820.6	7,854.8	16,195.8	23,517.2	47,467.8
9. Horticulture	(11.2)	(28.7)	(30.7)	(48.1)	(66.5)	(185.2)	1,763.0	16,646.6	18,224.4
10. Fisheries Development 4/	-	-	-	-	-	-	-	-	-
11. Training 2/	-	-	-	-	-	-	-	-	-
12. RCUP Central Staff 2/	-	-	-	-	-	-	-	-	-
13. GRAND TOTAL	323.1	1,154.3	4,066.8	6,911.6	8,071.0	20,526.8	55,847.7	100,674.0	177,048.5

1/ Unless otherwise noted, all estimates are equal to the U.S. $ equivalent (at NR 11.9/U.S.$) of total benefits presented in '000 NR in the summary tables for each program category.

2/ Since this is an activity which impacts on all RCUP activities, its benefits are not separable from those estimated for each program category.

3/ Irrigation benefits are included in the agronomy, extension, and research program category.

4/ No benefits are estimated since this program category is experimental.

TABLE XXI (continued)

All RCUP Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS BY PROGRAM CATEGORIES	FIRST FIVE YEARS Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
B. Economic Costs									
1. Inventory and Monitoring	207.8	200.1	167.8	143.3	131.2	850.1	560.3	589.8	2,000.2
2. Watershed Management	340.8	697.5	675.6	674.1	589.3	2,977.3	2,625.0	2,779.2	8,381.5
3. Forest Management	421.2	799.6	1,167.4	1,304.5	1,376.0	5,068.7	7,830.1	7,976.7	20,875.5
4. Energy	84.4	97.1	805.0	811.3	242.2	2,040.0	1,302.1	1,420.0	4,762.1
5. Irrigation	334.5	334.9	363.9	271.1	132.7	1,437.2	-	-	1,437.2
6. Drinking Water	171.4	167.7	225.5	164.6	172.4	901.6	326.2	13.0	1,240.8
7. Community Livestock-Range-Pasture Management	150.8	533.4	438.2	575.0	713.3	2,410.7	2,066.3	2,289.1	6,766.1
8. Agronomy, Extension, and Research	149.6	429.0	524.5	641.6	792.7	2,537.4	3,255.5	3,335.7	9,128.6
9. Horticulture	97.0	110.7	99.9	123.3	69.5	500.4	697.8	654.9	1,853.10
10. Fisheries Development	8.4	79.3	26.3	92.1	31.5	237.6	174.9	175.4	587.9
11. Training	627.8	1,347.3	1,119.2	964.7	1,145.6	5,204.6	-	-	2,889.0
Subtotal, RCUP Programs	2,593.7	4,796.6	5,613.3	5,765.6	5,396.4	24,165.6	18,838.2	19,233.8	59,922.0
12. RCUP U.S. Staff:									
a. long-term advisors	480.0	1,720.0	1,760.0	1,200.0	260.0	5,420.0	-	-	5,420.0
b. short-term consultants	297.5	343.0	318.5	357.0	259.0	1,575.0	-	-	1,575.0
c. tech./clerical support	84.0	84.0	84.0	84.0	84.0	420.0	-	-	420.0
d. Local Staff	21.9	120.8	23.0	25.0	27.0	117.5	-	-	117.7
Subtotal, Tech. Assist.	883.4	2,167.8	2,185.5	1,666.0	630.0	7,532.7	-	-	7,532.7
13. Other Costs:									
a. local resource conservation coordination fund	105.4	105.0	139.5	153.5	152.5	655.9	-	-	655.9
Subtotal, Other	105.4	105.0	139.5	153.5	152.5	655.9	-	-	655.9
14. Total, All RCUP Costs	3,582.5	7,069.4	7,938.3	7,585.1	6,178.9	32,354.2	18,838.2	19,233.8	70,426.2
15. Contingency @ 10%/year	358.3	706.9	793.8	758.5	617.9	3,235.4	1,883.8	1,923.4	7,042.6
16. GRAND TOTAL	3,940.8	7,776.3	8,732.1	8,343.6	6,796.8	35,589.6	20,722.0	21,157.2	77,468.8

TABLE XXI (continued)

All RCUP Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

TYPES OF ECONOMIC BENEFITS AND COSTS, BY PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5				
C. Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	(3,730.4)	(6,510.2)	(4,941.8)	(2,150.8)	146.4	(17,186.8)	34,627.4	79,531.1	96,971.
2. NPV (B-C), at 15% Disc. Factor									
-NPV Benefits	281.1	872.7	2,676.0	3,960.3	4,019.4	11,809.5	18,318.0	16,510.5	46,638.
-NPV Costs	(3,526.5)	(5,794.4)	(5,927.7)	(5,192.7)	(3,946.5)	(24,387.8)	(6,960.3)	(3,467.4)	34,815.
-NPV (B-C)	(3,245.4)	(4,921.7)	(3,251.7)	(1,232.4)	72.9	(12,578.3)	11,357.7	13,043.1	11,822.
3. B/C Ratio, at 15% Disc. Factor						0.5	2.6	4.8	1.
4. Internal Rate of Return (%)									
D. Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if -									
(a) 10% dec. in total benefits	- 28.1	- 87.3	- 267.6	- 396.0	- 401.9	-1,180.9	-1,831.8	-1,651.1	-4,663.
2. Changes in NPV Costs if -									
(a) 10% incr. in total costs	+352.6	+579.4	+ 592.8	+519.3	+ 394.7	+2,438.8	+ 696.0	+ 346.7	+3,481.
(b) deduct costs of all energy programs except stove improv. & solar demon.	-100.1	-100.8	- 775.3	-605.3	- 112.8	-1,694.3	- 426.3	- 232.6	-2,353.
(c) add forage costs to live-stock-range-pasture program	+ 11.7	+213.0	+ 293.3	+399.0	+ 539.8	+1,456.8	+3,446.1	+3,738.1	+8,641.
(d) add op. cost of family labor to horticulture program	+ 17.5	+ 12.5	+ 15.2	+ 17.9	+ 24.0	+ 87.1	+ 83.2	+ 43.7	+ 214.
3. B/C Ratio, at 15% Disc. Factor if									
(a) D.1(a) & D.2(a) changes occur						0.4	2.2	3.9	1.
(b) all changes D.1 & D.2 occur						0.4	1.5	2.0	0.
4. Internal Rate of Return (%) if-									
(a) D.1(a) & D.2(a) changes occur									
(b) all changes D.1 & D.2 occur									

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TABLE XXI (continued)

All RCUP Programs: Summary of Economic Benefits and Costs, Years 1-15
(all figures are in '000 NR)

YPES OF ECONOMIC ENEFITS AND COSTS, Y PROGRAM CATEGORIES	FIRST FIVE YEARS					TOTAL, YEARS 1-5	TOTAL, YEARS 6-10	TOTAL, YEARS 11-15	TOTAL, YEARS 1-15
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5				
• Economic Efficiency Measures									
1. Undiscounted Benefits - Costs	(3,730.4)	(6,510.2)	(4,941.8)	(2,150.8)	146.4	(17,186.8)	34,627.4	79,531.1	96,971.
2. NPV (B-C), at 15% Disc. Factor									
-NPV Benefits	281.1	872.7	2,676.0	3,960.3	4,019.4	11,809.5	18,318.0	16,510.5	46,638.
-NPV Costs	(3,526.5)	(5,79[illegible])	(5,927.7)	(5,192.7)	(3,946.5)	(24,387.8)	(6,960.3)	(3,467.4)	34,815.
-NPV (B-C)	(3,245.4)	(4,92[illegible])	(3,251.7)	(1,232.4)	72.9	(12,578.3)	11,357.7	13,043.1	11,822.
3. B/C Ratio, at 15% Disc. Factor						0.5	2.6	4.8	1.
4. Internal Rate of Return (%)									
• Sensitivity Analysis @ 15% D.F.									
1. Changes in NPV Benefits if -									
(a) 10% dec. in total benefits	- 28.1	- 87.3	- 267.6	- 396.0	- 401.9	-1,180.9	-1,831.8	-1,651.1	-4,663.
2. Changes in NPV Costs if -									
(a) 10% incr. in total costs	+352.6	+579.4	+ 592.8	+519.3	+ 394.7	+2,438.8	+ 696.0	+ 346.7	+3,481.
(b) deduct costs of all energy programs except stove improv. & solar demon.	-100.1	-100.8	- 775.3	-605.3	- 112.8	-1,694.3	- 426.3	- 232.6	-2,353.
(c) add forage costs to live-stock-range-pasture program	+ 11.7	+213.0	+ 293.3	+399.0	+ 539.8	+1,456.8	+3,446.1	+3,738.1	+8,641.
(d) add op. cost of family labor to horticulture program	+ 17.5	+ 12.5	+ 15.2	+ 17.9	+ 24.0	+ 87.1	+ 83.2	+ 43.7	+ 214.
3. B/C Ratio, at 15% Disc. Factor if									
(a) D.1(a) & D.2(a) changes occur						0.4	2.2	3.9	1.
(b) all changes D.1 & D.2 occur						0.4	1.5	2.0	0.
4. Internal Rate of Return (%) if-									
(a) D.1(a) & D.2(a) changes occur									
(b) all changes D.1 & D.2 occur									

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APPENDIX Ma

SOCIAL SOUNDNESS ANALYSIS AND ROLE OF WOMEN

Prepared by: J. Gabriel Campbell

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Attachment

SOCIAL SOUNDNESS ANALYSIS AND ROLE OF WOMEN[1/]

1. The Socio-economic Landscape

The populations of the RCU catchment areas typify the social diversity found in Nepal's middle hill and mountain regions. Approximately 39% of the total estimated population of 215,000 in the project area is composed of Nepali mother tongue speaking castes. Roughly 28% of these are high castes (mostly Chetris and Brahmans), and the rest are occupational low castes (untouchable Kamis, Sarkis, and Damais). Similar to other areas of Nepal, about 53% of the population is composed of Tibeto-Burman languages-speaking ethnic groups (mostly Magar, Gurung, Newar, Tamang, Shoba/Baragaonle, and Thakali), each with their own language and cultural traditions and all of whom rank in the middle range of the caste hierarchy. Representatives of over 20 smaller caste/ethnic groups make up the remaining 9% of the population. (See attached table.) While the Tibeto-Burman speaking ethnic groups are, in general, located in separate project areas, the Nepali speaking castes are distributed throughout all of the areas except Mustang.

Within this heterogeneous and stratified cultural context, a variety of economic and strategies based on land resources characterize the subsistence systems. Since the vast majority of households own less than 1 hectare (the average landholding for the hills of Nepal is .4 hectares),[2/] almost all households combine grain production with small-scale animal husbandry and supplement their income through daily-wage labor, petty trading, cottage industry, salaried employment, military service, or seasonal migration. With the exception of the Thakalis of lower Mustang--where ancient trading rights with Tibet, herding, and now, tourism, have been sources of higher income[3/]--most of the people in the project areas struggle to meet minimum subsistence requirements of food and clothing. Income and power distribution is skewed in favor of local elites who have greater access to economic resources and government services. However, even these elites rarely own land in excess of 4 hectares and are in fact usually small farmers. Also egalitarian features are found within many of the ethnic/caste groups in the project area.

1/ See Appendix Mb for additional Social Soundness Analysis by Patrick Morris which was drawn upon for this analysis.

2/ HMG, Agricultural Statistics of Nepal, HMG, Nepal.

3/ C. von Furer-Haimendorf, Himalayan Traders, John Murray, 1975.

The prevalent farming systems, or patterns of land use, vary according to the ecological zones and the types of land resources available rather than according to ethnic groups. Cropping patterns are usually based on rice in the irrigated lowlands (khet) and maize and millet on the sloping uplands (pakho). Potatoes, wheat and barley assume greater importance at the higher elevations. Access to, and exploitation of, non-agricultural public land resources are essential to the subsistence mixed farming economy. There is a common dependence on draft animals for power and manure, and patterns of grazing and fodder and fuel-wood collection are similar within the same ecological zone.

2. Social Feasibility

The ultimate objective of the RCU project is the widespread adoption of improved land use practices by the hill farmers of Nepal in order to reduce land degradation and to provide a self-sustaining basis for rural productivity. As such, its success will depend on the degree to which ecologically sound behavioral changes can be encouraged and supported. This brief summary of the project's social feasibility concentrates on analyzing the feasibility of the project's being able to foster these behavioral changes among the populations of the project areas, and the project's ability to provide the basis for extending these changes throughout the country.

The limited data available from field research strongly indicates that present land use behavior is, contrary to much prevalent opinion, not primarily the result of people's ignorance of ecological principles.[4/] The degree of awareness of the environmental problems addressed by the project varies according to the severity of the problems in each micro-area. Nevertheless, the populations of the project areas do exhibit a basic understanding of many of the ecological processes involved and some of their long-range implications. There is considerable room for the project to refine and accelerate people's awareness of the issues--once these have been better investigated--but the project is fortunate in that it can build on a shared perception of the overall problems.

Rather than local ignorance of ecology, the factors which appear to underlie present land-use behavior (including behavior which is ecologically unsound), relate to increasing resource scarcity, the propensity of farmers to maximize their individual household productivity through exploitation of public land resources, and the patterns of farmer decision-making which balance short-term productivity

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4/ J. G. Campbell, Community Involvement in Conservation: Social and Organizational Aspects of the Proposed Resource Conservation and Utilization Project in Nepal. USAID/N.

gains against a high degree of risk avoidance on private lands.

The accelerating population growth over the last century has gradually altered the farm and livestock production system such that the major constraint to increase productivity is no longer labor availability but resource shortage. The economic strategies adopted by the project area residents to deal with this changing equation have had both positive and negative environmental consequences.

On the one hand, there is increased utilization of land intensive agriculture as opposed to land extensive agriculture such as shifting agriculture. This trend is associated with increased use of terracing, increased use of irrigation, and to some degree, a decrease in the size of livestock herds.[5/] Significantly, all of these mostly positive investments in intensive land-management have taken place on privately owned land where the risk of losing the large labor investment is the least and the individual household receipt of long-term benefits is the most assured.

On the other hand, the increasing numbers of people depending on shrinking productive land resources has led to increased deforestation to meet fuel, fodder, and timber requirements, increased grazing pressures on smaller amounts of land, decreased seasonal rotation in grazing, increased frequency of pasture burning, decreased periods of fallowing on marginal uplands, and a greater dependence on on-farm sources of fodder. These environmentally negative trends were exacerbated by government nationalization of all community lands in 1957, without a governmental capability for enforcing sound management. Most communities in the project areas had (and often still have) traditional systems of resource management which were concerned with rights of exploitation and distribution. But the new act undermined these systems' authority and did not promote the local development of institutions for effective resource conservation management. As a result, individual farmers often continue to exploit these public resources regardless of their awareness of long-term negative consequences (social costs). In addition the farmers have not invested in resource renewal, reasoning that: a) if they don't exploit the resources, others will anyway, and b) any investment would be at such high risk that others (whether other farmers or the government) would reap the benefits.[6/]

In short, a situation has developed in Nepal in which farmers tend to maximize

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5/ Alan Macfarland, Resources and Population: A Study of the Gurwags of Nepal. Cambridge University Press, 1976.

6/ See Hans Reiger et. al., Himalayan Ecosystems Research Mission: Nepal Report, Heidelberg, 1976.

their investment in long-term land management--which is more often based on sound ecological principles--on their better private land where their investment security is highest and the chances of high returns greatest. Adoption of new practices on this land is feasible if it is demonstrated that the ecological and economical risk is low and the yields worth additional investment. So far, farmers--particularly small and marginal farmers--have been reluctant to adopt new agricultural inputs (such as high-yielding varieties and fertilizer) until they are convinced that the risks are not too high. If fertilizer supplies are uncertain, if the growing period of new varieties is too long to survive a year of late or poor monsoon, if stalk is not long enough to provide fodder for draft animals, if water availability is uncertain, if fertilizer use potentially reduces the future fertility of the field (all of which have been problems encountered in Nepal), farmers are hesitant to risk their long-term survival. Only when new varieties or cultural practices are proven acceptable within the farming system, such as has occurred in many areas with new wheat and potato varieties, are they adopted.[7/]

In contrast to private land management, ecologically damaging land-use practices are primarily conducted on public lands which are now legally owned by the government, lack systematic management, and for which the benefits from individual restraint or investment are insecure and ambiguous. In addition, some damaging practices are found on poorer private lands--particularly less productive uplands. However, it is not yet known to what extent these practices are related to insecurity of ownership (such as illegal cultivation or forest policies which no longer allow farmers to allow partially registered fields for more than two years), the high cost to benefit ratio of labor on these lands, insufficient appreciation of the soil loss occurring, or other factors.

Project activities--such as irrigation, drinking water, check-dams, supply of seedlings for private plantation, bridge and trail construction, and veterinary services--which require little (if any) behavioral change, little investment, and yield tangible individual benefits, are therefore readily acceptable. Similarly, while adoption of new agricultural practices and improved stoves require some behavioral changes, there are no _a priori_ social reasons why they will not be adopted if they are proven to work within the farming system, yield higher net returns,and do not incur very high risks. Since much of the

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7/ See Integrated Cereals Project, The Short Term Cropping Systems Potential of Five Sites of Nepal and Its Relevance to Similar Environments, HMG 1979.

project is devoted to these kinds of activities, it will be essential to work closely with the farmers to insure that this basically favorable social environment is capitalized upon to insure that the conditions for widespread adoption are fully met. In addition to paying close attention to the effects of these changes on the farming system as a whole (e.g., human and animal labor requirements, risk factors, fodder requirements, delivery and marketing mechanisms, etc.), it may be necessary to examine present forest and land ownership policies as well.

The principle issue in analyzing the project's social feasibility at the behavioral level, however, focuses mostly on changing public land use patterns. Range and pasture management, community forest plantations and protection, and national forest management are the primary project activities addressing this problem.

Evidence from pilot projects and analysis of examples of local initiative in Nepal indicate that these kinds of management of public lands can succeed if there is a high degree of local participation in plan formation and management, strong local leadership, and technical and financial support.[8/] Recent government legislation creating panchayat forests and panchayat protected forests in which local people are given some degree of ownership rights have also increased the chances of success. However, the degree of behavioral change required in introducing conservation-oriented management and control into an arena of daily life where it did not exist before will not be easily accomplished. In addition there are some intended behavioral changes (e.g., rotational grazing) which will result in short-term hardships for local people. These considerations suggest that the successful implementation of these project activities will require genuine collaboration with the local people in designing land-use plans and management systems, sensitive project monitoring, and responsible delivery of inputs and services.

The primary social factors posing potential constraints to the project's successful implementation of these strategies are: the social difference between government technicians and the rural population, the intensive management required to develop local management systems (viable Panchayat Committees), and the tendency for land-use technicians to develop plans based on physical (e.g., soil properties) criteria in isolation from local people.

8/ Pilot projects include the Dept. of Soil and Water Conservation/FAO Phewa Tal Project and the Dept. of Forest/Australia - Nepal Forestry Project. For background analysis, see J. G. Campbell, Community Involvement in Conservation (op. cit.).

In the project area there is a large diversity of hierarchically ordered castes and ethnic groups, the society is economically stratified and faction-ridden, prestige and high status are attached to education and higher positions in government service, and most government officers are necessarily drawn from the small part of urban, educated elite. In this kind of context it is not surprising that there is a considerable social distance between implementing personnel and rural populations. This social distance in combination with the shortage of trained personnel and the need for intensive collaboration with local people in order to establish workable land management systems, poses a challenge to successful project implementation. Given the frustrations entailed in intensive and time-consuming local collaboration and the technician's traditional professional commitment to planning land-use primarily on the basis of its physical properties, there is the danger that genuine local collaboration can be slighted.

The RCU project has incorporated a number of measures for overcoming these constraints. These include the development of new educational and training programs designed to recruit and train local people from the hills and the programs to train personnel at all levels in the special skills-including social skills--required by a community oriented project of this type. In addition, emphasis has been placed on developing grass roots institutions (the Panchayat Conservation Committee and the various functional sub-committees) capable of working collaboratively with project technicians and developing the local management systems essential to project success. To the degree that these institutions are supported by the project so that they operate with sufficient competence, authority and resources to manage local lands with a minimum of outside assistance, the project will achieve its ultimate goals. To assist in this difficult process, the project has also incorporated a socio-economic monitoring and adaptive research component that will function to identify social constraints and strategies for overcoming them.

3. Social Impact

In a context such as Nepal's where agriclutural resources are exceedingly scarce and society is highly stratified, it is universally found that local elites have differential access to resources and services made available through either private or governmental channels. In Nepal, this normal pattern of benefit distribution is reinforced by the social distance between government personnel and the majority of poor villagers noted earlier. However, this pattern is also mitigated in the hills and mountains where the differentials of wealth and power are substantially less than in the Terai (as in fact, in most all of South Asia), and where everyone beyond the top 5%-10% qualify as rural poor according to all standard measures.

Given the dominant pattern of benefit distribution, a project strategy which attempted to provide all of its benefits exclusively to the poor majority would fail either because it would be blocked by the local elites or its benefits would be co-opted by them regardless of targeting. Successful strategies for reaching the poor majority depend, rather, on including the wealthier farmers among the beneficiaries while simultaneously insuring that there are sufficient resources and services to benefit far larger numbers of the poor. These strategies should also aim to ensure that the more wealthy are not being directly provided the means to increase their relative wealth and power. Within this kind of strategy, it is also socially feasible to target special programs to marginal farmers and the landless who make up the poorest of the poor. By in large, it is this combination strategy that has been adopted by the project, although analysis of the project's social impact is complicated by the diversity of activities involved and the paucity of development impact evaluation data available in Nepal.

Project activities for which it is estimated that at least 25% and up to 100% of the target population will be directly benefited include forest management and tree plantation of various kinds, drinking water, animal health, and provision of improved crop varieties. This is followed by another group of project activities which are estimated to directly benefit between 5% and 25% of the population in the particular areas in which they are implemented. These include water source protection, bridges, irrigation, range and pasture development, agriculture credit and other agronomic inputs, and horticulture. These activities, with the possible exception of credit and irrigation, follow the strategy outlined above such that while the relatively wealthy are included among the beneficiaries, the vast majority to be benefited consist of the rural poor. With the regular credit and irrigation projects, the percentage of wealtheir beneficiaries--while still low in numbers--will be relatively higher. However, it is also these small, as opposed to marginal, farmers who have the resources to risk agricultural innovations and thus provide a positive basis for the innovation to diffuse to marginal farmers. The project has also incorporated a special conservation-oriented credit program which will be targeted particularly to the poor.

For the many additional project activities for which the initial direct project beneficiaries will probably number less than 5% of the population, benefit distribution is either neutral with regard to income levels (i.e., trail improvement, landslide and gully control, forage crop development), follows the strategy outlined above (i.e., energy efficient stoves, animal castration), or is directly or indirectly targeted to specific groups. Those targeted activities which will tend to more directly benefit the better off (i.e., biogas and microhydro plants, watermills, and sawmills) are included within the project both in order to indirectly benefit the poor by developing alternate energy technologies which will increase the availability of traditional technologies for the poor, as well as to improve the environment. The activities targeted to benefit the poorest segment of the population include employment generation through nursery and construction programs, terrace improvement for marginal land farmers and development of lease forests for landless/marginal groups. If these latter two programs prove successful, they have high potential for increasing the land-based income of marginal groups in an ecologically sound fashion.

The potential spread effect of the project activities both within and outside of the project areas differs according to type of activity. The replication of the financially and technically intensive activities such as watershed improvement through engineering activities (e.g., gabion construction) and through land inventory surveys will necessarily be limited by financial and manpower constraints. At the same time, many of the forest management, pasture and range development, and agricultural development activities have the potential for widespread diffusion. In particular, if viable local management systems are developed to deal with natural resource conservation and utilization, the project will have provided the basis for widescale reversal of present environmental degradation.

Project impact on women is not yet easily assessed. Since women are largely responsible for drinking water collection, a large number of unproductive person/hours per day presently wasted on this task will be eliminated wherever drinking water systems will be installed. For the short-term (perhaps the first five years), this labor time saved may be devoted to the increased labor requirements of hand harvesting more fodder and collecting firewood from greater distances that will be required by the project--although in the long term women's labor in these tasks will be decreased over what it would have been. This long term labor saving will be gained even sooner if energy efficient stoves can be successfully diffused throughout the project area--an accomplishment which will only take place if the technology is accepted by women.

These benefits for women, however, could be overshadowed by negative affects if the project does not take special measures to incorporate women into the implementation process. Present agricultural, livestock and horticultural extension practices as well as credit policies fail to directly involve women.[9/] Since over 50% of the agricultural work in the hills of Nepal is conducted by women--including many activities like manuring, seed storage and planting, and vegetable gardening, which are almost exclusively done by women[10/]--this approach runs the danger of not only failing to reach 50% of the population, but of lowering their relative status by transferring new skills entirely to men. The solution to some of these problems is beyond the scope of the project. But the adoption of implementation policies that insure that significant proportions of women are recruited and trained particularly at the local level could considerably alleviate this situation.

This project by itself cannot be expected to decrease the current natural rate of demographic increase in the short term. In fact, it may have a pro-natalist impact in the designated regions because: 1) the introduction of farming techniques which are more labor-intensive may increase the desire and demand for children, 2) greater off-farm employment opportunities may have a pronatalist effect if parents perceive the potential income-generating benefits derived from children's employment as greater than the cost of rearing them, and 3) infant mortality declines as a result of improved nutritional status.

On the other hand, increased management of public land resources as well as greater prospects for an improved standard of living may well promote the adoption of smaller family-sizes in the long term by increasing awareness of the limited total resource base for the family as well as by increasing family aspirations. Also, decreased child mortality rates could well have the long-term effect of decreasing numbers of births desired by families within the area. Insuring women's access to and participation in all aspects of the project may, in fact, be the most important project strategy for decreasing the present population growth rate.

9/ Acharya and Pradhan, Towards a Development Strategy for Rural Women, CEDA Seminar, 1979. Lynn Bennett, Tradition and Change in the Legal Status of Women, Status of Women in Nepal Project, CEDA, Tribhuvan University, 1979.

10/ Meena Acharya, Statistical Profile of Nepalese Women - A Critical Review, Status of Women in Nepal Project, CEDA, Tribhuvan University, 1979.

POPULATION BY CASTE/ETHNICITY IN PROJECT AREAS

Ethnic Group	Kulekhani	Gorkha	Mustang	Myagdi	Total	Percentage
Brahmans & Chetris	9,047	42,160			59.469	27.7%
Magar				24,785	42,145	19.6%
Occupational Castes	3,928	13,640	897	4,328	22,793	10.6%
Gurung		21,080			21,080	9.8%
Newar	8,684	11,160			19,844	9.3%
Tamang	14,475				14,475	6.7%
Shoba/Baragaonle			9,722		9,722	4.5%
Thakali			4,038	393	4,431	2 %
Chandel				1,180	1,180	.5%
Others	53	18,600	300	394	19,347	9.3%
Total Projected	36,187	124,000	14,957	39,342	214,486	100 %

Source: APROSC Baseline Survey.

APPENDIX Mb

COMMUNITY INVOLVEMENT IN CONSERVATION:
SOCIAL AND ORGANIZATIONAL ASPECTS OF THE PROPOSED
RESOURCE CONSERVATION AND UTILIZATION PROJECT IN NEPAL

Prepared by: J. Gabriel Campbell

CONTENTS

I. INTRODUCTION: RESOURCE CONSERVATION AS A SOCIAL PROBLEM

"The achievement of land using ethic which brings about the repair of damaged soil and water resources and maintains productivity of lands now in production or capable of increasing production depends upon the involvement of people. It depends upon anticipation of local people contributing to community awareness of conservation practices while at the same time assisting in the lowering of the conservation expense".1/

As has been clearly recognized by the Government of Nepal, natural resource conservation in the Nepalese hills depends on the active involvement of the local people. Not only are social factors primarily responsible for the deterioration of Nepal's natural environment, but realistic solutions require an unprecedented degree of local participation. The success or failure of the RCU Project is thus mainly contingent on the degree to which local people can be effectively mobilized to conduct their own conservation activities on a massive scale. Fortunately, there are strong grounds for optimism which suggest that a properly designed and implemented project can indeed enlist the support of many local people in managing the natural resources upon which their livelihood depends. This report represents a preliminary investigation into the social factors affecting resource conservation in Nepal. Its primary purpose is to examine the social soundness of the RCU Project, to make recommendation for increasing the project's degree of success, and to suggest a tentative outline for further inquiry during Phase I of the project. The report remains preliminary in the sense that it is not based on detailed research at project sites (which are yet to be selected). However, it is my conviction that many of the social principles discussed here apply throughout much of Nepal. Thus, it is hoped this report will assist the designing of more effective resource conservation projects, as well as stimulate more detailed investigations of the role local communities can play in preserving and improving their own environmental resources with adequate and properly implemented assistance. (For a brief explanation of the methodology used to gather information for this report, see Appendix).

1/ --Soil and Water Conservation System (Program-Planning-Budgeting, 25 years), HMG Department of Soil and Water Conservation, 1977.

I gratefully acknowledge the assistance and guidance received from Mr. John R. Wilson, Mr. M.D. Joshi, Mr. K.B. Malla, Mr. Tej B.S. Mahat, Mr. M. Stevens, Dr. David Thoroud, Dr. Ram Yadav, Dr. Linda Stone, Mr. Drone Rajaure, Ms. Augusta Molnar, Mr. Richard Burke, Dr. John Thames, Mr. Rollo Ehrich, Dr. Jerome Bosken, Mr. Steven Midgeley, Dr. Robert Campbell, Mr. Nir Bahadur Lama, Mr. Laksman Man Tamang, Dr. Lynn Bennett, Mr. A. Joshi, Mr. J.S. Spears, Mr. G. Devitt, Mr. Bihari Shrestha and Amb. Robert Blake.

II. SUMMARY OF RESEARCH FINDINGS AND RECOMMENDATIONS

A. Social Soundness Factors (III)

1. The Social Context of Environmental Degradation

Some ecologically unsound agricultural practices have always been part of the economic strategies that Nepalese farmers use to maximize their productivity. Deforestation and erosion was limited by the small population - i.e. by the fact that resources exceeded the availability of labor to exploit it. During the rapid population growth over the last century some economic strategies have actually proved to be ecologically sound - i.e. increased amount of terracing and decreased number of livestock per family. But with continued population growth these strategies are no longer viable ones. The carrying capacity of the environment has been exceeded to such an extent that environmental degradation is rapidly increasing. Now it is a shortage of resources rather than labor that limits production in most of Nepal and serves as a major constraint to both economic development and environmental conservation.

Most Nepalese communities used to have (and often still have) traditional systems of resource regulation. However these systems were usually concerned with rights of exploitation and distribution rather than with conservation. Even though these institutions were not adapted to the problem of shrinking resources, they can still serve as a basis for modern community action.

The motivation of communities to develop methods of conserving their own resources was also limited by the nationalization of community land in 1957. Despite the good intentions and partial benefits of this Act, nationalization of forests and forestry products has resulted in increased deforestation and negative attitudes towards outside enforcement. Forest policy has been oriented toward commercially valuable forests in the Terai; and both the regulations and personnel policy have been biased towards to Terai rather than the hills.

2. Locally Felt Needs and Awareness of the Problem

There is a growing awareness of the negative effects of deforestation and erosion among Nepalese hill farmers. The degree of awareness varies considerably from area to area, and seems to be primarily a function of the extent of deforestation and erosion prevalent within the area. Where deforestation and erosion are severe, awareness of the problem and the explicit desire to do something about it is also usually great. This awareness can be further promoted by government education programs.

In these areas of high awareness, the conservation activities in which people show most interest are (in order of priority):

a. planting fruit, fodder, and fuel trees (with more emphasis on the first two)

b. conserving existing forest resources, and

c. developing better fodder grass.

Associated felt needs include:

a. small-scale irrigation,

b. drinking water projects,

c. roads and suspension bridges, and

d. educational and health facitilies (with the order of priority differing by village).

3. Examples of Community Conservation Activities

While the number is still small, there are some notable examples of locally-sponsored conservation activities throughout Nepal. These include community protected forests as well as community established nurseries and orchards (examples described in this report are located in the Dang Valley, the Melemchi and Indrawati catchments of Sindhupalchok District, and in Nuwakot District.) These mark activities that go beyond the normal planting of individual orchards and fodder-tree seedlings which take place to a limited extent throughout the country. These examples provide concrete evidence of the willingness of some communities to support their own conservation activities even under present forest policy. They also serve as models for workable systems of community management and the analysis of these cases increases our understanding of how community conservation activities can be fostered in project areas.

4. The Change Process: Community Organization and the Role of Community Leaders

The examination of examples of community conservation activities reveals that depending on the type of activity involved, strong local leadership is often required to overcome initial opposition among farmers. Some activities, such as planting fruit and fodder trees on private or group-owned waste land, only require motivating the farmer to plant and protect seedlings. But, other activities, such as protecting neighbourhood forests and converting vast tracts of poor pasture land into plantation, often require considerably more persuasion and convincing demonstration. In these latter kinds of activities, the RCU project is more likely to meet with success if an effort is made to implement the project through local leaders. After an initial period, the tangible benefits that accrue to farmers (i.e. fodder grass from plantation areas, a greater abundance of fire wood) is, on the basis of cases examined, sufficient to win the approval of the majority of the community. Depending on the area and the unit of organization used, major problems with community cooperation need not be anticipated.

5. Factors Which Can Accelerate Awareness of Ecological Problems and Adoption of Conservation Activities

The new (1977) Forest Amendment Act and the activities envisioned in the RCU project will undoubtedly increase the social feasibility of conservation activities. By designating 4 categories of forests (panchayat forests, panchayat-protected forests, religious forests, and contract forests) which can be entrusted to local communities, the new forest act provides the means for local people to "own" their own resources under government supervision. In all areas investigated everyone questioned agreed that this measure would considerably increase their motivation for conducting conservation activities. In addition, the judicious use of contract forest could significantly contribute to solving the problem of the poor farmer's marginal land-use and actually increase his resource base over time.

The provision of additional inputs in the RCU project such as small-scale irrigation, drinking water, poultry and livestock credit and rural works will also increase motivation for cooperating with conservation schemes and provide immediate benefits to offset the delayed rewards of resource conservation. These additional inputs need to be coordinated with conservation activities -- perhaps by having the same community committees manage them. However, the primary focus on conservation should not be lost by reorganizing the project along the lines of the rural development model.

Different forms of participation will have to be explored and evaluated throughout the project. It is essential that most of the project components be based on "planning from below" in which local committees directly participate in the planning process.

6. Spread Effects

Judging from examples examined in Section III, the potential for diffusion of conservation activities from particular areas to neighboring villages is very good if:

a. panchayat officials and local leaders are involved with the projects.
b. there is encouragement and support from government officials.

This spread effect might be further increased through:

1) using local leaders as "extension agents" (conservation coordinators),
2) conducting local training programs, and
3) maximizing the chances of diffusion through initially working with responsive panchayats scattered throughout the selected areas rather than confining efforts to one small catchment.

7. Distribution of Benefits

The RCU project benefits will be differentally distributed according to the types of activities. While a detailed analysis of benefit distribution will require additional research, it is clear that some activities will more directly benefit large farmers, some will more directly benefit small farmers, and some will more or less equally benefit both groups. In my opinion the balance of benefits is such that the RCU project can in most of its activities, favor the smaller farmers while still benefiting the larger ones. Since landuse degradation is often associated with small farmers, many parcelled land holdings project activities should favor small scale and indirectly, this project has the potential to conserve the natural resources of the hills upon which all farmers in Nepal utimately depend.

B. Implications for Project Design and Suggested Strategies

1. General Considerations: Site Selection & Project Fexibility

The feasibility of resource conservation varies by area according to both environmental and social conditions. Project areas (whether catchments or districts) should be selected from the densely populated middle hills region primarily on the basis of environmental conditions. Within selected areas, specific project sites for the initial phases of project implementation should be selected according to social criteria -- i.e. their degree of willingness to mobilize themselves for participation in conservation activities. The ideal of complete coverage of all villages within a catchment area should be considered secondary to the establishment of successful activities in cooperative villages.

The project should be flexibly organized in order to:

a. respond to the specific requirements of each project site, and
b. respond to the results of on-going and planned adaptive and evaluative research now going on in the country.

2. Local Organization

The project should encourage the formation of conservation committees at the local level. These could serve as the organizational framework for all project related community activities. Two options are presented:

a. organizing the committee at the panchayat level with sub-committees at the ward level, or
b. organizing the committees at the ward(s) level with optional coordination at the panchayat level.

Both options have advantages and disadvantages, and the best solution might be to retain sufficient flexibility so that either can be employed in different situations, and inter-panchayat committees also formed if needed.

These community conservation committees could be linked with the catchment council plan, (as pioneered in the Phewa Tal Project) so long as authority is not allocated to the catchment council to such an extent that recalcitrant panchayats are able to frustrate rapid project implementation.

3. The Role of Local Committees

The suggested roles of the local committee and the RCU project staff are summarized in a chart in Section IV. In essence, the conservation committees would be responsible for proposing projects, organizing themselves for project management, providing voluntary labor, promoting conservation ideology and participating in evaluation. In turn, project staff would provide encouragement, technical advice and training, financial inputs, needed supplies, trained workers, supervision, demarcation and the administration of legal contracts.

4. Delegation of Authority to Local Committees

Many of the problems farmers presently experience in obtaining permits for the collection of forestry products (and the negative attitudes toward government regulations these problems engender) could be overcome by delegating some regulatory authority to conservation committees with appropriate government supervision. The degree of supervision required is an important question of the project.

5. Participation, Extension, Local Training and Non-formal Education

Suggested strategies for increasing effective participation in conservation activities include:

a. Establishing a district-level committee, similar to the one described in the District Administration Plan but with greater local participation;
b. Organizing educational and training tours for District Panchayat members;
c. Hiring local "conservation coordinators" from each catchment and training them to work as project motivators as channels of communication (i.e. non-technical extension agents);
d. Drastically increase the number of trained extension personnel;
e. Integrate National Development Service students and some Peace Corps Volunteers into the extension;
f. Organize training programs for conservation committee members in which they have the opportunity to learn from other farmers;
g. Train local nursery workers and forest watchmen in conservation techniques; and
h. Use trained local farmers as nursery foremen.

6. Forest Policy Consideration

Suggestions for implementing forest policy in order to accelerate the adoption of conservation activities include:

a. Placing priority on demarcating and establishing panchayat, religious, and contract forests;
b. In the demarcation of government forests giving priority to large tracts which will probably not be needed for panchayat forests;
c. Encouraging farmers with marginal land to plant fruit/fodder tree orchards in this land;

d. Leasing small patches of eroded waste land to small landless farmers or small farmer groups, for plantation;
e. Grant authority to panchayats to issue a certain number of construction wood permits per year;
f. Emphasize the plantation of tree species suitable for the site;
g. Emphasize use of local fencing materials and local watchmen over the use of imported wire fencing;
h. Provide a subsidized means for farmers to obtain those categories of trees on their own property that present regulations define as being owned by the government.

7. Formal Training Component

The forest policies that favor the Terai as presently found in the personnel and reward structures of the Forest Ministry, need to be reoriented to attract qualified people to work in the hills. This reorientation might include:

a. Special provisions for the recruitment of hill people;
b. Redefinition of present job descriptions, or creation of new conservation posts, that will place greater emphasis on community conservation activities in the hills;
c. Increasing the financial incentives for hill postings to compensate for the greater hardship there;
d. Increasing incentives for officials to tour hill villages by constructing decent living quarters and guest houses;
e. In allocating foreign training scholarships give preference to officials who have promoted hill conservation.

8. Project Organization

A tentative organizational model for the RCU project is presented in Section IV. This organization model works, on a national level, through a project coordination committee under the Ministry of Forests; on a catchment/district level, through a Project Action Committee; and at the Panchayat/Ward level through the conservation committee. In each major project area, the project coordinator would be a conservation officer from the Department of Soil and Water Conservation. He could work closely with the Divisional Forest Office, but the nature of their relationship needs further definition. The participation of local people and government officials is reflected at each level in the chart, and the special role of conservation coordinators and Peace Corps Volunteers is also included.

9. Relationship to Other Projects

The urgency for implementing conservation activities throughout Nepal and the high degree of international and bi-lateral support presently generated for this purpose a unique opportunity for inter-donor cooperation. This could be increased through:

a. Using the same project coordinating committee at the national level;
b. Developing a national conservation council; and
c. Establishing a forum for sharing regular progress reports and evaluations.

III. PRELIMINARY SOCIAL SOUNDNESS ANALYSIS

A. The Social Context of Environmental Degradation

Deforestation and erosion in Nepal results from over-exploitation and mismanagement of natural resources. A number of widespread practices - such as over-collection of fuel and fodder, over-grazing, shifting agriculture, and regeneration of fodder grasses through annual burning - are well known. These ecologically unsound activities are not new; but in recent years they have caused an unprecedented amount of environmental damage and now threaten to virtually destroy the Himalaya's natural resources. In order to understand the constraints of resource conservation in Nepal, it is important to briefly examine the socio-economic context in which these practices have developed as well as some of the factors that have contributed to their relatively unchecked growth in recent times.

The agricultural economy of Nepal has always depended on the farmer's use of a variety of complex economic strategies to exploit the available natural resources. While the principal source of income has always been crop production from arable land, the need for manure and draft animals as well as the need for additional income through the sale of livestock products has meant that the farmer has always depended heavily on fodder for livestock and forest products for fuelwood, compost materials, construction, cottage industry, ritual materials, etc.

Thus, forest and pasture land resources have traditionally been an indespensible component of the subsistence systems used by Nepalese farmers to maintain their livelihood. So long as there was (and in many parts of Nepal, there still is) a relative abundance of these natural resources, the ecologically unsound methods of exploiting these resources did not pose a severe problem. The social systems controlling the use of these resources were thus primarily concerned with rights of ownership and distribution of benefits. Many villages of Nepal had systems in which forests and pasture lands were considered community property (such as the _kipat_ system in eastern Nepal)[1/] that could only be used by noncommunity members through payment of fees or other commodities. Likewise,

1/ See Caplan, _Land and Social Change in Eastern Nepal_.

many villages (such as in the Far West) had (and have) communal systems of gathering and harvesting that insured fairly equal distribution of products such as fodder, composting materials, etc. Some communities, like the Sherpas in Khumbu, even had strict rationing systems to control the use of firewood and lumber since trees regenerated so slowly in their high altitude ecosystem.[1/] In addition, a tradition of temple and monastary forests ensured that there was no cutting of trees growing near religious structures. However, for most of the Nepalese hills, the main factor that limited the amount of deforestation was the relatively small population. In these demographic conditions, it was labor and not resources that limited agricultural productivity.

Ecologically unsound agricultural activities -- e.g. slash and burn agriculture and the cultivation of very steep slopes (over 100%) without terracing also mark traditional practices that must be understood within the broader context of the rural Nepalese subsistence systems. In hill areas of Nepal, agricultural production has been constrained by the lack of good arable land, limited availability of irrigation water, little organic fertilizer, and the high intensity of labor required to terrace fields, build irrigation channels, and transport manure composts. Under these conditions, a farmer could only properly cultivate a few fields. In addition, extensive state and private land tenancy systems deprived the farmer of over half the crop from his fields.[2/]. This meant that the average farmer supplemented his main agriculture in forest lands. In fact, it is clear that many poorer farmers who did not have access to any irrigated lands used this method extensively, as did some hunter-gatherers (e.g. the Chepang and Raji) and some high altitude pastoralist (e.g. Gurungs and the Pabai of the far West). Since these fields were cultivated for only one or two years, they usually remained unregistered and therefore untaxed. Many communities in Nepal allowed their own members to cultivate as many of these fields as they could physically manage. Again, so long as the population was small (Macfarlane estimates a total Nepalese population of 3 million in 1850)[3/] and resources/exceeded the amount of labor available to exploit them, this kind of extensive agriculture did not produce

1/ See C. Von Furer-Haimendorf's The Sherpas of Nepal for a description of this system.

2/ See Mahesh Regmi's Landownership in Nepal.

3/ A. Macfarlane, Resources and Population: A Study of the Gurungs of Nepal, p, 205.

severe ecological repercussions since the fields could be left fallow to naturally regenerate.

As the population dramatically increased from 1850 to the present the resources-to-labor equation reversed, such that throughout most of Nepal at present land rather than labor has become the limiting factor.1/ This has resulted in a shift to more intensive farming in which most cultivation is carried out on terraced fields. It also has resulted in a reduction of the number of livestock per family.

While these agricultural trends are ecologically beneficial, they are unfortunately offset by the increasing use of marginal lands for cultivation without sufficient fallowing and by the continuing practice of a number of economic strategies for utilizing forest and pasture resources which considerably exceed the carrying capacity of the environment.

With this background, it is evident that until recently, there was rarely any reason for local communities to develop their own methods of resource conservation. It is well known that in a given society alternations in social institutions tend to lag behind the introduction of new technical or economic arrangements. Population growth and the ecological disequilibrium it caused have been gradual processes. Farmers are only now becoming aware of the magnitude of their environmental problems. Local social institutions have not yet adjusted to the new demographic and ecological situation.

In addition, the nationalization of all nonregistered forest and waste land in 1957, together with the passage of the land ceiling regulations--despite the good intentions and beneficial effects of these laws--has had an adverse effect on the motivation for local people to conserve their own resources. Communities or individuals formerly had a sense of ownership over these resources and were at least protecting them from exploitation by outsiders. Now local people view these resources as government property that the government controls for its own benefit. And now communities lack the legal authority to protect land for exploitation by outsiders. Since demarcation of these lands by the Forest

1/ Macfarlane p. 32. Macfarlane's calculations reveal that even in the village he studied (where there was an average of almost a hectare of arable land per household as compared to the Nepal hill average of less than 0.4 hectares) only a total of four man months of labor are actually required to farm the available resources.

Department is still in its initial phases, and effective governmental supervision of the thousands of scattered patches of forests has been impossible, many farmers have accelerated their deforestation activities since the passage of this law. The regulations technically require farmers to obtain permits from rangers for collecting each load of firewood and a permit from the Divisional Forest Office (often up to 5 days walk away) for construction wood. Since these regulations are difficult for farmers to obey and nearly impossible for the authorities to enforce, most forest products have been collected illegally. A negative attitude towards governmental control has also developed. As long as these resources are categorized as government property local communities will continue to have little motivation to conserve or renew these natural resources.

Also, until recently, the national forest policy has been oriented toward the large tracts of marketable forests located in the Terai, and only very limited resources have been directed towards the hills. This has led to the classification of forestry with industry in district committees and has discouraged the understanding of hill forestry as a component of hill agricultural systems. Thus, for example, fallowing is discouraged under forestry demarcation regulations which specify that any field left fallow for two years can be alienated by the state.

With respect to the RCU project, this social context of environmental degradation may be summarized in the form of three constraints:

1. Economic pressures: With population increasing at the rate of 2.6%, subsistence for the vast majority of Nepalese farmers will increasingly depend on their using all available natural resources as well as adopting some alternative strategies like migrant labor. At the same time, the benefits of soil-and-water conservation projects tend to be realized only after a considerable lapse of time; and these projects may, in fact, require an initial reduction of the income presently generated from marginal agriculture and overgrazing. Thus, many farmers may perceive these projects as detrimental to their short-run interests.
2. Social Behavior: Present systems of resource management both on an individual and collective basis, perpetuate ecologically unsound practices. These systems will have to be modified in order for the RCU project to be successful.

3. Forest Policy: Nationalization of the forests while in many respects a necessary first step, has led to increased erosion and deforestation. Given the pattern of widely dispursed forest and pasture lands throughout the hills of Nepal, it is almost inconceivable that sufficient manpower could be mobilized to enforce the protection of these scattered lands. In addition, any effective enforcement program will require local cooperation.

B. Locally Felt Needs and Awareness of the Problem

Fortunately, this set of constraints is matched by a number of favorable conditions that can serve as a basis for overcoming the problems they present. Perhaps the most important of these favorable conditions is the growing awareness among farmers of the negative effects of deforestation and erosion and their growing desire to conserve and enlarge their stocks of natural resources. Throughout my field trips, I was constantly encourage by the high level of awareness of the shortage of fuel, fodder, construction wood, and pasture which most people expressed.

However it is crucial to understand that this awareness varies from area to area. Awareness is high only where deforestation and soil erosion have become particularly severe. Although much of Nepal's middle hills fall in this category, areas close to the heavily forested Mahabharat Lekh as well as particular villages near adequate forest patches, are not yet depleted enough for the local residents to be seriously concerned with deforestation and soil erosion. The degree of awareness differs according to watershed conditions as well as on the basis of the localized forestry and landslide conditions.[1/]

Awareness of the need for resources conservation also differs according to peoples exposure to the ecological concepts that relate the occurance of landslides, the availability of pasture and fodder, and the reliability of water sources to the problem of diminishing forests. Programs of the GON, however, have increased peoples' awareness of these ecological connections in some areas.

1/ This conclusion is supported by the Rockefeller team's Study of Hill Agriculture in Nepal in which they have written, "In subsistence farming systems most changes can be made only after sufficient pressure has built up within the system. A farmer will not plant fodder-fuel trees if alternate sources of feed are available close by . . . A relevant and acceptable change in one locality may thus be premature in terms of farmer acceptance in the next." P. 98.

It was encouraging to talk with many nonliterate hill people who were eager to conduct conservation and replantation measures in order to prevent landslides and increase their stock of fodder and fuelwood.1/

Where awareness of ecological processes is high, there is also a felt need for increased fodder and fuel trees as well as methods to check erosion. In the approximately 20 panchayats surveyed, the request for fruit, fodder and fuel seedlings was inevitably ranked as always one of the greatest community needs wherever natural resources were scarce. As is discussed below, this felt need for more fuel and fodder resources has in some areas even resulted in locally initated projects even though initial resistance to change in traditional behavior patterns is common. Of additional importance to the RCU projects design is that the survey conducted for this report substantiates the findings of previous surveys concerning the other highest felt needs in rural areas. These are:

1. irrigation
2. drinking water projects
3. education
4. roads and suspension bridges, and
5. health facilities.

The fact that there is a growing awareness among Nepalese hill farmers of the problems of deforestation and soil erosion and a felt need for conservation, considerably enhances the RCU projects' chances of success. However, there is still a need to increase the spread and the sophistication of this "conservation consciousness" through a variety of formal and non-formal educational strategies. It is clear that conservation projects will only be successful in Nepal to the extent that they are thoroughly understood by the individual farmers. Some methods for implementing conservation education are suggested in the next section.

C. Examples of Community Conservation Activities

While the number is still small, there are some notable examples of locally sponsored conservation activities throughout Nepal. These include community protected forests as well as community established nurseries and orchards.

1/ I was especially pleased when one old Tamang woman explained to me that if the trees remaining above her village were cut, a landslide might cover her home.

These many activities that go beyond the normal planting of individual orchards and fodder-tree seedlings take place to a limited extent throughout the country. The importance of these locally-sponsored activities for the RCU project is twofold:

1. they provide concrete evidence of the willingness of some communities to support their own conservation activities even under the present forest policy and
2. they serve as a model for workable systems of community management, the analysis of which increases our understanding of how community conservation activities can be fostered in project area.

Example A: Bagar village protected forest: A moderately wealthy Chetri landlord initiated this project in Dhanauri Panchayat (in the Dang Valley) about six years ago. For the first year or two this landlord worked alone to conserve a local forest of sal trees (covering approximately 5 sq. ml.). Initially, there was considerable option to him from some of the local people who were prevented from cutting trees or fodder from the main part of the forest. But when the local people saw the extent of natural regeneration which took place, they began to support his efforts. Now the villagers who live around the forest (which do not exactly coincide with panchayat or ward boundaries) support four full-time forest watchmen. These watchmen not only guard the forest but also work on irrigation ditches and keep livestock out of fields. Each watchman is given 16 muris of unhusked rice (@800 KG.) and 16 muris of mustard oil seeds (each muri fetches Rs 200-400). The amount contributed by each family varies according to income but average 1 pathi 1/20 muri) per family. Grazing is allowed on the edges of the forest, but no lopping or cutting is allowed in the forest proper. The forest looks very healthy and has become so thick in the middle that it now harbours leopards that are beginning to kill farmer's livestock. While this project received the unofficial blessing of the panchayat (the landlord was a ward representative) and the Forest Department, neither of these bodies directly participated in its development. There are also several other community-protected forests of this nature in the Dang Valley, including one at Hapur that has been operating for over 20 years.

In addition, to the leopard problem, the Bagar village community has encountered theft from neighboring villages that have not regenerated their own forests. The local people want the authority to find offenders as well as permission to utilize some of their now-abundant forest resources selectively. If this forest were officially given to the community as a Panchayat Protected Forest (under the new law, described below) it should be possible for both of these requests to be granted. (Perhaps the Panchayat could then also issue an expensive permit to tourists for hunting the leopard!)

Example B: Banskharka Panchayat Forest and Nursery: Another conservation project was started by the Pradhan Pancha (Mr. Laksman Man Tamang) of Banskharka Panchayat (3,000 - 8,000 ft. in altitude) two days walk from Chautara or Panchkal on the Indrawati catchment in Sindhu Palchok. About 8 years ago he started a program of protecting forests within his panchayat (which consisted mostly of sal). Many villagers were displeased with the restrictions he placed on the cutting of green wood; but he managed to coax villagers into forming informal "protection committees", in which each participating family took turns in enforcing the forest restrictions. As the forest resources regenerated and the abundance of fodder increased, the vast majority of villagers came to approve the project. The remaining dissenters are mostly political rivals who claim they have private rights to some of the forest land. But most villagers support this project to such an extent that they now pay salaried watchmen in each ward to protect the forests. Each household contributes Rs. 2-4 per month, according to their wealth, and each watchmen receives between Rs. 90 and Rs. 150 per month, depending on the wealth of his ward/village. Banskharka is now known to have the best forests in the area, and local people take considerable pride in their accomplishment. A number of neighboring panchayats that have recently instituted their own forest protection schemes are now actively competing with the Banskharka model.

With the assistance and encouragement of the Divisional Forest Officer, Mr. Tej Bahadur Singh Mahat, and the Australian-Nepal Forestry Project, the Banskharka Pradhan Panch built his own nursery two years ago. The nursery building, walls, and plots were built entirely with labor and material donated by the villagers (equivalent to Rs. 30,000 worth of materials and labor). The Forest Department provided the pipe, several bags of cement, some seed, and experienced foremen. Last year this nursery distributed approximately 60,000 seedlings to Banskharka and neighboring panchayats. This panchayat built nursery has also inspired neighboring panchyats to begin building their own nurseries with Forest Department advice and assistance.

The main problems faced by the Banskharka project are financial and jurisdictional. Since the cost of maintaining their own forest guards and nursery is substantial, village leaders have requested cost-sharing arrangements with the Forest Department. If the forests could be turned over to the village officially and if they could be given authority to fine offenders and issue permits for wood cutting they would receive additional rewards for taking the initiative to solve their own problems with natural resources.

Example C: Jyamire Forest Department Nursery: About two years ago the DFO built a nursery in the largely Brahman village of Jyamire, about one day's walk from Chautara in Sindhu Palchok. When the first batch of over 100,000 seedlings was planted in the scrub slope surrounding the nursery, there was considerable opposition from the neighboring village. These villagers objected that if their cattle were prevented from grazing on this land, the cattle would die and their economy would be destroyed. In fact, over the next year a large percentage of cattle were lost on high ridges where these people were now forced to herd. However, when winter arrived and the villagers were given permission to cut the new grass fodder on the plantation area, they discovered that they had considerably more fodder for stall feeding than in the past. This led them to invest in stall-fed buffaloes. The result has been an increase in the amount of milk products they produce as well as an increase in usable manure, since the manure of stall-fed buffaloes is not distributed over pasture areas. The people neighboring Jyamire now give strong support to the nursery. In addition to volunteering their help in extending the plantation area, they have also formed a committee to protect some of their forest resources below the nursery.

Example D: Tupche Small Farmer Group Orchard: The Agricultural Development Bank has established a Small Farmer Credit Group program in Tupche and Manikamana Panchayats, Nuwakot District with FAO assistance. One Group, No. 8 has started a community orchard. This group consists of farmers, all Brahman, most of whom own less than 8 ropanies (1 acre) of land. When members of this group were negotiating a loan for their orchard they faced a problem in obtaining suitable community waste land. As the forest and land regulations would not allow them to purchase or lease government land, they had to utilize waste land belonging to members of the group. With the assistance of local officials, they were able to expand the boundaries of these private plots to cover some adjoining waste land and to purchase one plot from another farmer who owned land in this area. Adding their own labor to the labor hired under a long-term low-interest loan from the ADB, they then constructed a rock wall around the orchard area. Here they have been planting fruit tree seedlings that they purchased from the Agricultural Department's horticulture section. With each member contributing Rs. 4 per month, they have pooled resources to hire a poor labourer to protect the orchard from livestock and to do the necessary gardening. While the project was initiated under the guidance of the ADB's research officer it has been implemented entirely by the group members themselves. This group, as well as many of the other small farmer groups in this panchayat, is interested in expanding orchard programs to other areas, but until they can buy or lease the necessary land, they will be unable to do so.

It is also worth noting that aside from inspiring the orchard project, the Small Farmer Group program in Tupche has encouraged conservation activities in other ways. By far the majority of loans that the Tupche groups have secured have been for milk buffaloes. While there is a yet relative abundance of fodder trees on privately registered land in Tupche, the recent growth in the buffalo population has stimulated villagers' interest in the planting of fodder trees as well as in the conservation of their existing community forest resources.

D. The Change Process: Community Organization and the Role of Community Leaders

From these and other uncited examples it is clear that although farmers are often aware of the problem of deforestation and soil erosion the acutal process of changing behaviour patterns through the implementation of conservation activities encounter initial resistance. The degree of resistance obviously differs according to the type of conservation activity as well as according to the ecological and social conditions prevalent in the area. Some activities, such as planting fruit and fodder trees on private or group-owned waste land only require motivating the farmer to plant and protect the seedlings. But other activities such as protecting neighborhood forests and converting vast tracts of pasture land into plantation can require considerably more persuasion and demonstration. These latter type of activities will involve farmers in a more fundamental change of traditional practice - often a change that the farmer fears will threaten his livelihood despite his concern with conservation.

The examples examined here suggest that these more extensive conservation projects require strong local leadership especially in the initial stages. In the cases discussed the success of a project depended on a local leader taking the initiative to start the project and using his authority to mobilize community action in spite of opposition. This suggests that a RCU project is more likely to meet with success if an effort is made to implement the project through local leaders.

The possible disadvantage of working through local leaders is that either through the fairly widespread existence of village factionalism or through the leader's identification with local elites, some people could be unfairly excluded from participation in conservation activities. But since, as will be discussed in more detail below, the benefits of these community projects seems to be fairly equally distributed, it is my opinion that this possible disadvantage would be offset by the effectiveness of local leaders in mobilizing community action. If RCU community activities follow the pattern of the examples examined here, it seems likely that after an initial 1 to 4 years period, the benefits of conservation activities will become apparant to all and that they will soon receive the full support of the majority of the community. This suggests that while local leaders are especially important in the initial phases of a project, a peoples' eventual perception of the benefits they were receiving helps to insure their participation in the on-going implementation of the project. In addition, inter-community competition over resources utilization rights, could be reinforced by the demarcation of local forests as panchayat protected forests. This would then serve to increase local motivation to protect resources for outsiders.

A community's ability to organize itself for conservation measures varies according to the local political situation, the authority and credibility of its leaders, and the level at which organization takes place. However, the research for this report indicates that if there is sufficient motivation, no overwhelming local political obstacles, and some flexibility in the level and form of organization, a wide variety of ethnic groups and mixed populations are able to organize themselves effectively. Some specific suggestions regarding local organizational formation are given in Section IV.

E. Factors Which Can Accelerate Awareness Of Ecological Problems and Adoption of Conservation Activities

The examples of community conservation activities examined above illustrate kinds of community action that have occurred within the present Forest Regulations and without the benefit of major outside support such as that proposed in the RCU project. The new (1977) Forest Amendment Act and the support that will be provided in the RCU project will undoubtedly increase the social feasibility of conservation activities. The potentials that these new measures carry are briefly discussed here.

1. 1977 Forest Amendment Act

On September 7, 1977 (Bhadra 22, 2034, Nepal Bajapatra, Vol. 27, No. 25) His Majesty enacted the Forest (First Amendment) Act. In Chapter 5 of the Act, 4 categories of forests are designated which can be entrusted to community control. These include:

a. Panchayat Forest: "Any governmental forest area or any part thereof, which has been rendered waste or contains only stumps, may be entrusted by His Majesty's Government to any village panchayat on prescribed terms and conditions for reforestation in the interest of the village community, and such forests shall be called Panchayat Forests."

b. Panchayat-Protected Forests: "Governmental forests in any area or part thereof may be entrusted by His Majesty's Government to any local panchayat on prescribed terms and conditions for the purpose of protection and proper management, and such forests shall be called Panchayat-Protected Forests."

c. Religious Forests: "Any governmental forest or part thereof located at any place of religious importance may be entrusted by His Majesty's Government to any religious institution on prescribed terms and conditions for the purpose of protection and proper management, and such forests may be called Religious Forests."

d. Contract Forests: "Any governmental forest in any area or any part thereof which is devoid of trees, or has only stray trees, may be entrusted by His Majesty's Government to any individual or agency on prescribed terms and conditions for reforestation and for production and consumption of forest products, and such forest shall be called Contract Forests."

In Section 31. "Adjudication", the Law also states that "The appropriate panchayat shall have the power to hear cases relating to offenses punishable with a maximum amount of one hundred rupees under this act, or involving a claim of the same amount in respect to Panchayat Forests and Panchayat-Protected Forests."

These new clauses mean that panchayats conducting reforestation or forest-protection activities with support from the RCU project will have these lands entrusted to them as part of their community resources (i.e. the government cannot come in and cut down their trees for use outside the community). In all areas where research was conducted, everyone questioned agreed that this measure would considerably increase their motivation for conducting conservation activities. The knowledge that these resources will belong exclusively to the community as long as the community maintains appropriate conservation practices will undoubtedly encourage panchayats to participate in conservation activities.

Likewise, the clear designation of certain lands as religious forests paves the way for better protection of the resources on this land. While many temples and monastaries have been protecting forests in their vicinity all along, there was no legislative authority sanctioning this practice and the government was at liberty to demarcate these forests as State property.

Of most importance to AID's interest in reaching the small farmer, is the new category of Contract Forests. If used judiciously, this clause could allow the Forest Department to contract with small farmers, landless people, and groups such as the ADB-sponsored Small Farmer Credit groups for the plantation and protection of fruit and fodder tree orchards. In addition, this clause could be used to designate heavily eroded farm land as appropriate for this kind of contract.

2. Additional Inputs in the RCU Project

The additional development inputs planned in the RCU project should also considerably increase the social feasibility of the project, particularly if these are coordinated with conservation activities. It is my opinion that the primary focus on conservation could be lost if the project is diluted with too many additional inputs. On the other hand, limited support for communities willing to engage in small-scale irrigation, drinking water, poultry and livestock, and rural works projects would provide immediate benefits to help offset the delayed benefits of resource conservation. By linking these additional inputs to conservation projects to the extent administratively advisable (i.e. by having the same community committee manage both), and by selecting specific inputs on the basis of each community's own desires, the RCU project will not only be increasing the chances for conservation programs to succeed, but will also be providing needed inputs to improve the standard of living in the project area.[1/]

3. Participatory Planning, Training and Evaluation

The GON's new policy of forests and the RCU project's emphasis on additional community needs vastly increases the scope for local participation in the conservation of Nepal's natural resources. As noted earlier in the excerpt from the Soil and Water Conservation Department's Program, this sort of participatory approach is not a goal in itself but a precondition for successful conservation projects. As Eckholm has noted, "In country after country, the same lesson has been learned: tree-planting programs are most successful when a majority of the local community is deeply involved in planning and implementation, and clearly perceives its self-interest in success."[2/] Community conservation is not an option to be experimented with in the hills of Nepal -- it is the only viable possibility for reversing the degradation of Nepal's environment.

1/ This conclusion is the same as that reached by the FAO in its report entitled "Mountain Forest Management for Local Community Development". On p. 13, they write, "The needs of the rural communities in terms of forestry are at many places closely linked with the other needs, i.e. drinking and irrigation water, trail improvement and introduction of new fodder grass species. Besides the need for fuelwood, there is an important request for trees with multipurpose utility, such as fruit and fodder trees. Any assistance activity must be fundamentally inspired by the very precise requests and observation of the local population. Any assistance programmes in this field must have a certain degree of flexibility built into it for adapting itself to the people's requirements promptly and sufficiently".

2/ (P. 109-110 Losing Ground.)

However, there are many different forms that community involvement can take. Not all of them will work equally well, and none of them may work in particular villages that are characterized by severe social and economic rivalries. The task of the RCU project is to explore as many ways of encouraging community participation in development as is feasible within the Nepalese framework. This should include such strategies as having local people participate in the planning and evaluation of conservation activities within their own areas both at the village and district level. Specific suggestions along this line are presented in Section IV.

F. Spread Effects

The degree to which conservation activities will be adopted by communities adjacent to the project area depends to some extent on how the project is implemented. However, judging from the examples examined here, the potential for diffusion to neighboring areas is very good. In Sindhu Palchok district, with the encouragement of the DFO, the number of panchayats that have adopted some kind of forest conservation has increased from 3 to over 10. Likewise, following the lead of one panchayat that set up its own nursery, another two groups of panchayats are now in the process of making their own nurseries with assistance from the Forest Department.

These examples demonstrate that conservation activities in selected communities can and do spread to other communities. The three factors which seem most important to the success of this spread effect are:

1. the encouragement of government officials,
2. the involvement of panchayat and district level panchayat representatives, and
3. sufficient time.

The last factor of time is especially important. The time ordinarily needed for a conservation activity in one panchayat to be adopted by another (perhaps 2-3 years) could be shortened using local leaders as "extension agents" and increasing participation. Nevertheless it must be realized that just as the rewards from conservation projects are long-term so will be the diffusion of conservation practices from one area to another.

This understanding of the kind of spread effects that can be expected from the RCU project suggests that the project might increase the spread by actively initiating activities in responsive panchayats throughout several selected watersheds or districts. In other words instead of trying to mobilize all wards and panchayats within a watershed for conservation activities, it would seem more efficient to take a scattered "shot-gun" approach over large areas to allow for the maximum spread effect with the minimum investment.

G. Distribution of Benefits

A detailed analysis of the distribution of benefits of the RCU project is of course, not possible at this stage. However, it is possible to examine the probable distribution of benefits according to category of development input. The actual distribution of benefits will depend greatly on the strategies used for implementing various components of the RCU project. Research on distribution of benefits will be needed during the design and implementation stages of the project.

1. Planting of fruit, fodder fire and timber trees on private land

   As this activity will bring benefits in proportion to the land owned, it will mostly favor large landowners. However, this can be offset by making special provisions for contracting waste land to small farmers, landless persons, and small farmer groups. Also, to the extent that larger farmers will be able to rely on private sources of fuel and fodder, a greater percentage of community resources should be available to small scale farmers.

2. Protection of community forests

   Fuel and fodder resources of community forests are equally available to all members of the community. Since large farmers require more of these resources than do small ones, initial restrictions on the collection of forest products will effect the large farmer more than the small farmer. But the increase in resources which will eventually result from protection will be equally available to all. To keep the costs of forest protection equitable, care will have to be taken to insure that communities continue to use sliding scales for local support of forest watchmen.

However, some occupational castes rely on wood products for the manufacture and sale of handicrafts, though the number of these people in most of the middle hills is small. The protection of forests will deprive these people of some of their income, but this could be compensated by off-farm employment in conservation activities. Or a plan could be made whereby timber is harvested according to annual growth rates for use by those whose primary income is wood product-dependent and more resource-efficient tools and methods could be introduced.

3. Community Reforestation and Fodder Production

Based on the example of the Jyamire Forest Nursery and plantation, it seems that after an initial adjustment period everyone, and especially the smaller farmers, benefits from this activity. As grazing of large herds of cows (and other livestock) requires an amount of labor that only larger farmers can afford, the present system is biased in their favor. However, the switch to stall feeding of buffaloes allows small farmers to maintain a proportionately larger number of productive livestock in relation to large farmers than was possible before the reduction to grazing land and the increase in grass and tree fodder resources. However, to insure that small farmers can make use of this changed balance of resources requires that they be given credit to purchase buffaloes (such as through the small farmer program) and that veterinary services are made available so that the investment is not lost.

Since reforestation activities will provide some off-farm employment, small farmers will also gain additional sources of income generated by this activity.

4. Irrigation Projects

The primary beneficiaries of small-scale irrigation projects will be those farmers who own or have secure tenancy rights on land that will be irrigated. This can only be determined on a case-by-case examination of areas to be irrigated. Such an examination can be included in the feasibility study of irrigation project proposals to make sure that sufficient numbers of farmers are being benefited. Since there is considerable fragmentation of land holdings and since very large land holdings in the hills are rare, the chances are good that most irrigation projects will benefit many small farmers as well as larger ones.

5. Drinking Water Projects

Drinking water is of primary benefit to the women and children in the community. While statistics will only be available after the current AID-CEDA time allocation study is completed, it is clear that it is mostly women who collect and carry drinking water - often spending up to several hours of labor a day in this activity. The construction of drinking water system will thus allow women to use more of their time on more productive activities as well as increase their opportunities for more satisfying social activities. In addition, the provision of less polluted drinking water will increase the public health standards and cut down on the amount of disease suffered by both children and adults. The availability of more water for vegetable gardens (most of which are also cultivated by women) will increase the level of nutrition and in some areas, provide additional income to farmers.

6. Conservation Structures

It appears to me (and many farmers that I have talked to) that conservation structures such as check dams, river course gabions, etc. are rarely an economically viable alternative to forestry activities; nevertheless a limited number of such structures should be constructed in places where gullies and soil erosion threaten major agricultural or residential areas or where rivers threaten to destroy suspension bridges or roads. These structures will directly benefit the laborers employed in their construction as well as indirectly benefit the community at large.

7. Trails and Bridges

If selected trail improvement and suspension bridge projects are included in the Project, they will benefit the whole community more or less equally. However, to the extent that educational and health facilities tend to be built in richer villages, trail and bridge projects will give poorer villagers greater access to these services.

8. Rural Works

Rural works will benefit small farmers and landless laborers who receive additional income through employment on these projects, e.g. in construction of bridges and conservation structures. Some long-term employment opportunities will also be generated in the form of jobs for nursery workers, forest watchmen, etc. However, unless a separate rural area development project or a large scale income-generating project would require a level of funding equal to that of the RCU project, I would suggest that income-generating activities remain a supplementary rather than central component of the RCU project.

9. Grazing Activities

There are many landslides and poorly stocked areas that can be rehabilitated by seeding and protecting and provide a fodder source. Recovery is often dramatic--showing results in one growing season. Depending on location and ownership, benefits from these activities will tend to be widespread.

10. Alternate Energy

Alternate energy projects such as bio-gas plants and mini-hydro projects will only directly benefit the larger farmers since at present only the large farmers can afford these new technologies. However, to the limited extent that these energy projects will reduce the amount of community resources that these larger farmers require, these activities will indirectly benefit the small farmers by allowing them to use a proportionately bigger share. To the extent that biogas plants are designed so that they can be manufactured cheaply and repaired by local craftsmen, this poorest segment of Nepalese society could also benefit from alternate energy projects.

H. Summary of Benefits

It is clear from the above that some activities will more directly benefit large farmers, some will more directly benefit small farmers, and some will equally benefit both groups. In my opinion the balance of benefits is such that the RCU project can favor the smaller farmers more than the larger ones without significantly threatening the latter. Most important, however, is the fact that both directly and indirectly, this project has the potential to conserve the natural resources of the hills upon which all farmers in Nepal depend.

IV. IMPLICATIONS FOR PROJECT DESIGN AND SUGGESTED STRATEGIES

A. General Considerations: Site Selection and Project Flexibility

The feasibility of resource conservation activities is site-specific, varying according to both environmental and social conditions. The selection of project areas (whether they are catchment areas or districts) should be based primarily on environmental factors -- that is, selected areas should be suffering sufficient deforestation and soil erosion for the local people to be well aware of the problem. In order to maximize the benefits of the project, areas within the more densely populated "problem-zone" of the middle hills should be given priority. Then, within these selected areas, specific sites for the initial phases of project implementation should be selected primarily according to social criteria -- i.e. selecting those panchayats and wards that demonstrate the most willingness to mobilize themselves for participation in conservation activities. The goal of complete coverage of all villages within a catchment area should be considered secondary to the establishment of successful activities in the more cooperative villages.

The need to maximize local participation to make conservation projects more successful demands that the project be flexible enough to respond to the specific requirements of each project site. This suggests that the project should conduct site-specific research and should make arrangements for sufficient budgetary flexibility. In order to maximize the project's potential for application throughout Nepal. The flexibility to respond to ongoing monitoring will also be required of the project. Above all, the long-term time frame of resource conservation must be kept constantly in mind. The ultimate success of the project will depend more on committment, patience and the ability to respond to local situations than on any other factors.

B. Local Organization

At the local level, the Project should encourage the formation of Conservation Committees (Samraksan Samiti). These conservation committees could then organize all community conservation activities in the project area with project assistance.

There are basically two ways in which these committees could be organized. Each has advantages and disadvantages, and it may be best for the project to experiment with both options in different project areas.

Option 1: This primary conservation committee is formed at the Panchayat level under the leadership of the Pradhan Panch, Ward representatives, and other village notables. In order to maximize participation in this committee, it could also include interested farmers from each ward. This committee would be the primary decision making-body and would receive such authority as it is given by government officials in connection with panchayat-protected forests, panchayat forests (i.e. plantation on waste land), and other development projects initiated in the village (such as irrigation systems). Under the guidance of this primary committee, ward level sub-committees could be formed according to the distribution of natural resources within the Panchayat. That is, one or a few wards could form a committee to oversee the conservation of community resources that their members share. These ward sub-committees would be responsible for the administration and support of project activities which fall within their boundaries.

This option, which has been adopted extensively in Chautara Division has also been used in the Phewa Tal Catchment Project, was the one most favoured by Panchayat representatives and Back-to-the-village National Campaign Members with whom I discussed the issue. It has the advantage of conforming most closely to the present administrative-political system and of limiting the number of official committees with which contract and support arrangements must be made. A disadvantage of this option is that it depends heavily on the level of the individual Pradhan Panch's interest in conservation. In other words, it does not allow for the possibility of particular wards forming their own committee without the support of the whole panchayat. This can mean that committed conservationists who are currently in power are excluded from participation and leadership roles.

A perhaps greater disadvantage is that it assumes forest areas in the hills are conterminus with panchayat boundaries when in fact many small forest areas are contained in one or two wards and many larger areas span more than one panchayat.

Option 2: Each ward or group of wards sharing a common natural resource form their own separate conservation committee and deal directly with district project officials. Where possible, a panchayat level coordinating committee could be formed to the various groups together. This option has the advantage of placing authority at the level of the working committee as well as allowing individual wards to act, whether or not they have panchayat level support. It has the disadvantage of increasing the number of committees formed-thereby increasing the amount of supervision and extension work for District and project officials. It also has the potential disadvantage of creating an institution which could overlap with the authority and functions of the village panchayat framework.

Perhaps the best approach would be to adopt Option 1, but retain the flexibility of forming individual ward committees as in Option 2. In fact, several community leaders suggested to me that this kind of combination would carry the greatest potential for maximizing conservation activities. It would also be advisable to allow the formation of committees that include wards from different panchayats in areas where forest resources span two or more panchayat areas. This would allow for the possibility of inter-panchayat committees. The main value of this approach is that it provides the flexibility for the institution to be organized around homogeneous forest or natural resource areas.

The catchment system developed in the Phewa Tāl Watershed project could also be employed in this project without disrupting the organizational suggestions presented here. This plan envisions a 4-tire system:

1. At the bottom, a Panchayat Conservation Committee followed by
2. a Catchment Conservation Council composed of 100 KM^2 average with 6-10 panchayats, followed by
3. a Regional Advisory Council for each of the four Development Regions, and
4. a National Advisory Council.

Coordinating conservation activities on a catchment basis seems an excellent idea. But I am concerned about the requirement for a catchment council that includes representatives from each panchayat and has the authority to approve or disapprove projects. This requirement may place an unnecessary stumbling block between the action groups (local conservation committees) and project/district personnel who are actually responsible for allocating funds to projects. However, if all these powers are not given to the catchment council, it appears to be an excellent idea to form a catchment council whose job is to plan, coordinate and motivate catchment-wide conservation activities. By linking this catchment council with project and district personnel—as has been recently done in the Phewa Tal area—its effectiveness will be considerably enhanced.

C. The Role of Local Committees

In cooperation with project personnel the panchayat/ward level Conservation Committees could be primarily responsible for the protection of their Panchayat-Protected Forests and for the reforestation of Panchayat Forests established on waste/pasture land in their community. In addition, they could work with project personnel in establishing priorities for additional project activities such as conservation structures, small-scale irrigation systems, drinking water, etc. The committees could be responsible for hiring forest and plantation watchmen with the cost of such labor shared by the Project. (A 50% cost-sharing arrangement seems both equitable and workable).

Community reforestation and conservation-structure projects conducted under the joint supervision of the committees and the project should be largely funded from project resources as "public works activities". Additional project activities if any (e.g. irrigation and drinking water) should use labor provided voluntarily by the community with most of the necessary capital inputs (i.e. cement, pipes, etc.) provided by the project. For panchayats interested in starting their own nurseries, the salaries for nursery workers and the needed technical assistance could be provided by the project while the local committees provide the necessary land and labor. These possible roles of the local committee and the project (including District) staff are summarized in the following chart:

Possible Roles of Local Committee	Corresponding Roles of Project/District
--Formation of committee and design of conservation activities plan	--Encouragement, advice, and extension/-training activities
--Protection of Panchayat-protected forests through hiring watchmen and fining offenders	—Demarcation of panchayat-protected forests and contract with committees, contribution of 50% of watchmen costs
--Promotion of conservation ethic	—Provision of training to committees

--Establishing area for reforestation under Panchayat-forest scheme; hiring of watchmen and assistance to reforestation	--Demarcation of panchayat-forest area provision of seedlings, supervision and funds or food-for-work for laborers financial assistance for watchmen
--Proposing and providing voluntary labor for approved projects such as irrigation, drinking water, pasture improvement, etc.; establishing local maintenance systems	—After feasibility study and approval providing necessary commodities and technical supervision/advice for construction of these projects

D. Delegation of Authority to Local Committees

Farmer motivation for farming and participating in local conservation committees will depend to a large extent on the degree of authority allowed this committee by the Forest Ministry. As noted in the previous section, almost every farmer is technically guilty of the infraction of fuelwood collection regulations. In addition, all farmers--but particularly the poorer ones--complain bitterly about the extreme difficulty of obtaining permits to construct a new house or reconstruct a dilapidated one. These problems and the negative attitudes toward the government that they engender can be alleviated by delegating a reasonable amount of authority to the local conservation committees while making an agreement with them regarding the protection of panchayat forests. Thus, authority to regulate collection of dried firewood and certain kinds of tree and grass fodder could be delegated to the local committees. These committees could also be given authority to issue a certain number of permits per year for house construction.

Since it is possible that local political rivalries may on occasion exclude certain people from obtaining needed construction permits, provision for these people to obtain a permit to cut wood in a nearby government forest could be retained. All permits for commercial use of wood or any permit for large amounts of wood would still have to receive the approval of both the committee and the forest authorities.

The exact lines of authority for these committees could be worked out according to the best judgement of the forest officials and the committee members. Naturally, the government would have to revoke this delegation of authority and resume control if it is misused by some committees. This means that methods of supervision by forest officials will have to be developed.

E. Participation, Extension, Local Training and Non-formal Education

The heavy emphasis on the local participation that is necessary for a successful RCU project means that participation needs to be fostered in all aspects of the project's design. A variety of strategies for increasing meaningful participation are possible and should be explored.

One possible strategy is that outlined by the Catchment Council. This system was developed with FAO cooperation in the Phewa Tal Catchment area. Here, the strategy is to include representatives of Panchayat Conservation Committees in the Catchment Conservation Councils; catchment representatives in Regional Advisory Councils; and regional representation in the National Advisory Council.

This system does not necessarily involve District level committees such as that set up under the District Administration Plan. It would seem, then, that even if the catchment system is used it will still be advisable to link these councils up at the district level through a district committee. Similar to the present DAP committee, this district level committee would be made up of District Officers, the Divisional Forest Officer, the Project Conservation Officer, District Panchayat Representatives, the Panchayat and Development Officer and Project Officers. If possible, it would be preferable to separate this committee from industry and include representatives from the Agriculture Ministry, the Local Development Department, and the Cottage Industries office. It would also be advisable to include representatives from conservation committees -- possibly those selected by Catchment Conservation Councils.

If participation at this district level is going to be meaningful, it is essential that District Panchayat representatives understand the nature and value of conservation projects. This might be best accomplished by organizing short training programs that expose these important leaders to the techniques, potentials, and demonstrated value of conservation activities. Educational tours to nursery sites, horticultural farms, conservation sites, and, most important, to those villages that have already instituted their own conservation activities could be conducted.

In addition to including district level personnel in conservation activities, it is clear that in order to achieve the required degree of local awareness and participation at the community level, the RCU project needs a special extension and training component. At present, there are very few extension personnel attached to the Forest Ministry Departments and the job description of rangers and foresters does not stress specific extension activities. While the use of

JTs, JTAs, and AAs should be encouraged. These peoples' lack of training in conservation as well as their well-known work limitations[1/] suggest that they will not by themselves function as sufficient implementors.

There are several methods for filling the extension gap in addition to radically increasing the number of soil and water conservation extension agents. Each is based on the idea that respected local farmers are often more credible communication agents than outsiders who may not share the same world view or even the language of the communities in which they work.

One method would be to hire as Conservation Coordinators local leaders in each district who have demonstrated their interest and concern with conservation. These conservation coordinators could be given short term training to work as project motivators and channels for communication between conservation committees and technical personnel. If possible, National Development Service Students and Peace Corps volunteers could also be recruited to provide technical assistance to community conservation committees. The use of Conservation Coordinators not only has the advantage of harnessing skills of proven conservation change agents, but insures that the agents are credible and "speak the same language" (in both the cultural and linguistic sense) as the peoples with whom they are working.

At the community level another method for inducing acceptance would be to provide general educational activities for key members of conservation committees. In addition to providing a brief training on conservation ideas and methods, an important component of this local training could (as at the district level) involve visits to panchayats that have already carried out successful conservation programs. This method has the advantage of increasing credibility by allowing farmers to learn directly from other farmers. Conservation coordinators could play an active part in organizing this kind of non-formal education.

Training should also be provided to local nursery workers and forest watchmen. Experience in Chautara Division shows that the best nursery foremen are farmers and farm-laborers who are given on-the-job-training to supplement their considerable experience in growing all kinds of plants. Experience also

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1/ See: R.P. Yadev's "Case Study of Small Farmers in Naktajhij Dhanusha, Nepal", Contributions to Nepalese Studies. Vol. V, No. 1, Dec. 1977.

shows that as long as one literate worker is available, the foreman himself does not have to be literate, and that formal educational criteria for the foreman positions are likely counter-effective in job performance. In addition, the success and failure of reforestation schemes partly rests on the ability of local nursery workers to collect good seeds, grow, and plant them correctly. These skills are best learned on-the-job, with some supplementary training provided by skilled technicians. Persons trained in this manner can then be transferred to other nearby panchayats thereby both providing continuing off-farm employment to these poor farmers and ensuring more successful conservation programs. Panchayat forest watchmen could also be given some nursery training as well as short courses in the proper management of fodder and wood collection.

F. Forest Policy Considerations

Possible recommendations for improving the implementation of forest policy in order to accelerate conservation activities are listed below. Most of these ideas were suggested by officials concerned with forestry and have been confirmed by farmers questioned.[1/]

1. Demarcation: As soon as the regulations spelling out the procedures for establishing Panchayat-Protected Forests, Panchayat Forests, Religious Forests, and Contract Forests have been promulgated, priority should be placed on demarcating these forests in cooperative panchayats that have formed active conservation committees. As contracts that allow the government to entrust authority over these communal lands to local committees may require prior land demarcations, it is important that this demarcation receive priority over the demarcation of State forests in project areas. This may well necessitate increasing the number of rangers presently allocated to each area as well as providing budgetary support for the demarcation process (i.e. erecting of concrete demarcation pillars if considered necessary).

1/ I am particularly grateful to Mr. Krishna B. Malla, Mr. Tej S.B. Mahat, Mr. A. Joshi, and Mr. Steven Midgeley for their suggestions in this area - although they may not agree with all of them.

The demarcation of government forests which takes place in the project area should be directed toward larger tracts-those tracts far enough from villages that they will not likely be needed for Panchayat forests. The present regulation on fallow land (which allows the government to subsume any land fallowed for two years) is often responsible for either encouraging erosion (through too frequent plowing) or for taking land away from marginal farmers. It may then be appropriate to provide a two year grace period to farmers claiming this land. During these two years, the farmers would either have to plant the land in fruit or fodder tree orchards, terrace it properly or lose it in community or government forest land.

Priority should be placed on leasing smaller patches of eroded or waste land to small/landless farmers living near these patches. The contract of the lease could specify that the lease could be cancelled unless this land is properly protected. This method of dealing with heavily eroded land and small patches of overgrazed waste land could bring the twin benefits of checking erosion and providing additional livelihood to small farmers, who could then sell the products from this land. This policy could become even more beneficial if the Agricultural Bank's small farmer group program is promoted as a vehicle for this kind of contract as this kind of program would provide greater accountability and distribution of benefits over a large number of poor farmers.

As noted above, the Forest officials could also give authority to Panchayat Conservation Committees to issue a specific number of construction wood permits and to fine offenders. As an interim measure -- while the process of legally delegating this authority is being worked out -- the Forest office could specify that each conservation committee has authority to recommend a set number of automatically - approved permits per year. The committees could also assist in identifying trees for felling so that the government does not act without their approval. This method has already been successfully instigated in the Chautara Division.

Technical aspects of forests policy which deserve consideration are the selection of tree species and the use of fences. Current forest nurseries emphasize fuelwood species over species which also could serve as sources of fruit and fodder. Depending on local requests, this emphasis should probably be reversed for much of the hills so that the majority of seedlings consist of fodder and fruit trees. These are in higher demand and can be just as useful for soil conservation.

With regard to fencing, evidence from current community protected forests and forest department plantation areas suggests that the extensive use of wire fencing material is financially prohibitive. This is not only because fencing has to be imported, and transported by human back at great expense, but also because a number of guards are still required to police the fence. This suggests that the use of organic or local fencing material is preferable, when necessary at all. Also, in most cases it is more economical to share the cost of local watchmen than to expend funds on fencing.

However, a detailed economic analysis of the various forest-protection options should be an important part of the economic aspects of the project's design. One final point pertains to the ownership of trees on private land. Current regulations specify that these trees belong only to the farmers if they were planted by them. Thus, especially in Terai and Inner Terai areas (but also to some extent in the hills) trees that cannot be proved to have been self-nurtured are declared government property. Since people feel that the government may claim these trees at any time, these trees are inevitably over-lopped and ill-treated. Perhaps some scheme could be developed that would permit farmers to purchase these trees from the government at reduced rates on condition they were not cut down within a set period (say five years).

G. Formal Training Component

The shortage of competent and motivated manpower of conservation is a well known constraint of conservation programs. Since the problem of providing facilities to train manpower will be addressed during the Design Phase, I will deal here only with a few points regarding motivation.

The tradition of Terai commercial forestry, which up until now has dominated Forest policy in Nepal, has resulted in the recruitment of a disproportionate number of Terai personnel as well as in an indirect reward-structure that favors Terai postings. This needs to be reoriented by making special provisions for the recruitment of hill-people to work in the hills and by rewriting job descriptions what will place much greater emphasis on the development of community forestry and conservation activities. Since work in the hills requires more laborious trekking and/or horse-back riding than is required in the Terai and since there are few or no commercial prospects in the hills, it is only fair to increase the financial incentive of hill-posting by raising hardship allowances and travel reimbursement rates. The construction of decent living and touring quarters should also be included within the project. In addition, the value of foreign training as an incentive should be kept in mind so that deserving personnel who have promoted conservation in the hills receive some preference in the distribution of these training opportunities.

H. Project Organization

Since the project's organization structure will be determined during the Design Phase, the following chart only represents a tentative scheme that can be used as a basis for further modification and elaboration.

At the National level, the project should fall under the purview of the Ministry of Forests. Within the Ministry of Forests, the project will need to be most closely associated with the Department of Soil and Water Conservation and the Department of Forests. Coordination with other government ministries and departments, including the Institute of Forestry, could be achieved through representation of these organizations on a Project Coordination Committee. A senior officer from the department of Soil and Water Conservation could serve as the member-secretary of this committee and function with assistance from the Technical Advisor as the Project Coordinator.

At the catchment or district level[1/] coordination could be achieved through a Project Action Committee that would include the CDO, DFO, PDO, District Panchayat representatives, and District officers from appropriate departments such as Agriculture, Cottage Industry, Local Development, etc. The member-secretary of this committee could be a Conservation Officer from the Department of Soil and Water Conservation who would be primarily responsible for project activities in his area. However, many of the project activities may require the kind of authority that presently appears to fall under the direction of the DFO. Further, the DFO of the Department of Forests is the only Forest Ministry officer presently located in most of the Divisions, outside of Kathmandu, with other forestry personnel under him. Therefore, it seems crucial that:

1/ For an analaysis of the Social and Adminisrative benefits of using the district as a basis for project activities, see Land Use Practices for the Conservation and Development of Nepal's Soil and Water Resources: Consultants Report, III, P. 15.

1. the conservation officer be delegated sufficient authority over the allocation of community forest land and that he be given sufficient staff to undertake conservation activities; and/or
2. the conservation officer be closely coordinated with the DSO office. In either case, it is clear that the CO and DFO would have to work closely together and that the development of conservation activities would be the primary responsibility of the CO.

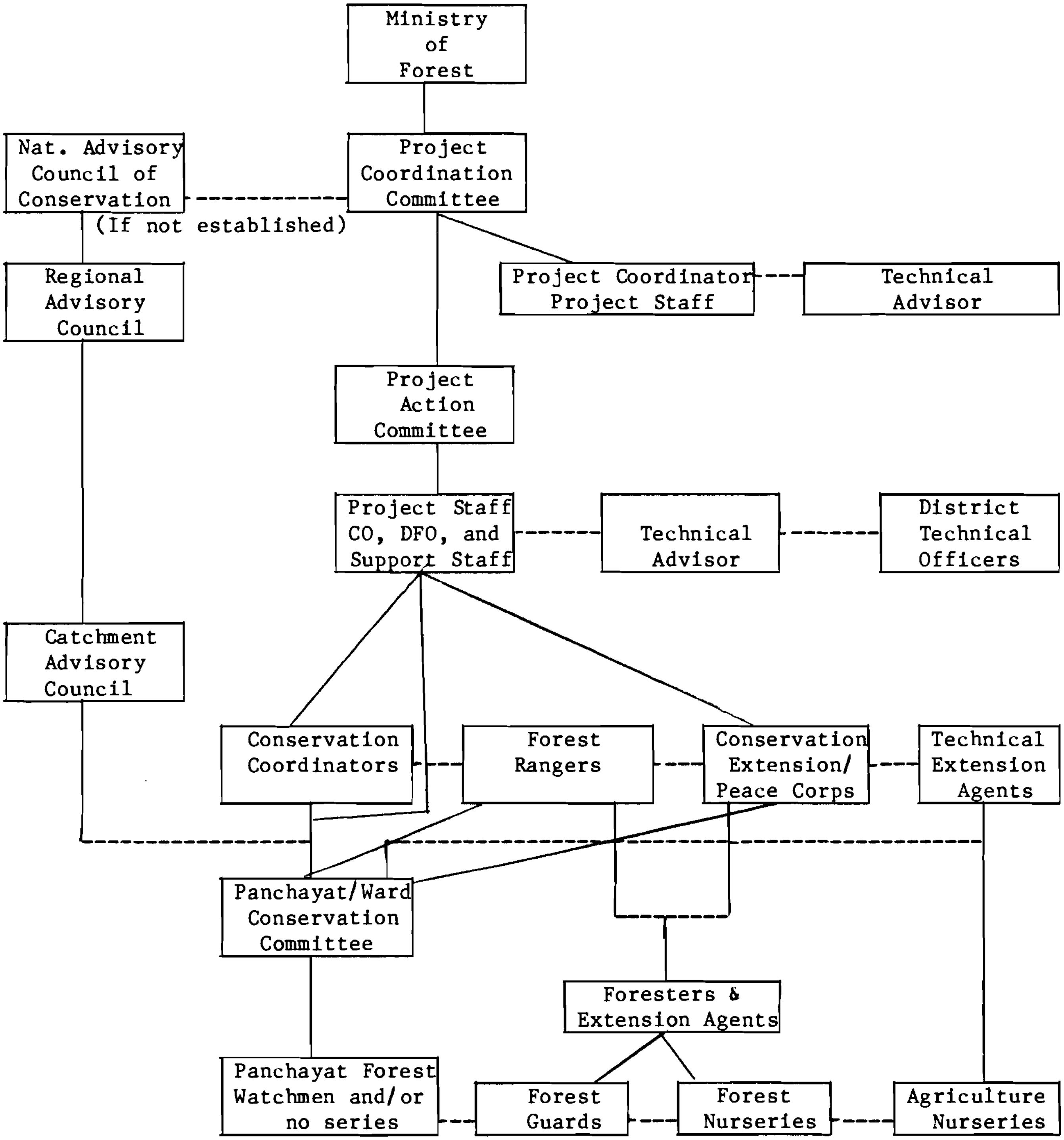
I. Relationship to Other Projects

The urgency for implementing conservation activities throughout Nepal and the high degree of international and bi-lateral support that is presently being generated for this purpose provides a unique opportunity for inter-donor cooperation. While allowing for some variation in approach according to the conditions of different watersheds the final organizational format for the RCU project will no doubt reflect the government's interest in coordinating the various projects being funded by various donors.

One method for achieving this coordination may well be to use the same project coordinating committee at the national level for each donor-supported project. Another possibility -- which could be used simultaneously -- would be to increase participatory coordination thorough the formation of the Conservation Councils. This possibility is reflected in the chart.

Perhaps the most important aspect of inter-project coordination is the sharing of information on the most successful methods for increasing conservation activities. This could be accomplished by providing a structured forum for the regular sharing of progress reports and evaluations, in addition to an on-going agency such as APROSC conducting periodic evaluations of the different methods used in different projects. This agency could present their results in annual workshops held by the Department of Soil and Water Conservation.

TENTATIVE ORGANIZATIONAL CHART



V. PRELIMINARY RESEARCH AND MONITORING POSSIBILITIES:

The following is an outline of socio-economic investigation activities tentatively suggested for the Design Phase of the RCU project. The primary aim is to uncover the socio-economic factors that will have a direct bearing on the success of implementing the RCU project. Thus the proposed inquires will be confined almost entirely to project sites, and can only be conducted once these sites have been selected. By conducting this kind of research concurrently with the implementation of initial project activities, and by involving the local people in the investigation, the local people could participate in the project to a greater extent than would otherwise be possible. The purpose of this outline is to present ideas for discussion -- the final investigation framework will require considerable refinement and reorganization.

A. Baseline Surveys

1. Preliminary Site Survey

Purpose

This preliminary site survey would provide important general information for all panchayats in the project areas and serve as a basis for devising further implementation strategies. Possibly, this could be combined with land-use surveys to produce a series of overlapping maps locating environmental, economic, and social characteristics of the project area.

a. Conduct preliminary survey of livestock population and general patterns of resource exploitation in each panchayat, including main cropping patterns, fuel wood and fodder collection patterns.
b. Survey location of roads, main trails, suspension bridges, markets, schools, health posts, government offices, nurseries, etc.
c. Survey population of selected areas in each panchayat to determine ethnic/caste composition, languages spoken, patterns of settlement and to combine these data with census information.
d. Conduct preliminary survey of socio-cultural feasibility in each panchayat by tentatively assessing community awareness of conservation needs, other felt needs, and attitudes towards other development projects that have been conducted in the community.

e. Make a preliminary list of important local leaders in each panchayat.

2. Benchmark Sample Household Survey

Purpose:

The benchmark sample household survey would provide crucial socio-economic data on the relevant categories of population in project areas. In addition to providing benchmark data for measuring project benefits, this survey would analyze the productive systems of various groups in relation to their available resources. This will enable the project to address itself to the specific socio-economic conditions of the people in project areas. This survey would also identify especially disadvantaged groups and provide comparative data on such resources as land-holding, livestock, etc.

Methodology:

The methodology of this survey could be similar to that which is being used for other surveys in Nepal (i.e. the benchmark survey of Raswa-Nuwakot). Another alternative is area sampling using remote sensing techniques. The population would be stratified on the basis of ecological, social and economic criteria using baseline data collected in the Preliminary Site Survey. Particular emphasis would be placed on measuring the use of natural resources such as forest and pastureland products.

B. Socio-Economic Dynamics and the Context of Change

1. In-Depth Cultural Ecology Studies

Purpose:

The purpose of these studies would be to provide in-depth information on the potentials and implications of the adoption of conservation activities among different communities in project areas. The studies' primary concerns would be to understand:

a. major production strategies in relation to cultural and ecological variation and demographic change

b. the socio-economic dynamics of resource utilization,

c. traditional rural institutions and patterns of inter-and-intra-community relations,

d. attitudes towards previous development projects and

e. methods of identifying "high potential" communities. Wherever possible, these studies would make use of ethnographic material that is already available.

Activities and Methodology:

These studies would rely mostly on standard anthropological methods for conducting in-depth studies in several villages in each project area. Activities could include:

a. Socio-economic case studies of 4-6 households per village to investigate in agricultural strategies, land-use history, relationship of livestock to resources over time, fuelwood collection and consumption patterns, as well as other "productive" and "consumptive" use of natural resources.

b. Cultural study of: traditional resource management systems, patterns of community cooperation, intergroup relations, patterns of marriage and residential mobility, and cultural ideas and institutions relevant to resource utilization.

c. Study of development potentials, including: history of previous development projects, social channels of innovation, decision making patterns, attitudes towards development inputs and extension agents, felt needs and the potential for various proposed project activities with an assessment of the probable distribution of benefits.

2. Case Studies

These would be relatively short-term case studies of community conservation activities and alternate energy which have already begun in various parts of Nepal (such as Chautara Division and Dang Valley). The purpose of these case studies would be to understand:

a. the process of change in each case (especially the role of community leaders) and

b. the distribution of benefits to various categories of the community.

3. Resource Economic Analysis

This study would analyze the economic cost and benefits of various categories of resource conservation and utilization activities. Its primary aims would be to:

a. estimate the macro and micro economic impact of RCU project activities, and
b. conduct a cost-benefit analysis of alternate project strategies. Data for this purpose would be obtained in the studies suggested above and perhaps through additional surveys.

C. Field Trails: Monitoring and Adaptive Research Needs

The establishment of an on-going monitoring and adaptive research capacity will be of crucial importance to project success. This kind of research would monitor specific project activities in order to:

a. evaluate their progress,
b. identify problems,
c. suggest strategies for over-coming these problems, and
d. provide information on the relative merits of various project strategies.

In addition to the use of competent researchers in this enterprise, it would seem very worthwhile to incorporate local farmers themselves in the evaluative and adaptive research process.

As conservation activities proceed it would also be valuable to design research that would examine the distribution of benefits of the various activities in different communities. At the end of five years, another sample household survey could be conducted to evaluate the overall benefits of the RCU project.

D. Relationship To Other Research

There is other on-going or planned research in Nepal that will be of value to this project. These research activities include:

a. APROSC studies being conducted for Rural Area Development Project,
b. Socio-economic studies of cropping system by the Integrated Cereals Project of the Department of Agriclture;

c. Time-allocation studies in nine villages through Nepal conducted by CEDA's Status of Women Project.

It is probable that some of these studies will be conducted in areas selected for the RCU project - in which case it may be possible to integrate some of the studies suggested here into these other research interests.

VI. ATTACHMENT: INVESTIGATION ACTIVITIES

No formal methodology was used to collect information for this report. Rather, the research conducted consisted of various kinds of "fact-finding" and "idea-generating" activities. These included:

a. reading relevant reports and published works,

b. conducting field trips to talk to farmers and local leaders in various catchments selected by the Soil and Water Conservation Department,

c. filling out spot-check questionnaires on resource utilization, felt needs, and organizational potentials, and

d. participating in seminars and holding discussions with various officials and experts in the field.

Field Trips Undertaken

1. Short trips in Kathmandu Valley to sites of conservation work conducted by the Department of Soil and Water Conservation with: Mr. K.B. Malla, Mr. Rajbhandari, Mr. John R. Wilson, Jr. Rollo Ehrich and Dr. John Thames.
2. Five day trip to Jomsom, Jumla, and Tulsipur (Dang) with: Mr. John R. Wilson, Mr. K.B. Malla, Dr. Ram Yadav, Dr. David Thoroud, Dr. John Thames, Dr. Jerome Bosken, Mr. Richard Burke, Mr. John Babylon, Mr. S.P. Rajbhandari, and Mr. C. Sharma.
3. Sixteen day trip to the Kulekhani, Rapti (Chitwan), Rapati (Deokhuri), and Bhabai (Dang) catchment areas with: Ms. Augusta Molnar and Mr. Drone Rajaure.
4. Three day trip to Tupche Panchayat, Nuwakot, at the site of the Agricultural development Bank's Small Farmer Group Development Program with: Dr. Ram Yadav and Dr. Linda Stone.
5. Ten day trip to the Indrawati, Melemchi, and Baliphi catchments of Sindhupalchok, Chautara Division with: Mr. Tej Bahadur Singh Mahat, Mr. Steven Midgeley, Mr. Nir Bahadur Lama, and Mr. Laksman Man Tamang.

Seminars Attended

1. Himalayan Ecosystems Seminar, Kathmandu
2. APROSC/Soil and Water Conservation Department workshop on the design of

the RCU project (presentation of social aspects of RCU).

3. Hill Agriculture Seminar, Department of Agriculture.

Panchayats in which Research Data was Collected:

1. Sikarkot Panchayat, Makwanpur, Kulekhani Catchment (mixed population)
2. Guaritar, Makwanpur, Rapti Catchment (mixed resettlement population)
3. Raksirang, Chitwan, Rapti Catchment (Chepang population)
4. Bachauli, Chitwan, Rapti (Brahman and Tharu)
5. Gobardiya, Deokhuri Rapti (Tharu)
6. Katuki, Dang, Bhadabi Catchment (Tharu and mixed hill population)
7. Jajarkot, Jajarkot District (Brahaman-Chetri)--data from L. Stone
8. Dhollabang/ Sehibang, Rolpa (Chetri)--data from A. Molnar
9. Thabang, Rolpa (Kham Magar)--data from A. Molnar
10. Tupche, Nuwakot, Trisuli Catchment (Brahaman, Chetri, Tamang)
11. Jyamire, Sindhupalchok, Indrawati (Brahaman-Chetri)
12. Banskharka, Sindhupalchok, Indrawati (Tamang, Newar)
13. Palchok, Sindhupalchok, Malemchi (Sherpa)
14. Tharkegyang, Sindhupalchok, Malemchi (Sherpa)
15. Bhotang, Sindhupalchok, Indrawati (Tamang)
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APPENDIX Mc

PARTICIPATION & EMPLOYMENT

Prepared by: Mervin E. Stevens

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Participation and employment are included under the same title because RCUP proposes to work on the principle of stimulating the people to "demand" productive alternative or part-time work as their conservation consciousness is raised by the project. Nepal is an almost 100 percent agrarian society, but only 15 percent or less of Nepal's landscape is suitable for intensive agriculture. On the rest of the land, there is great potential for development of such land-use activities as agro-forestry. One measure of success of the RCUP will be the degree to which people shift from scratching out a living on small marginal and submarginal farms to other natural resource-based employment that replaces or supplements farm income. By improving the quality of land, it is possible to improve the quality of life.

The Resource Conservation and Utilization Project reaches the core of soil and water conservation problems and develops the local and national support needed to reverse the accelerating trend of land degradation. Program activities include resource inventory and monitoring, soil and water conservation, forest management, development of sources of energy, irrigation, drinking water projects, community livestock-range-pasture management, agronomy extension and research, horticulture, training in natural resources and building project support structures. Projects will have both a local and a regional center component, and both will generate employment opportunities. People participating in local projects such as tree-planting or gabion construction will receive employment benefits, as well as Pikhara residents who become associated with The Institute of Renewable Natural Resources.

Employment

The RCUP is not primarily a rural works project. However, its structure does include programs that have employment opportunities in gully control, tree planting, nursery establishment, multi-purpose impoundment construction and building construction. These programs are somewhat flexible in timing and location, allowing them to be operated in communities where participation is most readily identifiable and labor can be mobilized.

Is the labor available to participate in such projects within the selected project areas? There are several ways of answering this question. One level of benefit measurement analyzed was how much labor "could be saved" if soil and water conservation practices were implemented.

It is estimated that after the RCUP is fully implemented and programs are self-sustaining, over 4,400 person-years per year of labor could be saved as a result of the pasture management, increased forage production, and drinking water projects alone.[1/] It is predicted that there will be a 70% reduction in labor required to collect fuel, fodder and timber as a result of increased woodland production. For every hectare of terrace brought under good management, 2.5 person days of labor per hectare per year will be saved. Aside from the erosion-control benefit, trail improvement will contribute to reducing labor and energy requirements for both humans and animals in travelling from place to place. Once the full range of activities, such as irrigation, watershed management, livestock management and agriculture are implemented, it is speculated that upwards of 30,000 person years of "labor savings" may be generated simply by promoting more productive land-use practices and controlling soil erosion and flooding during the first five years of the project.

This kind of projection seems to indicate a growing pool of people looking for new employment opportunities. However, the initial "labor savings" will probably be applied toward more productive labor in agriculture. The project activities will produce employment changes only over the long term. In the short term, changes are not expected. The labor savings effect will be a labor productivity exchange. In other words, less productive labor will be reallocated into more productive labor.

Another way of looking at labor availability is to examine the seasonal employment picture, since availability centers around the agricultural slack seasons. Figure 1 shows the approximate periods and percentage of time farmers spend on agriculture work, and also when the main forest/range planting must be conducted. As expected, labor is not always available.

The forestry activity can be used as one example to demonstrate the relationship between participation and employment. This activity will concentrate on the problem of linking reforestation efforts with management of existing forest stock, using multiple-use management principles. The far-reaching objective is to form a community and national forest program mix that can supply wood products at both the local and national levels. Because of the

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1/ S.C.S. 1979. Soil and Water Conservation Report. Kathmandu, Nepal. August. In the conversion from person days to person years, 220 days were used as a typical work year.

past history of nationalizing all forests in Nepal and the lack of faith normally shown by people towards national forest programs, the initial aim of the forestry activity will be to ensure that the individual farmer and household wood-using needs are met. However, the project must recognize that, for the long term, national forests must also be promoted. Therefore, the forest management activity must also contribute to national forests.

There are three main steps to achieving a community/national forest harmony:

1. Gain genuine support of the farmers and local residents. This means that the highest priority during the first stages of the RCUP forestry activity is to implement the community plantings, watershed or community water supplies, and private, leasehold or contract forest projects. Trees will be given to the people free of charge, but they must contribute the labor to plant them. The paid employment opportunities will be in seed collection and nursery work.
2. As the area's forest management plans are developed and the people become more involved in the forestry program, increased attention will be given to panchayat forest and panchayat-protected forest establishment. These forests are eventually seen as the mainstay of multiple wood production for the communities. Contributed labor is still expected since, in the main, these are the people's forests, but employment opportunities increase and begin to include planting crews, fire suppression crews, logging technicians, sawmilling and implement supplies, in addition to seed collection and nursery work.
3. While national forest development is the third step in the multiple-use management chain, it is most important. National forests, because of their extensive nature, will not only be a source of many products for local consumption, but will contribute to the national economy. Except for the labor that people may want to contribute, as their conservation dictates, national forest operations will be on a paid employment basis.

Planting of trees is not always a full-time labor-intensive proposition. In Nepal there are two main planting periods: (1) in early spring and (2) during monsoon. These two planting windows also coincide with the approximate time when farmers must grow, maintain and harvest their crops. Figure 1 shows the relationship of farm-labor availability to plant forest/ range land. The hatched areas indicate potential labor surplus times for planting during peak periods. The figure suggests that during the first planting in February/March, it would be possible to employ many people for up to a week or two, but that during the monsoon there would be a lean period when these people would only be available for one or two days at a time. In other words, the planting of extensive national forest areas cannot depend upon contributed labor since labor availability is agriculturally controlled. This supports the need to train planting crews that are reliable and have the capability to carry on with the main planting job. In further support of a planting crew is the fact that there is a labor conflict at two periods when some planting can be done. This is March/May and October/November. Planting is not normally done during the dry November/January period.

Figure 1 is a general summary of when farmers could be expected to spend time planting trees and forage. Individual areas may have a different pattern. Figure 1 strongly suggests that good planning is required in order to fulfill the objective of developing a forest-management plan.

A second RCUP employment participation example is the multi-purpose impoundment activity. This construction project will provide the opportunity to employ professional, skilled and unskilled labor. The location will be finalized after discussion with the catchment conservation committee and approved by professional engineers and earth scientists. The design should be contracted out to a private architectural and engineering firm. Construction labor must be locally employed within the project area. Training programs will be required to properly prepare for skills needed during design, through construction and to handle follow-up maintenance. This training may have to be individualized in order to develop required skills. Employment priority will be given to those people living within the catchment or district where the impoundment is to be constructed.

Table 1 is an estimate of the total five-year employment requirement of the RCUP. It is only a rough indicator of potential employment opportunities.

Table 1

Estimated 5-Year Employment Requirement of RCUP

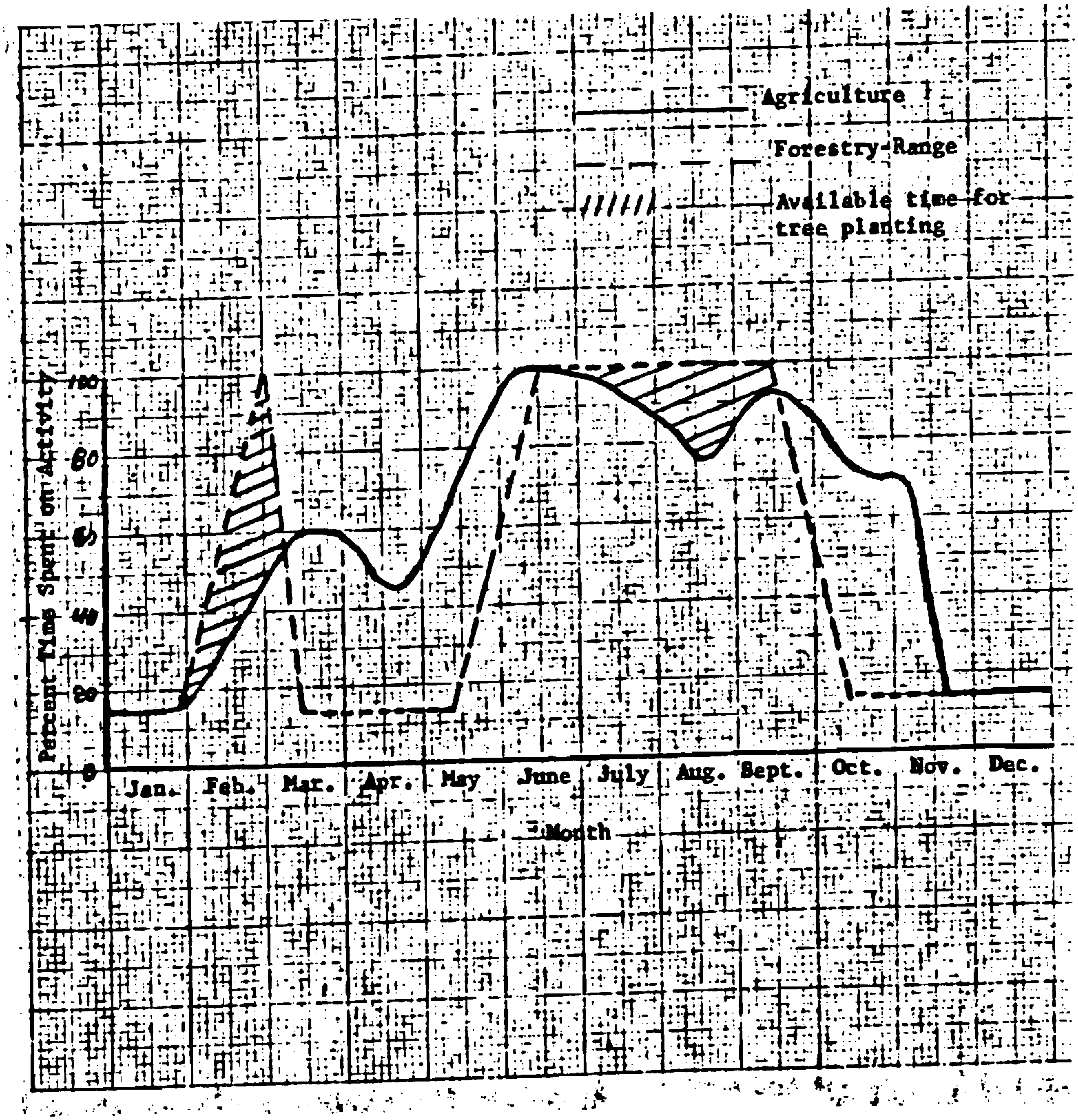
Employment Activity	Participating Labor Types (Person Years)		
	Non-Professional		
	Contributary 1/	Paid 2/	Professional 3/
Inventory and Monitoring	0	350	100
Watershed Management	1,900	300	110
Forest Management	1,000	1,000	320
Energy Development	1,300	400	60
Irrigation	500	300	30
Drinking Water Projects	400	150	30
Community Livestock/Range/Pasture Mngmt.	1,000	600	170
Agronomy-Extension Research	0	500	100
Horticulture	0	150	30
Training	0	2,500	200
Buildings	0	2,000	200
Total	6,100	8,250	1,350

1/ Includes all labor given without compensation and by beneficiaries of discrete projects.

2/ Includes all categories of employment in order to accomplish the activity, i.e., Chowkidars, laborers, mechanics, etc.

3/ Includes all categories of people with professional degrees and includes backstopping at national level such as the department head and staff involvement.

Figure 1. Showing approximate periods and percentage of time Farmers spend on Agriculture work and also when main Forest-range planting can be conducted.



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The real figures will only be known as projects are implemented and people become involved. Upwards of 14,000 nonprofessionals could become associated in some activity of the RCUP. Of this group, about 8,000 people should receive pay for their services. In the professional category 1,350 people could eventually be included in the work force. It does appear that there is a labor force available within the project area. However, as indicated above, while activities have a labor savings interpretation, the true effect is to reallocate unproductive labor into more productive labor. Figure 1 also suggests that labor availability is highly seasonal. Each project activity will have to anticipate labor problems and consider augmenting the local labor force with people from outside the project area, at least during the initial stages. Projects will have to be phased properly to ensure that required labor is available.

Participation

As the RCUP evolves and local people interact with staff at all levels, and as the staff interacts with the people, the project must rely on the people becoming increasingly involved and seeking other forms of employment, thus taking the pressure off the poorer lands. This will not be easy, nor is the transition to other employment opportunities expected to happen overnight.

Farmers are naturally conservative. RCUP has to take the initiative to encourage people living on marginal and submarginal land to seek other ways to manage and operate within the constraints of available resources. To initiate change without destroying the traditional structure will be difficult. While the project is land-resource oriented, its activities will set the stage for other kinds of programs to become established in the areas, such as cottage industries, health posts, family planning and farming systems. Some of these will generate employment.

"Popular participation" means essentially three things: the people must contribute their perceptions of their own problems, their own ideas for solutions to these problems, and their cooperation and labor in working out the solutions."[2/] To have these three things work in harmony, the RCUP will work on the premise

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2/ Stiller, L. F. and R. P. Yadav. 1979. Planning for People. Page 138.

of stimulating a change where people themselves will enter into new work, rather than subscribing to the "pressure" of entering into massive orientation-training programs that may or may not end in productive employment. This approach dictates a shift whereby technical services must support local involvement, be cognizant of evolving needs, and be prepared to undertake "personalized" training. Appendix N discusses organization and the role local government will play in project decisions, work supervision, and planning.

The project's technical staff must concentrate on helping the small or landless people. Generally, the smaller the farm, the greater the effort has to be in generating new skills for off farm employment. This is time consuming, but the approach must be fully understood when technicians commit themselves to living and working in the field.

It is important to recognize that the beneficiaries must be involved in the whole management process, from planning through implementation. RCUP is to act as the catalyst. Effective conservation means working in harmony. Compromises will be made using both the top-down and bottoms-up approach. At the national level, goals and targets must be set which meets national needs. These goals and targets must then be relayed to the people soliciting their advice and asking if they can be met. If they cannot be met, adjustment must be made (and training programs introduced to meet the next round of target discussions). It may be necessary to go through two, three or four rounds of two-way dialogue before output is agreed to. No doubt, we will find some villages have a good perception of their problems and are prepared to accept larger targets than others. For those villages not presently prepared to take on greater participation, the project's extension efforts will have to skew to those people.

While the objective of building and maintaining a resource conservation and utilization program depends upon the support of the community, it is also clear that the technicians' attitudes toward assisting the people will probably be the key factor in building the people's confidence. The technicians associated with RCUP must be ultrasensitive to the people's needs. From the long-range point of view, the introduction to how to work with and involve people can start from various training programs. At the formal level, this can begin in The Institute of Renewable Natural Resources. First-year certificate students must take a course in rural sociology and village economics and an introduction to extension work. Between the certificate and diploma course, students are required to serve one year in the field for practical experience within a village, preferably their home village. When these students are accepted into the diploma program, their awareness is added to by courses such as extension methods, personnel management, management science and electives in the humanities and social sciences. For those people who are already working, the in-service training unit (Ministry of Forests' training wing) must organize courses that sensitize staff to people's problems and needs and how to find solutions.

It will be the responsibility of The Ministry of Forests' training wing to devise training courses for village people which teach them how to become involved and participate in planning. Training of this nature should not be parroted by technicians from a standardized mimeograph course outline. Rather, a team of trainers, including sociologists and extensionists, should travel throughout the areas acquainting people with what resource conservation is, it's purpose, and how to participate in it. The local technicians should be involved and present during the sessions, but the actual instruction should be done by experts knowledgeable in people's motivations.

People's attitudes and perceptions can be added to by bringing them from their village to other villages where successes can be demonstrated. Throughout this process, the technical help has to be flexible enough to either answer questions or be willing to find out the answer.

Evolving from this multipronged participation-, employment-, and education-training program, we should expect an improvement in the administrative process and effective measures that can be practiced on the land. More importantly, the people, by seeing their ideas and solutions bear fruit, will have played a leading role in stretching the use of technical services.

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APPENDIX N

RCUP ORGANIZATION

Prepared by: K.P. Upadhyaya, APROSC

Over 60 percent of the people live in the hills and mountains. The typical rural family relies on the products from less than 1 hectare of mostly marginal and sub-marginal land. As a result exploitation of all natural resources is extreme.

CONTENTS

Introduction

As is stated under the objectives of this appendix and also commented on many fold in other appendices of the RCUP design reports, the success of the RCUP relies and depends upon community participation at both the local and national level. This appendix does not answer all organizational questions to guarantee participation. It does outline the framework for the people's participation and describes the linkage between national and local organization. With this as a beginning the RCUP must continue to critique its infrastructure, ensuring that the organization serves the aim of developing a well grounded and self-sustaining program of soil and water conservation in Nepal.

Appendix N

RESOURCE CONSERVATION AND UTILIZATION PROJECT

Organization

I. Definition

The Resource Conservation and Utilization Project will aim at conserving land and making it more productive by promoting appropriate land use practice, and controlling soil erosion and flooding through the effective management of soil and water resources. The Project attacks the critical and complex problems of resource economics and utilization through a series of integrated technical and social activities designed for selected landscape and cultures. The project includes activities such as watershed management, forestry, agriculture, livestock range and community pasture, energy, irrigation, drinking water and training/education. Each of these components are interrelated, one supporting the other.

II. Objectives

RCUP is an operational field project with some research incorporated within it. It relies and depends upon community participation at both the local and national levels. The primary objectives of RCUP are as follows:

A. Implement a wide range of tested soil and water conservation practices on identified deteriorated lands.

B. Promote interagency coordination and cooperation to solve and carry out the critical and complex programs of resource conservation and utilization in Nepal.

C. Develop a trained cadre of professionals and technicials in conservation and utilization of natural resources and help in institution building that will provide Nepal a self-sufficiency in the training of future personnel.

D. Promote and carry out training and other extension actions as required to ensure participation of the people.

E. Establish demonstration areas in selected landscapes and cultures for education, training and extension purposes.

F. Promote applied research in conservation practices.

G. Promote a conservation consciousness among inhabitants through a program of short courses and other information media regarding conservation problems and solutions.

H. Develop effective strategies for organizing and mobilizing local people in self-sustaining resource conservation activities.

III. Scope of RCUP

The primary beneficiaries of this project will be small and marginal farmers. In order to launch a successful program in resource conservation and utilization, strong national leadership from a line agency of His Majesty's Government of Nepal is essential. Although there is evidence that farmers as well as leaders in HMG line agencies recognize that environmental deterioration is occurring in the uplands of Nepal, there is also evidence that people are not overly enthusiastic when benefits will not be reaped for 10 to 15 years or longer, particularly for someone who does not have enough food for his family next year or the year after that. Consequently, a lack of interest, or at best a wary attitude, can be anticipated on the part of farmers who are asked to change their land use practices, especially if reduced food production is a possibility. Therefore, a local resource conservation coordination fund will be established to provide a mechanism with which to gain fuller appreciation and support for the program's goals and objectives. For these reasons, such a program should be national in scope and centrally led and supported, even though it must be implemented at the grass root level. In addition to genuinely involving the local prople in the project's activities, imagination and ingenuity to insure participation at all levels will be required. Furthermore, this type of integrated program will require difficult decision making and priority setting at all levels of project implementation. Therefore, if the objectives are to be fulfilled , the nature of RCUP is that of a national project to directly involve local peoples participation.

IV. RCUP Versus District Development Plan (DDP)

A. The District Development Plan represents a collection of all the development projects to be planned, implemented, and evaluated by the village and District Panchayat. RCUP addresses environmental deterioration of typical river catchment areas, irrespective of district boundaries, in order to maintain the ecological balance not only in the district, but in the nation as a whole.

B. A district level project shall include all those projects which need to be implemented under management of the local people and whose beneficiaries consists only of the inhabitants of the district.

In contrast, implementation of RCUP needs specialized management capability from the centre or national level, especially in the field of resource inventory, land use planning, design of the engineering structures, and applied research. Beneficiaries of the project activities are not limited to the district but will include people throughout the nation. However, the district level conservation-utilization program should be incorporated as part of the district development plan and work in harmony with integrated rural development strategies.

C. The gestation period of project output in district development plans is usually short compared to that of RCUP, which is designed for 10 to 15 years.

D. Both the DDP and RCUP recognize the potential for social and economic value of allowing local communities to manage the natural resources in their own community.

D. A project that appears of low priority to the community (tedious inventories) may get high priority from the resource conservation and utilization point of view. Therefore, in cases where there will be minimum community commitment in implementing low priority projects, the national level line agencies will have to assume full responsibility for implementing these activities.

V. RCUP and Integrated Rural Development Projects

The RCUP addresses the critical and complex issues of environmental degradation in the different ecosystems of the hills and mountains in Nepal. The primary focus is to support a land resource program contributing to reducing the decline in the productivity of Nepal's agricultural system.

Both resource conservation and the integrated rural development projects are interested in maintaining and/or improving the ecological balance. Both are concerned with raising the standard of living of a target population. The operational difference between the two lies in program emphasis. The RCUP will focus on only those objectives oriented to land conversation, whereas IRD projects try to achieve harmony through a whole range of objectives. The RCUP looks at environmental problems with a long range outlook of making land more productive by application of appropriate land use practices and controlling soil erosion and fully utilizing effective management of soil and water resources.

VI. Organizational Structure of RCUP

One of the biggest challenges of RCUP will be to bring together the different line agencies required to deliver the services and facilities, at all levels of project implementation in an organized and coordinated manner. The establishment of such an inter- and multidisciplinary structure in a country with a vertical administrative organization is certainly a major and difficult undertaking. Members of the RCUP design team, in their formal and informal sessions, carried out extensive discussions regarding this issue both in Kathmandu and while in the field. Several meetings were held in APROSC headquarter's office where almost all heads of the concerned line agencies participated. Two alternative organizations were discussed. Alternative 1 was supported by this group with some amendments. Thus, alternative 1 is selected as the RCUP operational organization and is discussed here in detail. The summary of alternative 2 is also presented.

A. Alternative 1

The recommended organization envisages a stable and rational basis for inter-agency coordination and cooperativeness. It encourages and relies upon the willingness to participate amongst local people and the different line agencies. This participation is done in an integrated resource conservation manner throughout the country by establishing project level and field level units. In the long run, this will help in building up a multidisciplinary cadre at the field level that interacts with the local population. The structure is presented in fig. 1. Following are the advantages and disadvantages of this organizational structure.

Advantages

1. Minimizes functional overlap among line agencies.
2. Is cost effective to replicate in other areas of Nepal.
3. Can be sustained after the termination of the project support by donor agencies.
4. Maximizes use of the present line agency staffs by developing their staff capability which lessens core project manpower requirements.
5. Promotes coordination and cooperation throughout the government to address the issues of resource conservation and utilization.

Disadvantages

1. Difficult to coordinate due to diverse nature of work of departments or agencies; requires strong management.

2. Manpower shortage in some of the line agencies may effect or delay implementation of site specific projects.
3. May not provide much opportunity for increasing individual agency commitment through project specific incentives.
4. Field project implementation during the initial stages of the project is likely to be slow.

B. Alternative 2

The organizational structure envisages a semi-autonomous agency equipped with a self-contained multidisciplinary staff at all levels. It is a vertical organization as shown in fig. 2. Following are the advantages and disadvantages of this organizational structure.

Advantages

1. Project will have all staff capability for RCUP implementation.
2. Less effort is required for project coordination.
3. Less confusion in the vertical hierarchy (e.g. district unit, and field unit) of the project office and staff.
4. Simple to operate.
5. Likelihood of immediate success is much higher.
6. May increase staff commitment through greater autonomy and incentives.

Disadvantages

1. Does not promote atmosphere of coordination and cooperativeness among line agencies.
2. Likelihood of continuation of the project after donor inputs (financial as well as expatriate) is withdrawn is very small.
3. Fails to promote environmental resource management sensitivities and capabilities of other line agencies that support balanced development.
4. Overlaps with the jurisdiction of other line agencies and hence promotes jealousy and conflicts.

VII. National Level Organization

The Ministry of Forests will be responsible for overall coordination of the RCUP through the Department of Soil and Water Conservation. There will be a National Conservation Committee under the Chairmanship of the Minister of Forests. The following are the authorities and agencies represented on the committee:

A.	Secretary of Forests	Member - Secretary
B.	Secretary Ministry of Home Panchayat	Member
C.	Secretary Department of Agriculture	Member
D.	Secretary Ministry of Water, Power, and Irrigation	Member
E.	Vice-Chancellor, Tribhuvan University	Member
F.	Secretary Ministry of Finance	Member
G.	Honorable Member Planning Commission	Member
H.	Representative USAID/Nepal, Kathmandu	Ex-officio Member

Functions of the Committee

A. Provide policy guidance and national level coordination between different agencies involved in the RCUP.

B. Review the project action plans and make the necessary decisions to implement the RCUP smoothly.

C. Review progress and take the necessary action to solve problems that are encountered during the project implementation.

This Committee has a direct association with the National Panchayat Coordinating Committee. The Secretary of Forest is a member of the Panchayat Development Central Coordinating Committee and serves as Secretary of the National Conservation Committee providing a viable link to assure that national policy will be followed. Each member of the Committee will be requested to appoint a Liaison Officer to work with RCUP staff in coordinating effort.

VIII. Lead Agency

The Department of Soil and Water Conversation will be the lead agency to coordinate the RCUP activities. The professionals charged with RCUP activities in DSWC will carry out the following responsibilities relating to RCUP.

A. Coordinate all the RCUP activities with other Departments.

B. Prepare guidelines for the preparation of panchayat resource conservation and utilization plans and be responsible for finalizing the action plan with close coordination of the field personnel and local leaders.

C. Coordinate and carry out physical resource inventories projects with other line agencies, e.g. Forest Survey, Soil Survey, Land Use Survey, Hydrologic Survey, etc.

D. Be responsible for the supervision and implementation of the following field activities:

1. Community fuel, fodder and grass production program. Included within this will be community forestry programs.
2. Carry out land treatment activities in eroded areas other than those outlined in the responsibility of other line agencies.
3. Carry out channel treatment, instrumentation erosion control structures and other water conservation activities other than those outlined in the responsibility of other line agencies.
4. Carry out a range management program.
5. Coordinate Soil and Water Conservation extension and education activities with the University and other line agencies.
6. Implement an alternative energy program.
7. Through the carrying out of conservation practices support agriculture, irrigation, forestry, cottage industry, wildlife, recreation, etc. as this support relates to increasing production and employment.
8. Monitor and evaluate project impact (both physical and socio-economic) and conduct on-going adaptive research to improve project performance through consultancy services (APROSC, University, etc.) when necessary and desirable.
9. Work with local people in promoting conservation practices and setting up organizations to carry out these practices.

E. The RCUP Central Coordinating Activities will be located in Kathmandu. The RCUP Project Manager and Project Co-Manager will supervise the overall operations. Specialist presently working in the DSWC planning cell will work in RCUP, full time or part time, according to project needs. Not all the specialist will be needed full time. Given the manpower constraints they will also work in other DSWC national projects. Since one of the primary objectives of ACUP is to build the planning and operational capability of the DSWC, these staffs in the long run will be the core national staff of DSWC.

Staff needs at all levels of ACUP organizational structures are shown as Table 1. The Department of Soil and Water Conservation core staff requirements are shown in Table 2. Table 3 shows the expatriate requirements and Table 4 the short-term expatriate consultants. Table 5 lists additional Nepali staff required for RCUP.

Table 1

Summarizes Staff Needs at all Levels of

RCUP Organizational Structures: RCUP, NEPAL

Staff Category	Numbers Needed: Beginning in 80 Yr. 1	81 Yr. 2	82 Yr. 3	83 Yr. 4	84 Yr. 5	Total 5 Years
Nepali Staff						
1. Central Level						
a. Professionals	8	2	2	-	-	12
b. Sub-Professionals	8	6	-	-	-	14
c. Administration	12	6	-	1	-	19
2. Field Staff						
a. Professionals	21	15	8	4	-	48
b. Sub-Professionals	102	75	66	76	58	377
c. Administration	73	14	15	12	4	118
d. Field Asst. Level	97	20	15	24	5	161
e. Village Asst. Level	54	97	120	125	138	534
Expatriates						
1. Long-Term						
a. Co-Team Leader	1	-	-	-	-	1
b. Ministry of Forests Training Wing	2	-	-	-	-	2
c. Institute of Renewable Natural Resources	2	3	-	-	-	5
d. RCUP Central Staff	6	2	-	-	-	8
2. Short-Term Consultants						
a. Project Level	4	5	4	4	-	17
b. Tribhuvan University	2	4	5	5	3	19

Table 2

Central Office Component - HMG/N, DSWC Staff[1/]

	Position	Duration of Assignment, Months	Apx. Timing
1.	Project Manager (Watershed Management Specialist)	Permanent	Jan. 1980
2.	Land Use Planner	Permanent	Jan. 1980
3.	Agriculture Engineer	Permanent	Jan. 1982
4.	Geologist	Permanent	Jan. 1980
5.	Socio-Economic Monitoring Specialist	Permanent	June 1980
6.	Civil Engineer	Permanent	Jan. 1980
7.	Soil Conservationist (Vegetation Treatment Nursery Management)	Permanent	Jan. 1980
8.	Conservation Education/Publicity Specialist	Permanent	Feb. 1980
9.	Overseers (4)	Permanent	Jan. 1980
10.	Soil and Water Cons. Asst. (8)	Permanent	Jan. 1980
11.	Junior Cartographer (2)	Permanent	Jan. 1980
	Administration		
12.	Senior Accountant (1)	Permanent	Jan. 1980
13.	Accountant (2)	Permanent	Jan. 1980
14.	Section Officer (1)	Permanent	Jan. 1980
15.	Administrative Assistant (4)	Permanent	Jan. 1980
16.	Typist (2)	Permanent	Jan. 1980
17.	Peons (6)	Permanent	Jan. 1980
18.	Drivers (5)	Permanent	Jan. 1980

1/ The following positions designated in the DSWC organization chart will be permanently filled through either participant trainee returnees or recruitment:

a. Social Scientist, 1983
b. Hydrologist, 1982
c. Range Management, 1982

Until these positions are filled, it will be necessary to "borrow" these specialists from cooperating agencies under a memorandum of understanding arrangement described in this paper.

Table 3

Expatriate Component

Position	Duration of Assignment Months	Date of Arrival
A. Project Co-Manager/Resource Specialist and overall Expatriate Coordinator	60	May, 1980
B. Ministry of Forests Training Wing		
1. Soil/Water Conservation Training Specialist	24	June 1980
2. Forestry Training Specialist	24	June 1980
C. Institute of Renewable Natural Resources, Tribhuvan University		
1. Assistant to Dean/Curriculum Development (Renewable Natural Resource-Conservation and Forestry)	36	May, 1980
2. Soil Engineer/Hydrolics	24	June 1981
3. Soil/Water Conservation Specialist	24	June 1980
4. Silviculturist/Forest Management	30	Jan. 1981
5. Economist (Soil Conservation & Forestry)	30	Jan. 1981
D. RCUP Central Staff, Department of Soil and Conservation		
1. Land-use Planner	40	July 1981
2. Soil Scientist	40	July 1980
3. Hydrologist	36	Jan. 1981
4. Range/Pasture Management Specialist	36	July 1980
5. Agricultural/Civil Engineer	48	July 1980
6. Forest Management Specialist	36	July 1980
7. Rural Sociologist/Anthropologist	24	June 1980
8. Soil and Water Conservation Specialist	36	Jan. 1981

Table 4

Short Term Expatriate Component

	Position	Duration of Assignment, Months	Apx. Timing CY
1.	Institute of Renewable Natural Resources	2	'80, '81, '82 '83, '84, '85
2.	Horticulturist	2-3	'81, '82, '83
3.	Watershed	2-3	'81, '82, '83
4.	High-Altitude Nursery Management Specialist	2-3	'80, '81
5.	Sampling Statistician	1-2	'80, '81, '82 '83
6.	Adaptive Research Expert	2-3	'83, '84
7.	Energy Specialist	2-3	'80, '81, '82 '83, '84
8.	Other	2-3	'80, '81, '82 '83, '84, '85

Table 5

Additional Staff Needs for RCUP Implementation (Nepali)

Project Component	Numbers Required: Beginning in					
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Total 5 Years
1. Central RCUP Office						
a. Professionals	8	2	2	-	-	12
b. Sub-Professionals	8	6	-	-	-	14
c. Administration	12	6	-	1	-	19
Sub-Total:	27	14	2	1	-	44
2. Catchment Conservation[1/] Offices (4)						
a. Professionals	4	4	4	4	-	16
b. Sub-Professionals	12	9	10	8	6	45
c. Administration	22	4	4	2	-	32
Sub-Total:	38	17	18	14	6	93
3. Forestry						
a. Professionals	4	-	-	-	-	4
b. Sub-Professionals	46	12	7	16	1	82
c. Field Asst. Level	42	9	5	14	1	71
d. Administration	16	-	-	-	-	16
Sub-Total:	108	21	12	30	2	173
4. Agronomy & Horticulture						
a. Professionals	2	2	3	-	-	7
b. Sub-Professionals	17	11	15	16	18	77
c. Field Asst. Level	51	6	5	5	2	69
d. Village Asst.	54	97	120	125	138	534
e. Administration	16	5	6	5	2	34
Sub-Total:	140	121	149	151	160	721

1/ Included manpower for energy, range management, community forestry, small irrigation improvement and conservation extension. Manpower requirement for extension has been incorporated in 2, 3, and 5. Manpower requirement for formal training is not incorporated.

Project Component	Numbers Required: Beginning in					
	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Total 5 Years
5. Livestock & Pasture						
a. Professionals	2	4	1	-	-	7
b. Sub-Professionals	10	20	20	22	20	92
c. Field Asst. Level	4	5	5	5	2	21
d. Administration	19	5	5	5	2	36
Sub-Total:	35	34	31	32	24	156
6. Drinking Water						
a. Professionals	5	2	-	-	-	7
b. Sub-Professionals	13	4	-	-	-	17
Sub-Total:	18	6	-	-	-	24
7. Irrigation						
a. Professionals	-	3	-	-	-	3
b. Sub-Professionals	-	6	-	-	-	6
Sub-Total:	-	9	-	-	-	9
8. Soil Survey						
a. Professionals	4	-	-	-	-	4
b. Sub-Professionals	4	-	-	-	-	4
Sub-Total:	8	-	-	-	-	8

Projection of all expatriate specialist requirements outlined in Tables 3 and 4 are based upon the recommendations of the RCUP design team. Timing of local specialists (DSWC) is scheduled keeping in view the on-going and future training activities of the DSWC. Expatriates, in partnership with their HMG/N counterparts, will formulate design criteria, guidelines, specifications and handbooks that are to become the operational method for resource conservation and utilization. The sources, in combination with on-the-ground-and-job training, will constitute the aim of assisting in establishing a well founded organizational structure. There will be a transition year of expatriate assistance to discrete project activities following immediately upon return of Nepalese specialists.

IX. RCUP Support to and from Supporting Agencies

As pointed out earlier, the RCUP organization maximizes use of line agency staffs by assisting to develop their staff and capability in areas which are outside the DSWC organizational limitations, but are also necessary to the success of the RCUP. Further, it is a primary aim of the RCUP to promote coordination and cooperativeness throughout the government to address the issues of resource conservation and utilization. The Ministry of Forests and Department of Soil and Water Conservation cannot carry out this job by themselves. Therefore, the RCUP makes provision to assist RCUP supporting line agencies in the way of technical assistanee, equipment and materials, and participant training to the extent required to execute successful implementation.

The support to be given to and from line agencies will be spelled out in memorandum of understanding. An example of a memorandum of understanding is included as attachment 1 of this agreement. It is for the purpose of conducting soil surveys. These agreements will detail the working relationships between participating agencies to the RCUP and will include reference to the types of goods and services to be arranged between the agencies. Following is a brief description of individual agency RCUP support:

A. Ministry of Forests - Planning Cell

The Ministry of Forests Planning Cell has a vital role to play in the successful implementation of the RCUP by coordinating interrelated activities within the Ministry of Forests. They will play a major role in programming priorities of the Ministry's activities in the RCUP areas and coordinating RCUP activities with other line agencies.

B. Ministry of Forests - Training Wing

A Training Wing has been established in the Ministry of Forests (MFTW).

A full-time in-service training person will be assigned from the DSWC. An expatriate will be assigned to assist in developing the soil and water conservation training guidelines. The MFTW will have responsibility to carry out in-service training for the DSWC as follows:

1. Carry out short in-service, job related courses for staff already working.
2. Work out guidelines and assist in implementing in-service training program for panobayas.
3. Work out guidelines and provide materials for sources at the panchayat and ward levels.
4. Make its facilities available to the RCUP for publicity, conferences, etc. as feasible.
5. Maintain a small working library for training purposes that the RCUP staff can borrow from. (See Arthur Berry's report and ODM/USAID/ World Bank report on Ministry of Forests Training Project).

C. Catchment Conservation Committee

There is provision for different coordination committees in the DAP. However, there is no provision for helping in coordination of a national project like the RCUP which recognizes the potential social and economic value of local communities to manage the natural resources in their own community. Therefore, there could be a duplication of activities of DAP and RCUP in the project area. Hence, to avoid duplication and enhance coordination a catchment conservation committee is recommended as follows:

1.	District Panchayat Chairman	Chairman
2.	Chief District Officer	Member
3.	Panchayat Development Officer	Member
4.	District Forest Officer	Member
5.	District Agriculture Development Officer	Member
6.	Project Incharge Irrigation	Member
7.	Project Incharge - Drinking Water	Member
8.	Project Incharge - Livestock Development Centre	Member
9.	Others as required (ADB and AIC for example)	
10.	RCUP Catchment Conservation Officer	Member-Secretary

This Committee will meet at least once every three months to perform the following functions:

1. Review the planning and implementation of the program and decide on the work priorities and funding needs.
2. Arrange for the assured supply of resources necessary for the smooth

implementation of the program.

3. Maintain coordination among different components of the program.
4. Coordinate and include RCUP activities with the district plan to avoid duplication.
5. Review progress of the program.

In its initial formative years the RCUP is designed to function along the catchment boundaries. This provides evaluation control. As results from RCUP spread and become part of the day-to-day institutional operation, the catchment offices should evolve into the next hierarchial level, possibly the district. The organizational pattern should eventually be along lines developed by sister agencies such as the Department of Forests and Department of Agriculture in order to strengthen and complement each other's support for managing resources and in order to integrate with HMG/N's ongoing policy for developing rural areas.

D. Catchment Level Organization

Five project offices will be established in the RCU project areas to coordinate the implementation of project activities as outlined in the responsibility of the lead line agency (DSWC/RCUP). The following staff and specialists needs are identified within each project office of Kulekhani, Daraudi (Gorkha), Myagdi, Mustang and Jumla.

1. Catchment Conservation Officer
2. Asst. Soil Conservation Officer (Land Treatment)
3. Asst. Soil Conservation Officer (Channel Treatment)
4. Asst. Soil Conservation Officer (Extension, Education & Research)
5. Overseer for Civil works (1)
6. Accountants (1)
7. Administrative Assistant (2)
8. Storekeeper (1)
9. Peons and Guards (4)
10. Driver (2)

These staffs may not be available at the same time during the initial project period. In the beginning, one Assistant Soil Conservation Officer may have to assume all the responsibility of his counterparts. This is justified because of 1) less project activities in the initial stages, and 2) lack of manpower availability. The Central RCUP staff will provide assistance for field implementation. However, it is contemplated that all these staffs will be fielded during the first five year phase of the project. The details are given in attachment 1.

E. Panchayat Conservation Committee

Under the Chairmanship of the Pradhan Pancha or other recognized Panchayat leader, a Panchayat Conservation Committee shall be constituted in each Panchayat. A representative from each ward will be a member. In addition, if no women members are selected from any of the wards, at least one woman will be added as a member of this committee from each ward. This committee will serve as a sub-committee of the Panchayat Development Committee.

JTs, JTAs, and Forest Rangers working in the Panchayat will be ex-officio members of the committee and the Soil Conservation Assistant shall attend the meetings as committee Secretary. If the Soil Conservation Assistant is unavailable as Secretary, one of the committee or ex-officio members will be appointed to this position.

Whenever feasible, functional sub-committees will be formed of other members of the panchayat around specific activities which contain at least one member of the Panchayat Committee, in order to put management of discrete activities as directly as possible into the hands of the local beneficiaries. For example, members of three wards who share a separate portion of panchayat forest will form a separate sub-committee to manage this forest. Or, the participants in a particular irrigation project or in a contract forest scheme for marginal land farmers would also be examples of functional sub-committees for implementing and maintaining project activities formed on a benefit-user basis. These sub-committees will be made up of a cross section of community publics to include political leadership, small farmers, progressive farmers, women and people in education. The RCUP catchment conservation office shall select in consultation with local leadership the committee membership.

The Panchayat Conservation Committee will be responsible for participating in the identification, planning, implementation and monitoring of a community conservation program in the Panchayats. In addition to helping set up and monitor the sub-committees, this committee will be responsible for solving conflicts that are encountered during the development of panchayat plans and implementation of these programs. The committee will call upon the panchayat level field center for technical assistance or in difficult problems on the catchment organization.

F. Catchment Representatives Assembly

Each of the Chairmen of the Panchayat Conservation Committees will constitute members of the Catchment Representatives Assembly. The assembly will be called at least twice a year to participate in planning and reviewing the various catchment conservation activities, making recommentations, and helping to solve outstanding problems.

G. Panchayat Level Field Centre Organization

One Field Centre will be located in each panchayat to demonstrate and coordinate the techniques of the Soil and Water Conservation programs. This Centre will be a nucleus for identifying and implementing community conservation program activities with the panchayat population. This Centre will also be responsible for building a confidence in the people that changes in land use and improved cultivation practices are profitable and technically sound. The Centre will be a common platform for all the extension workers from different line agencies. In this way, farmers will not have to run from one agency to the other. They will not be confused by the diverse versions of extension workers in different fields. These Field Centers will be developed in conjunction with the District Service Centers to facilitate effective implementation and insure coordination with other development activities in the district. Soil Conservation Assistants will serve as the primary Coordinators with JTs and other technicians. (For details on the function of Soil Conservation Assistant see report on extension by Dr. G. C. Sharma). The following manpower will be needed for each panchayat and will be selected from the panchayat area.

1. Soil and Water Conservation Assistant (1)
2. Village Technicians (2)

H. Department of Agriculture

Under the overall direction of the Director General of Agriculture, the Department of Agriculture will have the responsibility to execute following activities of RCUP:

1. Carry out all the programs recommended by the design team on better agronomic practices and agriculture extension.
2. Conduct the soil survey in the RCUP areas following national soil survey policy.
3. Carry out an improved pasture management program in the project area.
4. Carry out an improved animal husbandry and animal health program.
5. Carry out a community horticulture program as recommended by the design team.
6. Conduct adaptive research and field trials.

7. Participate in the land use planning of the project area.

At the national level, the Deputy Director General responsible for extension will be the principal Coordinator for RCUP field activities related to the Department of Agriculture. Programs as identified by the design team in agriculture will be incorporated in the annual programs of the Department of Agriculture and will be accorded equal priority as other department programs. In order to carry out these activities the Department of Agriculture will provide the services of the following specialists during detailed planning and implementation of RCUP:

1. Soil Scientists plus four Soil Surveyors (US Peace Corps)
2. Pasture Management Specialist
3. Animal Husbandry Specialist
4. Agronomist
5. Horticulturist
6. Plant Pathologist/Entomologist
7. Agriculture Extension and Education Specialist

One expatriate agriculturist will be attached to the Department of Agriculture to coordinate and advise on RCUP related activities for 3 years starting January 1980. One expatriate Soil Scientist will be attached to the Soils Section to advise on conducting the soil survey. Twelve months of short term consultancies in identified subject matter will be provided during the project period.

I. Catchment Level Organization

1. District Agriculture Development Office (DADO)

Under the overall direction of the Regional Director the Agriculture Development Officer will coordinate all the activities of the Agriculture Department. The DADO Office will be strengthened with new additions as below: (for details see Agriculture, Livestock and Pasture Development Reports.)

Agronomy

Kulekhani and Gorkha

Assistant Agriculture Development Officer (Horticulture, Gazetted Technical III)	1981
Assistant Production Agronomist (Gazetted Technician III)	1985

Mustang and Myagdi

Agriculture Development Officer (Gazetted Technician II)	1980

Assistant Agriculture Development Officer (Gazetted Technician III Horticulture)	1985

Agronomy Research Unit Marpha Farm

To carry out research on high altitude crops, one Agronomy Research Unit will be established at Marpha Farm. The following manpower will be required:

1.	Assistant Agronomist (Gazetted Technician III)	1980
2.	JT (1) (Non-Gazetted I)	1980
3.	JTA (1) (Non-Gazetted II)	1980
4.	Field Assistant (1)	1980
5.	Peon (1)	1980

The primary function of the DADO Office will be to carry out supervision, extension, coordination and administration of the Agriculture component of RCUP activities.

Livestock and Pasture Development

Existing livestock farms located in the project area will be strengthened to carry out added responsibilities in the livestock component of RCUP. The following additional staff will be added (for details see report on livestock and pasture management):

Chitlang Livestock Farm (Markhu)

1.	Livestock Officer (1) (Gaz. II Tech. Agri. service, livestock diary dev. faculty)	1981
2.	Assistant Pasture Development Officer (1) (Gaz. III, Agri, service, livestock/dairy dev. faculty)	1980
3.	JT (Non-Gaz. tech. I) (1)	1980
4.	Assistant Accountant (Non. Gaz. Adm.) (1)	1980
5.	Gothala (3)	1980
6.	Driver (1)	1980

Livestock Development Center Gorakhkali

1.	Livestock Officer (Gaz. II, Tech.) Agri. service, livestock diary dev. faculty) (1)	1985
2.	Assistant Pasture Dev. Officer (1)	1980
3.	JT (2)	1980
4.	Assistant Accountant-cum-Clerk (Non-Gaz. II Adm.) (1)	1980
5.	Field Assistant	1980
6.	Peons (4)	1980
7.	Driver (1)	1980

Livestock Development Center Marpha

1.	Additional Livestock Officer (Gaz. II, Tech. Agri. service, livestock dairy faculty) (1)	1982
2.	Assistant Pasture Officer (Gaz. III, Tech. Agri. service, livestock dairy faculty) (1)	1980
3.	Accountant (1)	1982
4.	Storekeeper/Clerk/Typist (1)	1980
5.	Peon (1)	1980
6.	Saish (1)	1980

Livestock Development Center/District Agriculture Development Office, Myagdi

Initially this division will be attached to the DADO Office in Myagdi. There is no specialized manpower in livestock development at present. The following manpower will be attached to the DADO Office, to carry out RCUP related activities:

1.	Additional Livestock Officer (Gaz. II, Tech. Agri. service, livestock and dairy faculty) (1)	1985
2.	Assistant Livestock Officer (Gaz. III, Tech. Agri. service, livestock and dairy faculty) (1)	1980
3.	Assistant Pasture Officer (Gaz. III, Tech. Agri. service livestock and dairy faculty) (1)	1980
4.	JT (Non-Gaz. Tech. I) (3)	1980
5.	Field Assistant (1)	1980
6.	Accountant (Non-Gaz. I Adm.) (1)	1985
7.	Assistant Clerk/Storekeeper (Non-Gaz. II, Adm.) (II)	1980
8.	Peon (4)	1980
9.	Saish (1)	1980

Horticulture

All the horticulture programs in RCUP areas will be channelled through the Department of Agriculture. Existing horticulture farms will be strengthened and additional satellite nurseries will be established (for details see Horticulture report). The following units and staff will be strengthened or added:

Kulekhani

1. Daman Horticulture Farm

   The physical facilities of Daman Horticulture Farm will be strengthened. The farm will be responsible for production of plant materials. In coordination with the DADO Office, this farm will be responsible for technical and administrative supervision and other extension services. No additional manpower needed.

2. Sisneri Satellite Nursery (New Establishment)

One additional nursery will be established in Sisneri Panchayat. The following additional staff will be needed:

a.	JTA (1)	1980
b.	Field Assistant (1)	1980
c.	Storekeeper (1)	1980
d.	Gardener (3)	1980

3. Daraundi Catchment (Gorkha)

The horticulture activity in Gorkha will be coordinated by the ADO. One agriculture graduate specializing in horticulture will be attached to the DADO Office for the technical supervision of this activity. One central nursery and 3 satellite nurseries will be established in the project area during the project period (for details see the horticulture report). The following staff is required for the horticulture component:

a.	Horticulturist (Gaz. III, Tech. to be attached to the DADO Office)	1980
b.	JT (1)	1980
c.	JTAs (4)	1980
d.	Field Assistant (4)	1980
e.	Storekeeper (4)	1980
f.	Gardeners (21)	1980

4. Mustang

The Marpha Horticulture Farm will coordinate all the horticulture activities and will serve as the central nursery for the area. Some physical facilities will be improved but no additional manpower will be required.

One satellite nursery will be located in Thani Panchayat and the following staff will be needed:

a.	JTA (1)	1980
b.	Field Assistant (1)	1980
c.	Storekeeper (1)	1980
d.	Gardners (3)	1980

J. Panchayat Level Sub-Center Organization (Agriculture)

Under the DADO Office of each district, although 21 sub-centres

(Kulekhani 3, Gorkha 8, Myagdi 5, and Mustang 5) will be established. Each sub-centre will cover one to five panchayats depending upon the local situation. In each sub-centre will be located two groups dealing with (1) plant science and (2) animal science. Each group will be handled by a JT and assisted by one JTA, one field man and one peon. In each Panchayat two general JTA will be located to look after plant and animal science programs respectively. Nine village Agriculture Assistants will be attached. The sub-centre activities will be coordinated with the field centre.

K. <u>Agriculture Development Bank, Nepal (ADB/N)</u>

Existing sub-branches at Gorkha and Hetauda would participate in meeting the credit requirements of the farmers in the project area. In Myagdi and Mustang the existing ADB/N depot offices should be elevated to sub-branch level to meet the expanded credit requirements in the project area.

L. <u>Agriculture Input Corporation (AIC)</u>

The existing AIC Office in Gorkha, Kulekhani, and Myagdi will participate in meeting increased agriculture inputs demand under the various programs of RCUP.

M. <u>Cooperatives (Sajha)</u>

Using the prevailing HMG set-up, cooperatives will be expanded and developed. At present there are only 8 cooperatives in RCUP areas. This number should be increased by 21 to meet the requirements to improve agriculture practices recommended under RCUP. ADB/N and AIC will cooperate and coordinate in the credit and input distribution by Sajha in the project area.

N. <u>Department of Forests</u>

Under the overall direction of the Chief Conservator of Forests, the Department of Forests will actively participate in the following activities of RCUP:

1. General forest administration in the project area.
2. Demarcation of Panchayat Forest, Panchayat Protected Forest, and National Forest.
3. Plantation activities on national forest land.
4. Aerial photography of the project areas in coordination with the Remote Sensing Laboratory of DSWC. Aerial photography is required for all project areas.

5. Preparation of operational forest management plans and carrying out all the prescriptions in national forest land accordingly.
6. Protection of all the national forest land.
7. Forest research.

At the national level, the Deputy Chief Conservator of Forest, Development and Planning, will be the Coordinator of RCUP activities assigned for the Department of Forests.

The forest survey and research office in the Department of Forests will be responsible to:

1. Coordinate and carry out aerial photography of the project area in cooperation with the Remote Sensing Center.
2. Prepare vegetation maps of the project area.
3. Prepare management plans for the project areas.
4. Carry out forestry research in the project areas in cooperation with the Institute of Renewable Natural Resources.

One full time expatriate expert, starting January 1980, in Forest Inventory and Management will be assigned to the Forest Survey Office for a period of 3 years to advise and coordinate aerial photography, forest inventory, research and management planning. A short term consultancy for a total period of 6 person months to assist in the field of aerial photography and navigation is recommended. Four U.S. Peace Corps Volunteers will be assigned to assist in carrying out the forestry programs in the field.

At present, Divisional Forest Offices are located in Hetauda (responsible for Kulekhani Watershed), Damauli (responsible for Daraundi Watershed) and Bheri (responsible for Mustang and Myagdi Watershed). These three Forest Divisions will be strengthened as follows:

Staff	Kulekhani	Daraundi(Gorkha)	Myagdi	Mustang	Total
Attached Officer	1	1	1	1	4
Rangers	4	9	9	5	27
Forester	9	28	28	14	79
Senior Clerk	1	1	1	1	4
Forest Guards	9	28	28	14	79
Driver	1	1	-	-	2
Nursery Man	2	5	5	5	17
Peon	2	2	3	3	10
Total:	29	75	75	43	222

This staff will be stationed in the RCUP Project Offices (headquarters) and will work as different mobile groups to implement field projects like forest demarcation, national forest plantation, forest protection and all other activities recommended by the management plan. Day-to-day administration will be the responsibility of the respective Forest Divisions. All the activities under forestry will be coordinated through respective divisions of the Department of Forests (e.g. national forest plantation will be coordinated by the Afforestation Section).

O. Water Supply and Sewerage Department

The water supply project has been divided into two types. First are those projects which serve populations of more than 1500 people, which will be handled by the Water Supply and Sewerage Department. Second are projects serving less than 1500 people, which will be handled by the Local Development Department.

Under the overall supervision of the Chief Engineer, Water Supply and Sewerage Department (WSSD), the Department will actively participate in the detailed design and implementation of the identified RCUP water supply projects. The Chief Engineer will nominate a Coordinator from his staff for the planning and program development. The Department, through its Central Construction Unit, will handle the project in Kulekhani, and through its western division office (Pokhara) will manage the projects in Daraúndi and Kaligandaki Watersheds. The following manpower is projected as needed to implement the RCUP water supply activity:

Staff	Kulekhani	Daraundi(Gorkha)	Myagdi & Mustang
Civil Engineers	1	1	1
Overseers	2	2	3

This staff will work out of the WSSD Office as a mobile project implementation group under the technical direction of the WSSD Departments central and divisional construction office. WSSD will operate initially with the existing staff and consultancies and will hire additional manpower as and when needed.

P. Department of Irrigation, Hydrology and Meterology

Under the overall supervision of the Director General of Department of Irrigation, Hydrology and Meterology, the Department will actively participate in the following activities of RCUP:

1. Design and implement irrigation programs coverning more than 50 hectares

of land in the RCUP Project area through its regional and divisional offices. The Local Development Department will oversee implementation of projects less than 50 hectares.

2. Help coordinate and advise in the installation of hydrometerological instruments and training of the field staff in recording and collecting data.

The Director General will nominate his staff member involved in the planning and programme development as the principle Coordinator. One hydrologist will also be assigned to help coordinate and install hydro-meterological equipment and begin data evaluation. The recommended projects will be implemented by existing regional and project offices under the Department, and additional manpower is not recommended. (For details, see RCUP report on Irrigation.)

Q. Local Development Department (LDD)

Under the overall supervision of the Director General, Local Development Department, the Department will actively participate in the following activities of the RCUP.

1. Detailed design and implementation of water supply projects which serve less than 1500 people.
2. Detailed design and implementation of Irrigation projects which irrigate less than 50 hectares of land.

It has been estimated that the following manpower will be needed during the first 5 years of the project:

Staff	Kulekhani	Daraundi (Gorkha)	Kali Gandaki (Mustang-Myagdi)
1. Drinking Water			
Engineers	1	1	2
Overseers	3	3	4
2. Irrigation			
Engineers	1	1	1
Overseers	2	2	2

The manpower projection does not include the existing-manpower. The discussion with the LDD reveals that LDD will operate RCUP activities initially with the existing staff in the centre and in the field and will hire local consultancies and staff as and when needed.

R. Institute of Renewable Natural Resources

The Institute is responsible for formal training of Foresters and Soil and Water Conservation Officers. As Officers graduate, preference will be given to placing these graduates in direct or support RCUP positions. The RCUP areas will also serve as a training-research base for the Institute. As many students as possible will serve their one year field training requirement, between the certificate and diploma course, associated with RCUP projects. The expatriate staffing will be according to the agreed-upon recommendations outlined in the "Training In Renewable Natural Resources in Nepal" report.

S. APROSC and Other Consultancies

As concluded by different reports, project monitoring--including both impact evaluation and on-going adaptive research and feedback--is essential for achieving and measuring project success. Since this activity includes both physical (land) and socio-economic (inhabitants) monitoring of a wide variety of project activities, it will be coordinated and managed by the RCUP Central Staff. One full time socio-economic Monitoring Specialist with the assistance of an expatriate rural sociologist/anthropologists and short-term consultancies on statistical methods will be assigned to work with the staff in setting up the monitoring program, carrying out its initial activities for two years, training the DSWC Monitoring Specialist, and providing short term follow-up consultancy services.

Manpower constraints in different line agencies may have to be resolved by making arrangements with local consultancy and research organization's inside the country. Since APROSC has had a principal role in the projects's design and was responsible for the household baseline study which will be repeated after five years to measure impact, its role in project monitoring is vital. In addition, individual consultants and contracts with other institutions (either private or public such as the University), will probably be necessary to the extent practicable. These consultants will be retained to either compliment or eventually replace identified expatriate staffing.

RESOURCE CONSERVATION & UTILIZATION PROJECT ORGANIZATION

Alternative - 1

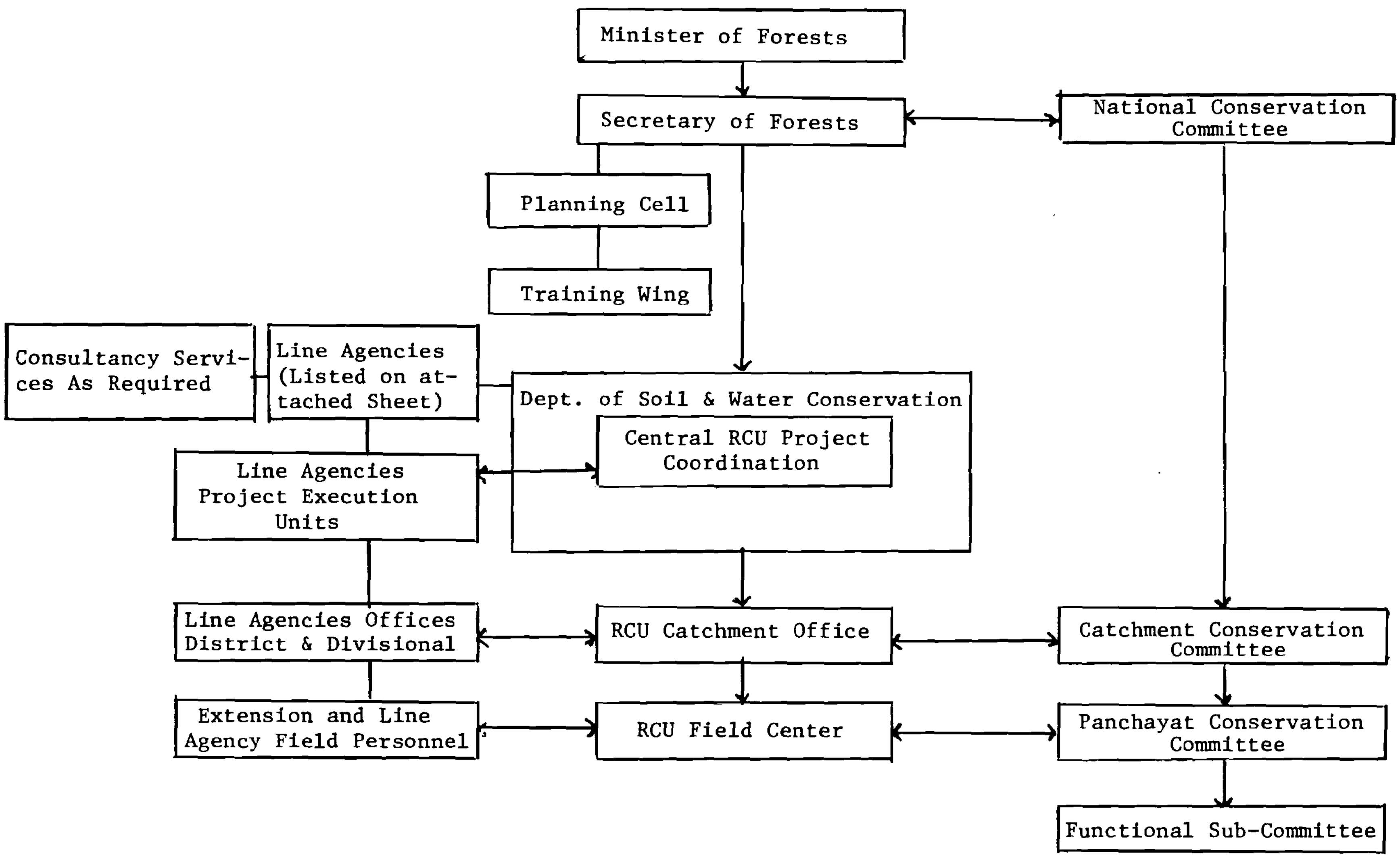
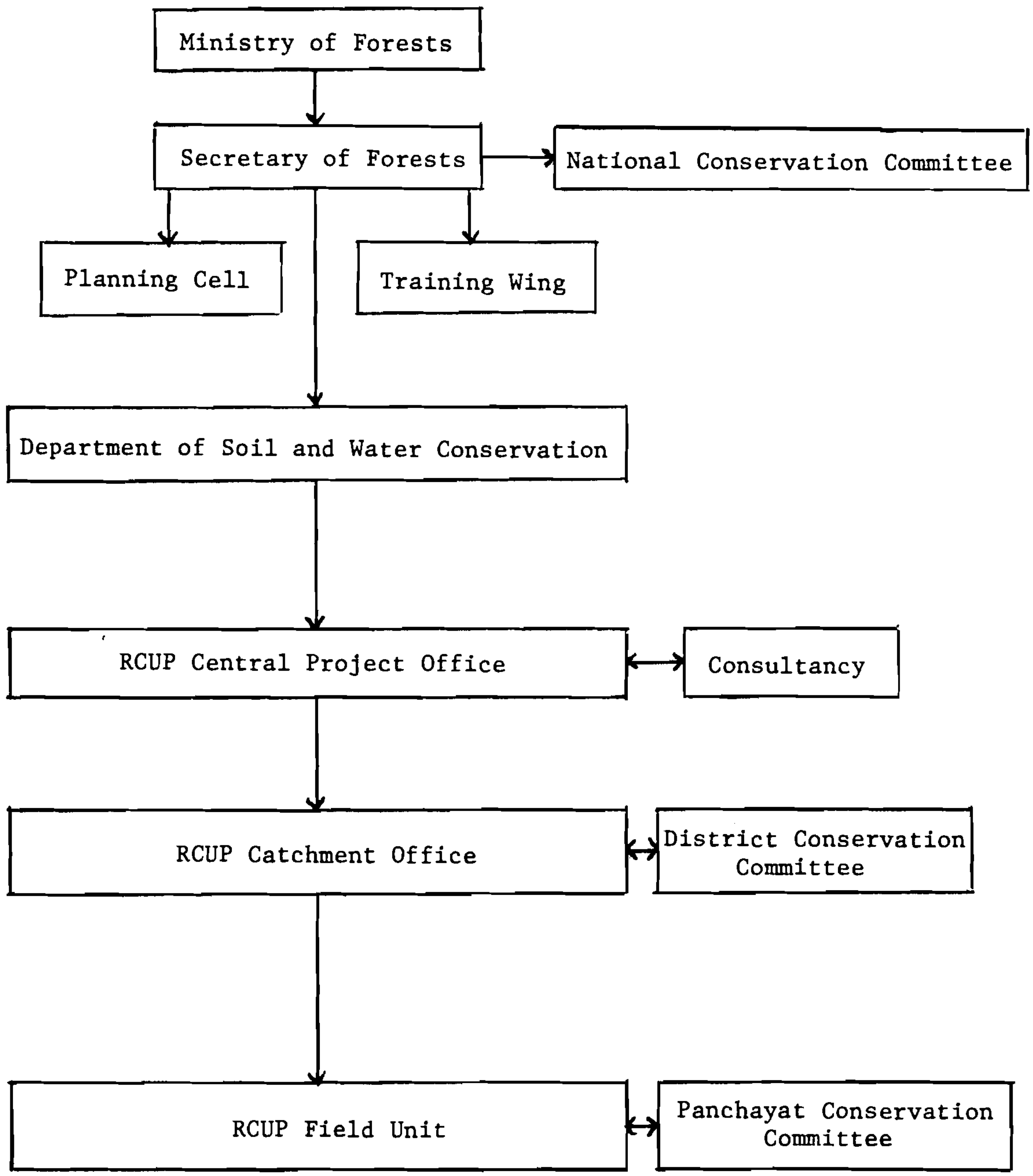


Fig. 1

Fig. 2

RESOURCE CONSERVATION & UTILIZATION PROJECT ORGANIZATION

Alternative - 2



August 1979

DRAFT

MEMORANDUM OF UNDERSTANDING

BETWEEN

DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

DEPARTMENT OF AGRICULTURE

AND

AGRICULTURAL PROJECTS SERVICE CENTRE

MINISTRY OF FOOD AND AGRICULTURE

AND

THE FOREST RESOURCES SURVEY OFFICE

DEPARTMENT OF FORESTRY

AND

DEPARTMENT OF SOIL AND WATER CONSERVATION

MINISTRY OF FORESTRY

RELATIVE TO SOIL SURVEYS

This Memorandum of Understanding is between the Department of Soil and Water Conservation hereinafter called the Department; the Division of Soil Science and Agricultural Chemistry hereinafter called the Division of Soil Science; the Forest Resources Survey Office hereinafter called the Forestry Resources Office; and the Agricultural Project Services Centre hereinafter called the Service Centre.

This Memorandum recognizes the joint and individual responsibilities of the four parties in making a cooperative soil survey in Nepal. These surveys are part of the National Soil Survey Program. Soil surveys as used in this memorandum include the determination of important characteristics of soils; the classification of soils; the classification of soils into defined and described taxonomic units; the establishment of the limits of these taxonomic units; the plotting of the soil boundaries on maps; the description and correlation of these map units; the interpretation of the maps and other data obtained in the surveys; the publication of the maps; the publication of reports; and investigations in soil genesis, morphology and classification.

GENERAL PURPOSES

1. Soil surveys are needed to determine accurately the nature, distribution and extent of the various kinds of soils. They contribute to a knowledge of the soil resources of Nepal. Combined with the information on the properties, interrelationships and behavior of soils obtained through research and through the experience of engineers, farmers, range specialists, forest land managers, and others, they provide a geographical basis for efficient and prudent use of soils. They provide data on which to base decisions for planning in both urban and rural areas.
2. This Memorandum is to:
   a. provide for cooperative efforts in the development and utilization of soil surveys in Nepal,
   b. assure that all phases of the soil survey program including that for forested lands are given adequate attention, and
   c. strive for maximum utilization of resources of all parties working toward a common goal.

IT IS MUTUALLY AGREED THAT:

1. Soil surveys are to be made cooperatively according to sound scientific and technical standards in accord with a national system of soil classifications, correlation, and nomenclature as developed by the National Soil Survey Program.
2. All new cooperative soil surveys conducted in Nepal by the parties to this

Memorandum shall be carried out in accordance with procedures contained in this Memorandum. When soil surveys are initiated outside the procedures contained in this Memorandum, the initiating agency shall inform the other signatories of the Memorandum of such plans before the survey is started.

3. Parties to this Memorandum shall expedite soil surveys made within the terms of the Memorandum and will seek to continually improve their quality and usefulness to the end that the resources available for soil surveys will make the maximum contribution feasible to all potential users, including farmers, land use planners, engineers, sanitarians, land appraisers, land developers, recreation and park planners, architects, foresters, range specialists, wildlife specialists and others.
4. Parties to this Memorandum shall cooperate in establishing and updating priorities of areas needing soil surveys and in scheduling surveys according to agreed upon criteria, including adequate lead time.
5. Parties to the Memorandum will cooperate in keeping soil survey activities within the framework of the National Soil Survey Program including soil correlations and interpretations.
6. Parties to this Memorandum shall cooperate in initial, progress, and final soil survey field reviews and in legend reviews in progressive survey areas according to their interests or degree of participation in the survey.
7. All parties to this Memorandum will cooperate in informing the public regarding progress of soil survey operations and about the use of published soil surveys.
8. All parties to this Memorandum will cooperate in the preparation of educational materials such as brochures, pamphlets, circulars, and similar material about soils and their use.
9. This Memorandum of Understanding is to define in general terms the basis on which the agencies concerned will cooperate and does not constitute a financial obligation to serve as a basis for expenditures. The responsibilities assumed by each of the cooperating parties are contingent on funds being available from which expenditures may legally be made. Each party will administer its own funds in accord with its rules and regulations.
10. Parties to this Memorandum shall be free to use in official correspondence any of the results obtained in the surveys made under this agreement giving due credit to the other agencies. Publications may be independent or joint as agreed upon. In case of failure to agree as to the manner of publication or to the interpretation of results, any of the cooperating agencies may publish

data or reports after due notice and submission of the proposed manuscript to the others. In such instances, the agency publishing the data will assume full responsibility for any statement in which there is a difference of opinion.

11. Administrators from each agency signatory to this Memorandum will appoint appropriate staff members to constitute a technical committee and meet at least once each calendar year. Members of the staffs of these agencies and other interested people shall also be invited to participate. This technical committee will act on matters incident to the purpose of this Memorandum; will consider recommendations for meeting the needs of users of soil survey information; will appoint advisory committees as needed. Each year the committee will elect its chairman. The committee will review progress of the soil survey program and present annual plans, with schedules, and make recommendations for improvement of the overall program.
12. This Memorandum of Understanding shall become effective when signed by all signatories and shall remain in effect indefinitely, but may be modified by mutual agreement among the parties in writing. It may be discontinued at the request of any party. Request for termination or any major change shall be submitted to the other parties, not less than 60 days in advance of the effective date desired.

UNDER THE PROVISION OF THIS MEMORANDUM THE DIVISION OF SOIL SCIENCE AGREES TO:

1. Provide leadership in soil characterization by providing facilities, supplies and personnel for procuring laboratory data in Nepal, in addition to that provided by the Department and Forest Resources Office, as needed for interpretations, classification and correlation.
2. Provide leadership in soil correlations and interpretations within the Division of Soil Science Soil Survey Areas in preparation of standard soil series descriptions and interpretation sheets and preparing soil survey manuscript for publication; all in cooperation with the signatory agencies.
3. Provide leadership in carrying out the initial, progress, and final field reviews within the Division of Soil Science in cooperation with the other agencies of this agreement.
4. Provide leadership in the development and amendment of the mapping legend for each Division of Soil Science survey being surveyed cooperatively within the standards of the National Soil Survey Program.
5. Provide leadership in and cooperate with other agencies in informing the public regarding progress of soil survey operations and about the use of published soil surveys.

6. Provide leadership and cooperate with other agencies in the preparation of educational materials such as brochures, pamphlets, circulars and similar material about soils and their use.
7. Cooperate in establishing and updating priority list of soils to be studied for characterization or special studies.
8. Cooperate in the development and amendment of the mapping legend for each progressive survey being conducted cooperatively within the standards of the National Soil Survey Program.
9. Cooperate in preparing soil profile descriptions and mapping unit descriptions and in the sampling of soils for research, educational and interpretative purposes.
10. Provide training for soil scientists employed by the Division of Soil Science and other agencies as appropriate.

UNDER THE PROVISIONS OF THIS MEMORANDUM THE FORESTRY RESOURCES OFFICE AGREES TO:

1. Provide leadership in assembling soils and productivity information for Nepal soils with the goal of improving the standards and guidelines for soil survey in forested areas and providing the best possible woodland interpretations.
2. Cooperate in soil characterization studies to identify soil features that are predictive of forest production and management opportunities and by providing facilities and personnel for procuring laboratory data for forest soils in addition to that provided by the Division of Soil Science and the Department.
3. Provide leadership in the development and amendment of the mapping legend for each progressive survey in forested areas being surveyed cooperatively within the standards of the National Soil Survey Program.
4. Cooperate in preparing soil profile descriptions and mapping unit descriptions and in sampling of soils for research, educational and interpretative purposes.
5. Provide leadership in the preparation of interim and final soil survey reports for soil surveys in forested areas.
6. Provide training for soil scientists employed by the Forestry Resources Office and other agencies as appropriate.
7. On His Majesty's Government's National Forests, cooperate with other parties to this Memorandum in the development and amendment of the mapping legends, within the standards of the National Soil Survey Program.

8. Cooperate with other parties to this Memorandum in all other aspects of soil survey operations including the preparation of soil survey manuscripts, and soil correlation.

UNDER THE PROVISIONS OF THIS MEMORANDUM THE SERVICE CENTRE AGREES TO:

1. Provide leadership in Service Centre soil surveys in carrying out the initial, progress, and final field reviews in cooperation with the other agencies to this agreement.
2. Provide leadership in soil correlations and interpretations within Service Centre soil survey areas in the preparation of standard soil series descriptions and interpretation sheets, and preparing soil survey manuscripts for publishers; all in cooperation with signatory agencies.
3. Develop work plans and amendments when needed, for Service Centre areas being surveyed, within the standards of the National Soil Survey Program.
4. Provide leadership in the development and amendment of the mapping legend for each Service Centre survey being surveyed cooperatively, within the standards of the National Soil Survey Program.
5. Provide leadership in training soil scientists employed by Service Centre and other agencies as appropriate.
6. Cooperate in establishing and update priority lists of soils to be studied for characterization or special studies.

UNDER THE PROVISIONS OF THIS MEMORANDUM THE DEPARTMENT AGREES TO:

1. Provide leadership in Resource Conservation and Utilization soil surveys in carrying out the initial, progress, and final field reviews in cooperation with the other agencies to this agreement.
2. Provide leadership in soil correlations and interpretations within Resource Conservation and Utilization soil survey areas in the preparation of standard soil series descriptions and interpretation sheets, and preparing soil survey manuscripts for publication; all in cooperation with signatory agencies.
3. Develop work plans and amendments when needed, for Resource Conservation and Utilization areas being surveyed, within the standards of the National Soil Survey Program.
4. Provide leadership in the development and amendment of the mapping, legend for each Resource Conservation and Utilization survey being surveyed cooperatively, within the standards of the National Soil Survey Program.
5. Provide leadership in training soil scientists employed by Resource Conservation and Utilization and other agencies as appropriate.

6. Provide leadership in encouraging district soil and water conservation committees through the National Soil and Water Conservation Committee to support the soil survey and its uses.
7. Cooperate in establishing and updating priority lists of soils to be studied for characterization or special studies.

Signed________________________________ Date________________

Director General
Department of Agriculture

Signed________________________________ Date________________

Chief Conservator of Forest
Department of Forestry

Signed________________________________ Date________________

Director General
Department of Soil and Water Conservation

Signed________________________________ Date________________

Executive Director
Agricultural Project Service Centre

APPENDIX O

EXTENSION COMPONENT OF RCUP

Prepared by: Govind C. Sharma/SECID

Table of Contents

ABSTRACT

The Resource Conservation and Utilization Project can be defined as an extension program assisting the Nepalese people in conserving and utilizing their renewable and non-renewable resources most efficiently. Considerable attention is given to organizational and staffing needs of the RCU program at the panchayat, catchment and national level. This section emphasizes use of the Training and Visit system as well as on-farm demonstration approach to extension in RCU Project areas. Adult conservation education and a strong public information program have been discussed and made an integral part of the RCUP extension. This paper also outlines the type of measurements that should be made to monitor the effectiveness of the proposed extension network.

The author wishes to acknowledge the input provided by other design team members particularly in defining the staffing needs in their respective subject matter areas. Comments and suggestions given by Mr. Achyat Bhattarai, Deputy Director General of Agriculture for Extension, by Dr. Shiva Lohani, Agronomist, RCUP/APROSC, and by Mr. Brian Scouller, Extension Specialist, FAO, were quite valuable in drafting this section.

EXTENSION SUPPORT FOR RCUP

Govind C. Sharma

Design Team Member

A. Introduction

In the context of multi-disciplinary resource conservation and utilization in Nepal, extension functions must be conceived as the key element. Extension delivery configurations should transcend the traditional disciplinary boundaries of subjects and departments. At the same time the traditional role must be supported by extension workers -- that is, bringing new technological information and materials input to the patrons in the panchayat and wards while feeding back to research, administrative and service agencies the problems that are encountered by the clientele. To support such a two-way exchange of information, a realistic extension and education program will need to be developed in the selected sites and be supplemented by an applied research, demonstration and subject matter support infrastructure.

Selection of the study areas (Kulakhani, Gorkha and Mustang/Myagdi) in hill and mountain regions is an appropriate step in the right direction of applying some precise treatment measures to a mammoth problem. The hill and mountainous areas accommodate two-thirds of Nepal's people and a large proportion of the 240 million m^3/yr of eroded soils originate in the hills and the mountains. Also, in this region forests are being destroyed for firewood and fodder and some of the most denudation-prone soils have been cleared for cultivation. Such pressure on land by people and livestock alike and by unchecked movement of water has forced large regions into the desertification process. Since environmental degradation is also proportional to increase in human and livestock population coordination of RCUP activities with HMG family planning and livestock management program should also be considered.

The purpose of this component of the RCUP report is to outline specific mechanisms that include coordination of agricultural, forestry, soil and water conservation and energy components, and how these various program activities can best be taken to the people in the above project areas.

B. Current Status of Extension Programs in Nepal

In order to place specific proposals in their proper perspective, a brief review of the existing extension infrastructure is presented here.

The largest extension infrastructure in Nepal is operated under the auspices of the HMG's Department of Agriculture. Its formal beginning in 1953 makes it one of the youngest extension services in the world and therefore it can be best described as being in its formative years. The basic administrative structure, most recently revised in 1973, places considerable emphasis on JTA's (Junior Technical Assistants) and JT's (Junior Technicians) at the panchayat and sub-district level. At times, they are aided by Agricultural Assistants located at the village level who provide part-time support. The JT's are supervised by the Agricultural Development Office (ADO) stationed at the district headquarters. Both the Chief District Officers (CDO) and the Regional Directors supervise the ADO and the Deputy Director General of Agriculture for extension's office in turn provides national coordination. At the national level this line of command is supported by an Agricultural Information Section, a Rural Youth Section and an Agricultural Marketing Corporation (AMC). This agricultural extension network has been described in considerable detail[1/]. The Department of Agriculture in addition to agricultural extension, has Crop Research, Animal Research and Planning and Administration Divisions. The Department of Agriculture is housed in the Ministry of Food, Agriculture and Irrigation with parallel Departments for Irrigation and Hydro-Meteorology and for Food and Marketing Services. The Ministry of Forest also has its own nation-wide infrastructure. The Ministry has four Departments: Forestry, Botany (Medicinal Plants), Soil and Water Conservation (DSWC), and Resettlement. The DSWC has various components and the expertise is provided by planners, foresters, agriculturists, civil engineers and research and publicity specialists. At present DSWC is carrying out different projects on a catchment basis and is in the process of establishing distinct offices where such watershed management projects are being undertaken. The Department of Forest has a country-wide organization and work grouped in 9 forest circles and 40 forest divisions.

At the divisional level a Divisional Forest Officer (DFO) supervises forestry related functions and has on his staff 3 Rangers, about 10 Foresters, and generally more than 20 Forest Guards. In most cases one forest division

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1/ Agricultural Projects Services Centre, 1978, Nepal Agricultural Extension Project Phase II, Vol. I-IV., Lazimpat, Kathmandu.

covers two districts, but some divisions extend to three districts while others are confined to only one.[2/]

C. Critical Evaluation of Present Extension Approaches

The present extension program suffers from several constraints that became obvious in the design team's discussions with farmers and village leaders during the field trips in the RCUP regions:

1. The JT's and JTA's are understaffed. In several cases one JTA was responsible for three or more panchayats, which translates into approximately 3,000 or more farm families/JTA. In many extension circles the ideal number of farm families contacted by a JTA-like person would be more like 1,000.[3/] Considering the rugged terrain and the amount of time consumed in travel, the present load on JTA's is unrealistic.

2. Wide gaps exist in extension support components: limited training of JT's and JTA's; inadequate subject matter support at the district level; tardy input of new technology in terms of new research findings, improved varieties, fertilizers and pesticides; and the disbursement of credit or price support is inadequate and not tied closely to extension personnel services.

3. Although morale and high attrition rates are not conditions unique to HMG's extension service, continuous review of its personnel policies (salary level, promotions, TA, DA, remote area allowance, provision of living quarters) seems to be necessary.

4. There is physical separation between extension and research facilities in the field and to an extent at the national level also. Therefore, except for special meetings researchers and subject matter specialists do not come in contact with the extension workers.

5. There is some confusion in terms of the prioritization of an extension worker's main calendar of activities (e.g., emphasizing improved rice seed distribution in June). They also function as the government's data collectors, thus, dividing their efforts between extension and non-

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2/ FAO/World Bank, 1979. Draft report of the Nepal community forestry development project. Rep. No. 16/79 NEP 12. 11 April 1979 FAO/UN, Rome 33 p., annexes.

3/ Benor, Daniel and James Q. Harrison, 1977. Agricultural Extension: The training and visit system. World Bank, Washington, D.C. 55 p.

extension functions.

6. Both the Department of Forestry and the DSWC staff in the field and at the national level are too few to carry out an effective resource conservation program and extension. Also greater interfacing of all extension workers (i.e., in agriculture, forestry and soil and water conservation) is needed. At present, they work under separate quotas and directives which may not be mutually compatible. If the present state continues, there is a danger of the village communities receiving contradictory recommendations from the extension workers in different departments.

7. Greater interaction with people and the leaders in the panchayats and wards in planning could facilitate implementation activities. Formalizing of such citizen based advisory, goal-setting implementation groups should be an important feature of extension activity.

8. Up to now, the Forest Department has mainly been concerned with licensing and organizing timber sales from the forest and with forest law enforcement and had limited programs in reforestation and extension. Therefore, at present no area-wide soil and water, farmland, and other resource conservation extension infrastructure exists in Nepal.

Many of the above mentioned limitations have been addressed in the subsequent pages, particularly in the project organization and the action plan for extension.

D. Novel Appraches Used in Extension

Several novel extension packages have been put together by HMG and by bilateral donor agencies.[4/] Generally such programs are for limited geographic areas and/or are for a select target group of people. Only a few examples of such programs are mentioned. The Small Area Development Program (SADP) in which viable panchayat areas are identified where resources including extension support are applied for their all-round development. In the past decade seven Integrated Rural Development (IRD) or Hill Area Development Projects have also brought about different extension approaches. In these projects a greater number of extension and subject matter specialist support from governmental agencies is generally provided. Expatriate consultants as well as participation by people via Conservation Committees and Advisory

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4/ World Bank, 1978. Nepal Forestry Sector Review. Rep. No. 1952-NEP. August, 1978.

Councils also provide needed inputs to the projects.[5/] Examples of such projects include Karnali-Bheri Integrated Rural Development (K-Bird), Kosi Hill Area Rural Development Project (KHARDEP), Hill Area Development Project (HADF), Integrated Hill Development Project (IHDP). The Integrated Watershed Management, Torrent Control and Land Use Development Program was designed to build up the Department of Soil and Water Conservation and to carry out training and demonstration.

The Phewatal Watershed Project of DSWC is a multi-disciplinary project having as one of its activities the development of reafforestation and erosion control. The Gandaki Agricultural Development Project concentrated its activities in the central region, serving an area of 821,000 ha with an objective of achieving increased overall agricultural production by an intensified extension service coupled with sources of credit. The Rural Resettlement Scheme at Lumle and Pakhribas offers agricultural and silvicultural training for rehabilition of Gorkha soldiers. The veterans thus settled are also provided with extension follow-up visits at their farms.

E. Extension -- Training and Motivational Considerations for RCUP

I. Pre-Service Training Considerations.

The Resource Conservation and Utilization program must be augmented with a similar broad-based extension support. In the context of this project the extension staff must take to the people the knowledge of forestry, range and watershed management, soil conservation, irrigation, drinking water, animal husbandry, agronomy and horticulture.

Under the present training configuration in Nepal it seems that the panchayat and district level extension personnel for RCUP will be derived from two distinctly separate education programs. One of these currently trains JT's and JTA's and also degree level agricultural graduates whose basic training is in the agricultural sciences. The other is the forestry training program at Hetaura which at present trains certificate-level (2 years post-SLC) foresters. There is as yet no professional forestry degree course in Nepal. In 1977, a certificate training program in soil and water conservation was also introduced at Hetaura and about 20 gradu

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5/ Agricultural Project Services Centre, 1978. Peoples Participation in Rural Development in Nepal. APROSC Report. Lazimpat, Kathmandu, Nepal.

ates/year are coming from this program: culturally and ecologically, Hetaura is a part of the Terai wheras the RCUP emphasis is on the hill and mountain ecology. Students in this program are largely drawn from the Kathmandu Valley and the Terai, and naturally become conditioned to working in the Terai. It is a welcome development for RCUP that a separate hill campus for forestry, soil and water conservation will be established at Pokhara with emphasis on hill community forestry and natural resource conservation.[6/] If progress is made as planned, certificate and diploma graduates should be coming from the Pokhara campus in 1983 and 1984, respectively. This training program is described in greater detail in the training component of this project paper. Actually, considerable expansion of RCUP into additional panchayats may need to be delayed until the graduates of the Pokhara school are available to RCUP to carry out the RCUP extension and technical work.

The following are training related recommendations relevant for short and long range extension support:

1. Both for agricultural extension (JT's, JTA's and diploma holders) and for the forestry and SWC (Soil and Water Conservation) programs, SLC graduates from hill regions should be identified, trained and placed in RCUP areas.

   An excellent approach to consider in the selection process would be to invite nominations of qualified trainees from panchayat or ward level conservation committees. Such an approach will keep to ensure the appropriate placement and retention of graduates in the hill region.

2. Potential extension workers must be exposed to the same level of technical and subject matter training as a typical certificate, diploma or degree holder will receive. In addition, they must be sensitized to extension methodologies of communication, techniques of mobilizing, organizing and stimulating citizen interest in conservation issues and in adult conservation education methodologies.

3. The agricultural trainees in their curricula must be exposed to rudiments of natural resource conservation, and, similarly, forestry, SWC trainees be exposed to various aspects of agriculture.

4. Since there is an obvious gap between initiation of RCUP and the

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6/ FAO/World Bank, 1979. Community Forestry Development Project. Proj. Rep. No. 16/79 NEP. 12. FAO/UN, Rome.

availability of graduates from the Pokhara school, RCUP should consider effective utilization of NDS scholars during their field appointment as well as Peace Corps Volunteers in well-defined positions in the RCUP organization. However, this is not recommended in the long term strategy. Later these groups may take more of a support role in a fairly well-established extension infrastructure.

5. It is proposed that one JTA and one graduate of the certificate level course from Pokhara form the basic extension arm of the RCUP effort at the panchayat level. A team of two such individuals working together will be capable of carrying out a balanced RCUP extension program in agriculture and in the renewable and non-renewable natural resource management aspects.

6. The JTA's and the soil conservation assistants should be fully oriented to the challenges of working in hills and be prepared for hill life.

II. Inservice Training Considerations.

The greatest need for inservice training will be at the panchayat level. The extension component of RCUP should organize periodic inservice training programs along the following lines:

1. Catchment Level Training. Training sessions conducted by catchment level staff (routine, as outlined).

2. Cross Discipline Training. Consistent with the mission of RCUP, yearly training sessions should be conducted of two week duration to orient JTA's to non-agricultural issues and similarly ranger (soil conservation assistants) to agricultural aspects. Other topics as outlined in Table 2 can also be covered in the training program. The JTA's in two neighboring panchayats may divide their responsibility, whereby one may specialize to work with animal husbandry while another, with crops.

3. Refresher Training. After every 3 years of active association with RCUP, the panchayat level extension worker should be given a refresher course of two months duration. Such a course should be designed with input from the Agricultural Institute at Rampur; Forestry and Soil Conservation School (Pokhara); the research agencies of agriculture, forestry training wing, and soil conservation department. Included in such refresher courses should be visits to demonstration sites. Extension pro-

grams in Nepal or in neighboring countries could also be visited to observe how other workers carry out their programs under a different set of variables.

Extension Budget allocates support for above mentioned inservice training activities.

III. Considerations for Promotions and Fair Compensation.

The desire to improve oneself and advance in one's profession is a natural attribute of all human beings. The RCUP program and decision-makers must always consider providing advancement opportunity to panchayat and catchment level staff. Actually phased build up of a personnel as outlined in the action plan would make it quite possible to promote capable individuals to more responsible positions. It is imperative that important office holders in RCUP be sensitive to the initiative shown by catchment level and panchayat staff and provide opportunities for advancement at those levels.

The budget section also outlines compensations that are considered equitable and fair under present HMG pay structures. The RCUP organization should have some flexibility to award superior performance and consideration should be given to the following:

1. It is strongly felt that the present system of starting Gazetted technical professionals in the same grade regardless of educational preparation is one of the major causes of low morale. Just as HMG recognizes experience, equitable consideration should also be given to the level of education. In some circles both in HMG and in bilateral agencies some reservation has been expressed about the relevance of advanced education to nation building aspects of Nepal. The author can not think of any developing country where progress in development has been achieved without a well trained technical core of professionals.
2. Just and equitable compensation should be provided to extension staff for remote area appointments.

F. The Philosophy and Extension Approach For RCUP

In the RCUP, extension should be considered an integral part of all activities rather than an independent component by itself. To carry this concept one step further, RCUP can be defined as an extension program of assisting people in conserving and utilizing their renewable and nonrenewable resources most efficiently.

In the above definition lies the philosophy of the extension program of RCUP. It will be people-oriented and people-originated and our role as technicians will be in assisting people in solving their resource management problems. The technical input in various forms should be shared with the people right from the time they devise conservation and utilization plans, and continue through the implementation and the follow-up. The project organization as outlined below has taken into account such an approach. Following is a brief discussion of such approaches.

A cadre of Nepalese subject matter specialists have been included at the national and district levels. Their prime responsibilities to support extension are considered threefold:

1. Being equipped with the knowledge of existing research and development information, identify specific demonstrations and conduct them on a limited basis first in selected panchayats.
2. If such approaches are successful, gear up for catchment wide application of proven techniques by insuring proper materials and technical support, and
3. Conduct training programs, develop extension aids, publications, and adult conservation education modules for projects in which RCUP wishes to make the greatest impact.

Table 1 outlines specific Panchayat level extension tasks to be conducted by the RCUP staff.

G. Strengthening Existing Public Information Services of DSWC

The RCUP extension component proposes a strong publication and publicity program to further strengthen the existing capabilities of DSWC. An excellent beginning has been made by the regular publication of a newsletter in Nepali titled Samrakshan and in several bulletins related to soil and water conservation.[7/] The intent of RCUP support will be to expand this effort in terms of the quantity of such documents published for RCUP areas and for other parts of the country, also. Samrakshan must be streamlined and should contain periodic information on topics such as shown in Table 2.

7/ Samrakshan. Pustika 1979 (Nepali Year 2034/35). Nepal Ko Samrakshan Hamro Hat Ma. DSWC Bulletin 28 p.

Table 1

Typical Examples of RCU Extension Activities to be Undertaken by the Panchayat Level Staff

Extension Activity	Number of Activities[1/]	Target Audience and Remarks
1. Meetings with the farmers (Training and visit system)	3 such weekly visits by JTA and Soil Conservationist each with groups of approx. 10 farmers.	Villagers and farmers
2. Training at catchment level of Panchayat extension workers	Two, 2-day training sessions by respective subject matter specialists to support the following months' extension activities.	Panchayat level extension workers
3. Demonstration on farmers' fields, forests, home gardens, homes		
-- Agronomy related	10 demonstrations/ growing season	Private farmers Panchayat key leaders Forestry guards Conservation assistants
-- Horticulture related	30 (20 on fruits, 10 on vegetables)/yr.	" " " "
-- Range and Pasture	10 (on seeding, management, hand cut forages)/ yr.	" " " "
-- Forestry	50,000 trees to be planted in private, PF, PPF, or national forests	" " " "
-- Soil & Water Conservation	Terrace management (3 ha/season) Channel improvement (50 m/yr) Small gulley control (30 m/yr)	Panchayat (lands)

1/ Such activities will be achieved when full extension staff at national, catchment and Panchayat level is in place as outlined in the project organization. Full staffing at these levels will be achieved by the year five from project inception.

(Cont'd Table 1)

Extension Activity	Number of Activities	Target Audience and Remarks
-- Energy related	10 villages (10 Chulas/ village, 2 solar cookers)	In private homes, Bhattis, Hotels
4. On-Farm extension assistance	Numerous (Simple demonstrations, e.g., how to plant fruits, row planting of agronomic crops, etc.)	Villagers and farmers
5. Attendance of panchayat Conservation Committee meetings		Panchas, key leaders
6. Adult conservation education classes	30/year dealing with conservation education, to be conducted by catchment and panchayat extension staff	Modules to be developed for use as instructional aids by extension staff: distribution restricted only among literate farmers and in the area schools
7. Inputs distribution (e.g., seeds, supplies for Chulas, supplies for conservation structures)	Refer to individual design team report	Farmers -- villagers
8. Displays (e.g., showing soil loss from burn vs. intact landcover)	5 per year	On special occasions, e.g., VRIKSHA ROPAN DAY, etc., and also for the panchayat and catchment officers. Some of these displays should be portable to be used in the fairs or other occasions.

Table 2

Examples of Topics to be Covered in RCUP
Publications and in Adult Education Modules

-- How to organize citizen task committees at village and panchayat level.
-- Forest fires -- The advantages, disadvantages and how to control them.
-- Landslides -- What causes them and how to minimize occurrence.
-- Soil loss -- What are the chief contributing factors.
-- Role of citizens in watershed management.
-- Effect of deep weeding (cultivation) on soil loss and injury to crop roots
-- How to improve drinking water sources.
-- How to lay pipes for drinking water.
-- How to improve fuel wood use (use of dry wood vs. freshly cut wood).
-- Solar water heaters for Bhattis and Hotels.
-- How to build energy efficient Chulas.
-- How to plant and care for hand cut forage.
-- How to improve pasture.
-- Simple erosion control structures.
-- How to build and maintain small impoundments.
-- Use of marginal terraces for forage and fruits.
-- How to improve trails and bridges.
-- Planting and care of young trees.
-- Role of nurseries in improving village forests.
-- How to gather seeds from local trees.
-- How many livestock can be raised by a family and panchayat.
-- Case studies of how other villages and communities are participating in conservation in Nepal.[8/]
-- Brief reports on conservation programs in neighboring countries such as China, India and Korea.
-- Exotic tree seeds and saplings and their care.
-- Forestry and soil conservation legislation.
-- The training and visit system of extension.
-- How to use horticultural plants for conservation, nutrition and for income.
-- Proper lopping techniques.
-- Principles and methods of controlled grazing.

8/ For example, see Campbell, J. Gabriel, 1978. Community Involvement in Conservation USAID/AGR, Nepal. p. 17-20.

As can be seen from the examples in Table 2 that several bulletins serialized periodical and adult education modules can be developed which could play an important extension role in RCUP areas as well as in imparting general awareness among other citizens, government officials and policy makers in the country. Contributions made by the publications arising from NDS[9/] (National Development Service), UNICEF, and the HMG Department of Agriculture could serve as examples of such efforts and liaison should be established between the publication effort proposed in the RCUP program and these agencies.

A modest program for mass media (radio) has already been initiated by DSWC, and with the staff and resources allocated to the RCU program, marked improvement in such activities should result. Music, songs and skits are quite popular among villages visited by the design team. Utilization of such techniques with which village folk can identify with should be considered. One way of coming up with conservation tunes would be to have panchayat level staff organize competitions. For a long term conservation program children and young adults should also be reached. Conservation lessons, painting competitions, conservation days and field trips to know their environment should be planned.

H. Adult Conservation Education

Lack of awareness that many individual family practices lead to major conservation problems can only be approached by an effective adult education program. The panchayat level and district level organization of RCUP will carry such programs. Prior to initiation of the actual adult education program, the national and catchment level subject matter and extension specialist will spend one year developing adult education modules on the topics listed in Table 1.

The initial organization and delivery of the adult education program will be done by the catchment subject matter specialist; however, as the panchayat level workers show ability and willingness in offering such programs, such responsibility can be transferred to them.

Once these modules are developed, they can also be supplied to vocational agriculture program in the hill area high schools.

[9/] National Development Service. (undated). Mato Ra Pani Kasari Jogaine NDS Village Improvement Booklet #6. Joint NDS/UNICEF Pub 11 p.

I. The Role of Peace Corps Volunteers and NDS Scholars

Seeking participation of these two groups should be considered an overall objective of the entire RCU program. Their value would be greatest during the early phase of RCUP when a large proportion of full time staff is in training. Based on individual expertise, appointments can be made from these two pools of professionals and technicians to fill vacancies on a short term basis while permanent employees are being trained.

At the district and panchayat level positions, other pools of semi-technical level personnel can be identified. Many ex-army officers from the British, Indian and Nepali armies are involved in farming and in small businesses. This pool could be tapped as lay leaders or for full time workers in nurseries, in spearheading trail development, in building conservation structures or for building improved stoves or chulas.

J. Physical Facilities of Panchayat and Catchment Level

It is strongly recommended that offices and other service areas of the RCUP program at panchayat or catachment level should be at one location. This would facilitate greater interaction among the members of the team, and place them within easy access of the facilities of the conservation centers. In support of such a consolidated service facility, a diagram outlining a Panchayat Conservation Center is presented (Figure 1). The villagers of a particular panchayat will come to this Conservation Center for extension advice, adult edutation classes and for seedlings, seeds and other supplies rather than going to two or three locations for the information and inputs. A modest amount for this facility is outlayed in the budget.

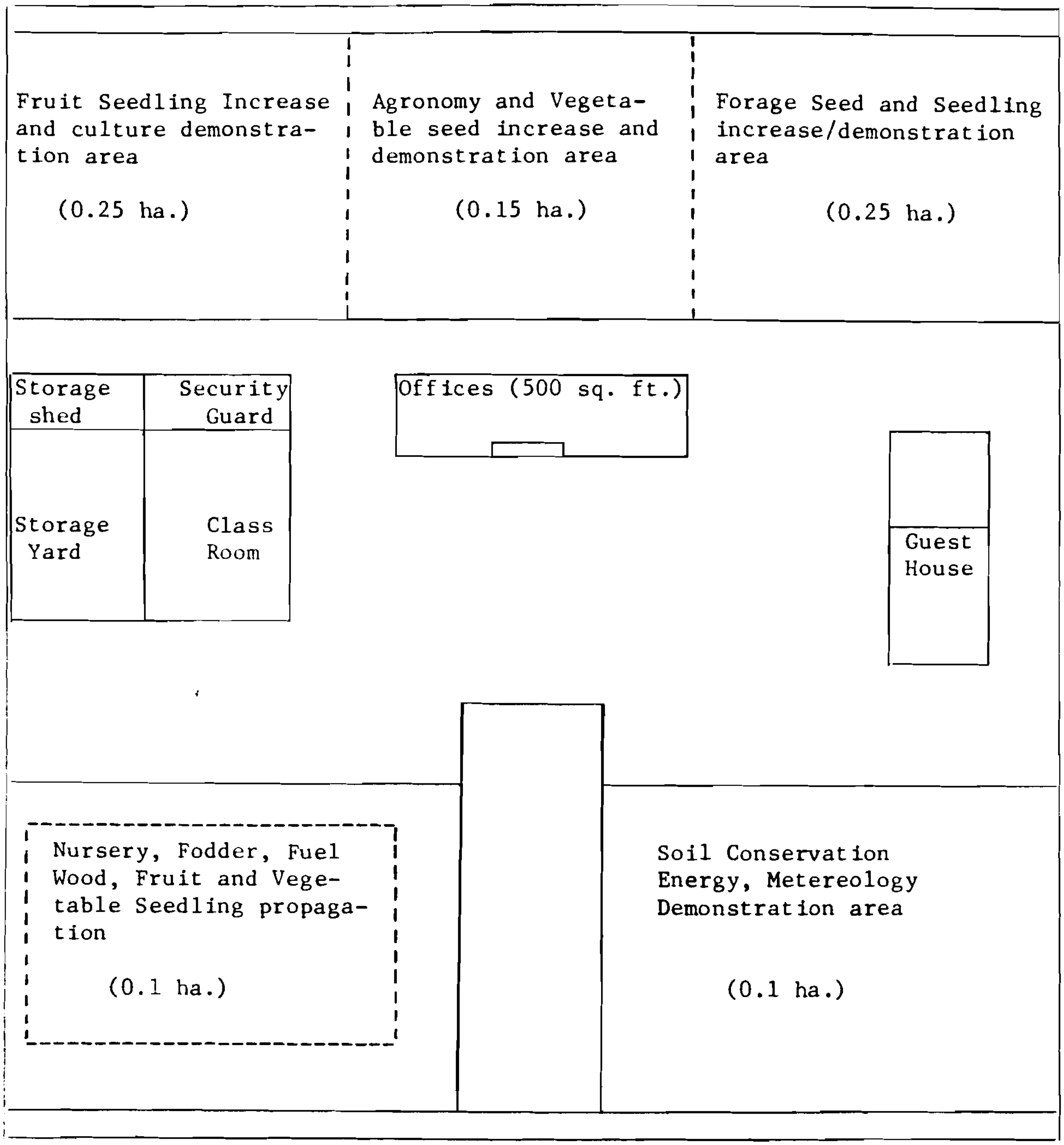
The catchment level conservation center should have following features:

-- Land area for nurseries, small demonstration plantings, limited seed increases, and for metereological station (2-3 ha.).
-- Office space for Catchment Conservation Office, Subject Matter Specialist (2,000 sq. ft. divided into 10 offices and reception area).
-- Classroom facilities (500 sq. ft.).
-- Storage room (200 sq. ft.).
-- Storage shed (500 sq. ft.).
-- Guest house and security guard quarters (500 sq. ft.).
-- Residential quarters (based on amount of money available).

It is suggested that five such centers be built for Kulekhani, Gorkha, Mustang and Myagdi. The last of these in Myagdi could be designated as a sub-catchment center, however, considering the distance between Mustang and Myagdi, this recommendation for a separate sub-center is being made. The budget calls for construction of three of these facilities (preferably at Kulekhani, Gorkha and Mustang) be built in the first year and the other two in the second year.

Figure 1

TYPICAL PANCHAYAT CONSERVATION CENTER (AREA A. 1 ha.)



K. Organization of RCUP

The dictum "planning from the top has in practice usually meant planning for the top" has significant relevance to planning and organization of the extension program of RCUP. During our numerous conversations with Panchas and farmers, we could see a perception of priorities which in most cases was not drastically different from the main thrust of the RCUP program. In some cases where the people's awareness is lacking, our approach should be to introduce a concept and show its relevance in their real time situation. The basis of the proposed organization matrix for RCUP is people's participation in the planning, decision making and in the implementation process.

As Campbell[10/] points out:

> The success or failure of the RCUP is thus mainly contingent on the degree to which local people can be effectively mobilized to conduct their own conservation . . . .

In the best extension systems the time to enlist people's participation is during the planning phase and not at the implementation stage. This concept has been incorporated in the organization function listed below.

A significant step in obtaining people's input to major RCU problems as they perceive them in their households, villages, wards and panchayats has already been taken in the form of baseline surveys conducted by the RCUP. Some of the inputs (e.g., felt needs) provided in such surveys have also been taken into account in the formulation of this organization.

Outlining extension organization for RCUP was one of the requirements made in the contract of this design team member. Below is a description of various Nepalese subject matter specialist requirements (as suggested by colleagues in the team) for RCU project and functions of various committees and their memberships. His Majesty's Government must determine prior to program initiation whether RCUP will function as an autonomous project or through the line agencies.

I. Panchayat Level Organization (see figure 2).

Under the existing self-government structure in Nepal the panchayat is the basic administration unit. For extension purposes it is a suitable size since it includes approximately seven hundred to two thousand farm families. The following organizational system is proposed for the basic RCUP extension

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10/ Campbell, Gabriel. 1978. Community Involvement in Conservation: Soil and Organizational Aspects of the Proposed RCUP in Nepal. Rep. to USAID/AGR. Final draft June 10, 1978.

network at the panchayat level.

a. Panchayat Conservation Committee (RCUP)

1. Membership. Consist of 1/2 of its members derived from elected officials and the rest from the citizens from different segments of society, including women. The JTA, Forestry/SW Conservationist (to serve as Executive Secretary of PCC) will serve as ex-officio organizers and facilitators of PCC. Pradhan Panch could be a member of PCC; however, he should appoint some other local citizen who has greater interest in conservation activities to take that responsibility.

2. RCUP Staff at Panchayat Level. As shown above, each panchayat where RCUP projects will be initiated and sustained at full scale, phased building up of staff should be achieved to the following level:

-- 1 JTA with 1 year agricultural training post -- SLC

-- 1 Forester/SW conservationist with 2 year (certificate) training

-- 1 Nursery Foreman with 8th grade education or equivalent training or experience and interest in the culture of saplings and plants (see forestry and range management section)[11/]

-- 9 Conservation Assistants, one per ward, part time forest guards, nursery assistants, voluntary or paid seasonal labor for tree plantation, fencing, range improvement, irrigation or drinking water or for other hydrological construction, etc.

b. Functions of the Panchayat Conservation Committee

1. Approve yearly conservation plans developed by RCUP employees, set targets (e.g., number of seedlings to be raised, planted, number of forest guards to be employed, nursery site selection, conservation or energy structures to be built).

2. Obtain appropriate permits for conservation activities in Pan-

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[11/] Consideration should be given to selection of local high school graduates for training for these positions as suggested in item 1 of section E.a. of this report.

chayat Forests (PF), Panchayat Protected Forests (PPF)[12/] and for harvesting activities from DFO and other appropriate agencies.

3. Actively coordinate all PCC approved RCU activities by facilitating logistical and labor support functions whenever panchayat resources are to be mobilized.

4. Encourage formation of relevant village or ward level conservation committees for stimulating specific conservation activities.

5. Assist panchayat or catchment level conservation specialists in adult education and extension activities through existing school system or citizen meetings.

6. Evaluate work progress activities and provide this input to the catchment conservation officer.

c. Function of Panchayat Level Conservation Officers

1. Develop conservation plans and submit these to PCC for their concurrence. (In some cases this may require some extension effort in presenting complex conservation concepts to PCC but in principle it should be done particularly since the citizen participation would facilitate implementation.)

2. Having developed panchayat conservation plans, meet with Catchment Conservation Officer and the subject matter specialists on a regular basis (at least monthly, twice monthly would be even better) for determining specific job activities that need to occur during the next weeks. Obtain necessary support materials and supplies from catchment level.

3. Identify groups of farmers and lay leaders in each ward or village and meet with them regularly on a twice-monthly or monthly schedule. During such meetings discuss steps that are most crucial from the resource production and conservation standpoint that they will encounter till the next meeting. The RCUP staff at panchayat level must offer common, unified, technically sound advice. Differing opinions (e.g., the merits of increasing crop land on certain terraces vs. planting hand harvested forages) must be resolved between the panchayat staff in consultation with the subject matter

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12/ See Nepal Rajpatra, Vol. 27, No. 25, Bhadra 22, 2034 (Sept. 7, 1977) for definitions and description of forest lands and also Campbell's (op. cit.) and FAO/World Bank (op. cit.) reports describing such forest cadastral jurisdictions.

specialists and Catchment Conservation Officer (CCO) prior to taking such recommendations to the farmers.

4. In consultation with CCO, a well defined and prepared adult education program must be carried out to educate citizens on conservation education. All levels of RCUP organization will support this activity as outlined in this segment. The adult education should not necessarily mean increasing reading and writing skills of the people but more of an oral and visual exchange of information related to RCUP objectives.

5. Carry out routine extension activities as outlined in Table 1.

II. Catchment Level Organization.

As the work expands in a given district to numerous panchayats, a Sub-Catchment Conservation Officer (SCCO) may be added who would supervise the conservation activities of about 5 panchayats in a given district. The SCCO when incroporated should have at least a B.S. degree or equivalent training in Forestry/Soil and Water Conservation.

a. Catchment Area Conservation Committee (CACC)

i. Membership. Chairmen of the Panchayat Conservation Committees, two citizens at large to be nominated by the CACC, one representative from respective district or divisions line agencies (e.g., Agriculture, Forestry, Irrigation, Marketing and Foods each).

The Catchment Conservation Officer (CCO) will serve as the ex-officio secretary of the committee. In attendance will be the subject matter specialists attached to the CCO office.

ii. RCUP Staff at the Catchment Level

Catchment Conservation Officer
Subject Matter Specialist (1 each)
Animal Husbandry Specialist
Soil Conservationist/Agronomist
Irrigation Drinking Water Engineer
Forester
Range Management Specialist
Horticulturist (Pomologist/Olericulturist)
Hydrologist

Not all of the above mentioned Nepalese subject matter specialists will be in place in each of the districts at the inception and they will be phased in as per needed and according to the thrust of RCUP activities. However, in order to provide sound technical support to extension personnel, the above array of subject matter specialists are considered minimum by the RCUP design team.

b. Function of the Catchment Conservation Committee[13/]

i. Consolidate panchayat conservation plans and develop catchment level conservation plan. Coordinate conservation activities for areas larger than a panchayat. Prioritize conservation activities for budgetary purposes. Approve outlays each year for RCUP activities in the catchment area.

ii. Seek coordination and cooperation from all district level line agencies for cost effectiveness.

iii. Define broad work responsibilities for catchment level staff. Conduct yearly evaluations of work.

c. Functions of the Catchment Conservation Officers

i. The CCO will have executive secretarial responsibility to the CACC and will be the Chief Administrative Officer for the RCUP in a given catchment area. It will be his responsibility to supervise the panchayat level staff as well as the subject matter specialists at the district level.

ii. The CCO must be sensitive to the district needs as defined by CACC and must insure their integration in the national RCUP plans.

iii. The subject matter specialists must have both the research (better designated as demonstration activities) as well as extension functions. They must meet with their appropriate panchayat contact (either JTA or Forester/SW Conservationist) at a predetermined date not less than once a month to train them for the next month's most

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13/ Organization and function of CACC would have some similarities to the organization matrix described in the Integrated Watershed Management (Torrent Control and Land Use Development Project): See An organizational scheme for involving land users in catchment development in Nepal; the Phewatal catchment as a model describes similar approach (undated).

crucial activities.[14/] They must also develop instructional extension materials in concert with the national RCUP staff. The research/demonstration function could be limited forage trails, multiplication of desirable seeds for district-wide use, carrying out varietal trials in farmers' fields and forests, etc. The specialist must spend at least 10 person days/month in the field to assist panchayat conservation staff with specific conservation problems. They must also keep in touch with the subject matter counterparts at the national level and in other RCUP regions and governmental line agencies.

III. National Level RCUP Organization.

The National Level/Function envisaged as:

1. Providing strong management and subject matter support to all RCUP region projects.

2. Coordination of RCUP with similar parallel programs in HMG and international donor agency supported programs of HMG.

3. Liaison with USAID during the funding period for fiscal, training and other agreements.

4. Carrying out project activities (e.g., development of publications, displays, public education programs, acquisition of inputs, etc.) common for all the RCUP sites.

a. National Resource Conservation and Utilization Committee

i. Membership

1. One representative each from:

Department of Agriculture

Department of Forestry

Department of Irrigation

Department of Soil and Water Conservation

2. Chairmen of the catchment area conservation committees

14/ Such method of constant contact between the subject matter specialist and the panchayat level extension worker and in turn between them and the farmers are referred to as the Training and Visit System. In this method the panchayat level extension staff is trained in specific improved methodologies that they encounter in the coming month. See: Benor, Daniel and James Q. Harrison, 1977. Agricultural Extension: The Training and Visiting System. World Bank, Washington, D.C. 55 p.

3. One USAID representative
4. One ODM representative
5. Two representatives from relevant programs (e.g., IRD or watershed or community forestry projects) to be nominated by the RCUP national committee.

The Director of the RCUP will serve as the Ex-officio secretary of the committee.

ii. RCUP Staff at the National Level (Specialists)

-- Project Director, RCUP
-- Subject matter specialists:
   -- Planner (Evaluation and Monitoring)
   -- Geographer (Remote Sensing and Land Use)
   -- Soil Scientist (Soil Mapping)
   -- Animal Husbandry Specialist
   -- Soil Conservationist/Agronomist
   -- Horticulturist (Pomology and Olericulture)
   -- Plant Pathologist/Entomologist
   -- Range and Pasture Specialist
   -- Energy Specialist
   -- Bridge and Trail Engineer
   -- Hydrologist
   -- Irrigation and Drinking Water Specialist
   -- Forester
   -- Extension and Education Coordinator
   -- Rural Sociologist/Anthropologist
   -- Coordinator of Publications and Publicity
   -- Fiscal Officer

b. Functions of the National Resource Conservation and Utilization Committee

1. Using catchment conservation plans as the basis, develop unified national RCUP conservation plans.

2. Establish project priorities and approve yearly catchment action plans and also approve long range programs for RCUP as submitted by the RCUP Director.

3. Inter-Departmental Liaison among line agencies of HMG.

4. Approve training, expatriate participation and major project costs.

5. Monitor and evaluate project progress and the evaluation of national level project professionals.

c. Functions of National RCUP Staff

1. The Director's principal responsibility will be in the area of providing technical and administrative assistance to the national committee in above mentioned functions. In addition, liaison with the governmental departments and USAID are considered crucial. The Director will also assign specific responsibilities (outlined in the action plans and in the design team members' reports) and will evaluate the subject matter specialists as well as the catchment level staff.

2. The Napalese subject matter specialists at the national level will probably be the most knowledgeable professionals in their respective areas in RCUP. They will develop programs, provide technical and materials support to catchment level personnel, develop technical and extension bulletins, guides, and educational modules that will be utilized at the panchayat level. They should be in constant touch with their couterparts at the catchment level and support their activities. Sufficient resources should be provided by RCUP so that the subject matter specialists could undertake appropriate research and demonstration activities preferably in cooperation with line agencies and the university and try new approaches in problem solving. At least 4 person months/year should be spent by the national subject matter specialist in the field. If in some cases considerable subject matter activity is occurring such specialists should be placed in that catchment area at the discretion of the RCUP Director.

Figure 1

PROPOSED ORGANIZATION OF RCUP

Ministry of Forestry

Department of Soil & Water
Conservation

National Resources
Conservation & Utilization Committee

NATIONAL DIRECTOR, RCUP

Specialists

Administration/Coordination
Geographer (Remote Sensing and Land Use)
Soil Scientist (Soil Mapping)
Animal Husbandry Specialist
Soil Conservationist/Agronomist
Horticulturist (Pomology and Olericulture)
Plant Pathologist/Entomologist
Range and Pasture Specialist
Energy Specialist
Bridge and Trail Engineer
Hydrologist
Irrigation and Drinking Water Specialist
Forester
Extension and Education Coordinator
Coordinator of Publications and Publicity
Fiscal Officer
Rural Sociologist/Anthropologist

Catchment Conservation
Committee (CCC)

Catchment Conservation Office, CCO

Animal Husbandry Specialist
Soil Conservationist/Agronomist
Irrigation, Energy & Drinking Water Engineer
Forester
Range Management Specialist
Horticulturist
Hydrologist

Sub-District Conservation Officer, SDCO

Panchayat Conservation
Committee (PCC)

Junior Technical Assistant, JTA
Forester/SW Conservationist
Nursery Foreman
Ward Level Assistant (Part Time)
Laborers

L. Consultancies and Expatriate Support

The HMG's RCU Project is designed to address Nepal's problems. In such a long term program it is best that HMG undertake training either in Nepal or abroad of the Nepalese project personnel, as discussed in the organization. Expatriates consultatnts are extremely valuable to the RCU Project, especially in the early phases, but the long term strategy must clearly be to train project personnel from RCUP, DSWC or from other line agencies to give permanence to this program. Those of us who have spent some time in Nepal quickly realize that there are some Nepalese who could also serve as consultants to the RCU project, and such individuals should be identified and utilized in the RCUP.

M. Monitoring the Impact of Extension Program

Having conducted the baseline surveys, the detection of the change as it will occur in villages and farm families could be measured. Any evaluation of the RCU Project is an evaluation of its extension program. The aim here should be to gain an understanding of the changes in farmers' perceptions of their needs and to what extent the extension program has been able to resolve technical and social constraints toward meeting these needs.

Examples of some general questions[15/] that would be able to provide above mentioned information are:

-- What are the most important improvements which have occurred for you, your family, with your farm, your animals, your village forests and your soil (landscape) over the last 5 years? Can you name 5 improvements?
-- Which are the 5 most important improvements you would like to see happen in the next 5 years?
-- In what ways can extension agents (of RCUP) best assist you to make those changes?

Several routine documentation activities the panchayat and the catchment level extension personnel should undertake which would quantify the extension or program input. Proper evaluation instruments and the reporting procedures for this would need to be developed. Below are some examples of the items to

[15/] Scouller, Brian B. 1979. Watershed Extension Program. HMG/GAO Phewatal. OP/RE/4.23. sp.

be considered:

- -- Identification and names of farmer groups regularly visited by JTA or the Soil Conservationist, the extension worker.
- -- Number of training sessions conducted by each subject matter specialist at the catchment level and the national level to train and motivate the panchayat extension staff, documentation of the topics covered.
- -- Number of adult conservation education modules developed by the national and catchment staff for use in the extension program. Emphasis on this effort will be during the beginning of the RCUP Project. Therefore, monitoring should also be concentrated during that time.
- -- Number of adult education classes held by the panchayat and the catchment level staff, their dates, times and topics covered.
- -- Numbers of media programs developed by the public information specialist of RCUP and the effectiveness of such programs.
- -- Precise documentation of the inputs generated or acquired and disseminated by all of the RCU Project personnel. It must be done accurately and it should become the responsibility of all supervisory level personnel to insure accountability of inputs or products such as:

  <u>Forestry</u>

  - -- Number of forest seedlings planted by species in the nurseries.
  - -- Number of trees survived by the species at the end of year 1, year 3 and year 5. Steps taken for replacement.
  - -- Number of paid and voluntary labor involvement in forestry site preparation and planting.

  <u>Range Management and Improved Pastures</u>

  - -- Quantity of forage and grass seeds (by species) acquired and/or multiplied by the RCU Project personnel for dissemination.
  - -- Quantity of seed provided to the farm families or to panchayat common lands; ropanis planted and their survival at the end of 1 year by species.
  - -- Quantity and area of hand harvested forages planted by RCU extension staff in each panchayat.
  - — Amount of inputs (fertilizers, pesticides, tools) used on pastures.

-- The area of range with improved management (e.g., controlled grazing) per panchayat.

Animal Husbandry

-- Yearly record of livestock population in the panchayat.

-- Number of treatments for parasites and inoculations administered by the extension staff.

-- Documentation of any breed improvement.

Soil Conservation (excluding forestry and range, etc.)

-- Number and areas of eroded and landslide sites protected by gabions or fencing, types of seeding and plantings done.

-- Ropanis of terrace area improved by vegetation of backslopes, grade improvement and by surface water management.

-- Numbers of farmers assisted and area improved by soil conservation measures.

Agronomy

-- Number of demonstrations conducted to show superiority of improved seeds, improved practices and improved inputs (fertilizers, pesticides, tools).

-- Amount of improved seed distributed by crop species.

-- Amount of fertilizers acquired and distributed by district (catchment) and panchayat staff.

-- Area under recommended cropping rotations.

Horticulture

-- Number of fruit trees raised in the nursery by species. Exact documentation of scion and stock combinations.

-- Amount of vegetable seeds or seedlings supplied to the farmer, by variety.

-- Amount of fertilizer and pesticide made available to the panchayat.

-- Number of planting, pruning, pest control and hail protection demonstrations conducted by the extension staff, their dates and the audience attending such demonstrations.

Energy

-- Documentation of the number of improved chulas built in the panchayat.

-- Number of bio-gas plants erected, their types and operational status at the end of the each year.

-- Number of solar collectors and hydropowered electrical generator devices installed and their operational status.

-- Number of energy demonstrations (on above items) conducted, their dates and the target audience.

The RCUP design team component addressing sociology further identifies methods of change process detection and attitudinal change measurement among people in the project area.

Sequencing of RCUP Project Concentration by Panchayats

1st yr.	2nd yr.	3rd yr.	Village Panchayats	Villages
			KULEKHANI	
			Markhu (Kulekhani)	Markhu Kulekhani, Bajarmath
X			Chitlang	Sheep Farm, Kuslechaur, Tubaikhal, Ampudol Parigaon, Chitlang, Taukhel, Nulgaon, Bisingkhel, Ratemato, Kanleton
	X		Palung	Phendigaon, Dwankate Pairo, Lakholi Tole Phedigaon Chautara, Areas along the banks of Palung and Sankhamul Khola
	X		Daman	Sikbarkotgaon
		X	Thachok	Tistunggaon, Bakhedanda, Areas along the road side
			MUSTANG	
	X		Tukche	Tukche
X			Marpha	Marpha, Jomsom
		X	Jomsom	Jomsom
	X		Kagbeni	Kagbeni
X			Jharkot	Jharkot, Khinger
		X	Muktinath	Muktinath
			MYAGDI	
x			Pakhapani	Pakhapanigaon, Kotgaon, Ward 4 and 5
		X	Jhee	Jhingaon, Patlakhetgaon
	X		Ghatan	Kaulegaura
			GORKHA	
X			Choprak	Chorkate, Nayasangu, Mahtar, Nibol, Archale, Choprak School area
	X		Barpak	
		X	Deurali	

Status	Salary NRs.	Project allowance2/	Providant fund 10% of salary	Medical 10% of salary	Remote allowance3/	Ration allowance Rs.18/ head	TA/DA 4/	Total per month Rs.	Total per year Rs.	Total per year $
I. <u>Panchayat Level Staff</u>										
Ward Level Conservation Assistant	75	-	-	-	-	-	-	75	900	75
Security Guard (Peon)(Part Time)	155	78	16	16	116	18	-	399	4,788	399
a. <u>Non Gazetted Technical</u>										
JTA (Class II)	320	160	32	32	240	18	128	930	11,160	930
Soil Conservation Assistant (Class I)	500	250	50	50	375	18	200	1433	17,316	1,443
Nursery Foreman 5/	-	-	-	-	-	-	-	-	-	-
II. <u>Catchment Level Staff</u>										
a. <u>Gazetted Technical</u>										
Catchment Conservation Officer (Class II) with experience	875	350	88	88	656	-	350	2407	28,884	2,407
Horticultural (Class III)	775	310	78	78	581	-	310	2132	25,584	2,132
III. <u>National Staff</u>										
a. <u>Non-Gazetted Technical</u>										
Typist (Class II) with experience	450	225	45	45	338	18	-	1121	13,452	1,121
Media Assistant (Class I)	500	250	50	50	-	18	-	868	10,416	868
Printing Assistant (Class II)	500	250	50	50	-	18	-	868	10,416	868

Footnotes on following page.

Status	Salary NRs.	Project allow-ance2/	Providant fund 10% of salary	Medical 10% of salary	Remote allow-ance3/	Ration allow-ance RS.18/ head	TA/DA 4/	Total per month Rs.	Total per year Rs.	Total per year $
b. <u>Gazetted Technical</u>										
Extension and Edu. Coordinator (Class II)	1070	420	107	107	-	-	420	2140	25600	2140
Public Information Specialist (Class II)	1070	428	107	107	-	-	428	2140	25680	2140
Horticulturist (Class II)	1070	428	107	107	-	-	428	2140	25680	2140
Plant Pathologist (Class I)	1475	590	148	148	-	-	590	2931	35412	2951

1/ Source of information: Nepal community forestry development project report FAO/UN. Rap. No. 15/78 Nep. 12 April 11, 1979.

2/ Project allowance is 40% of base salary and 50% of base salary for gazetted and non-gazetted staff respectively

3/ HMG at present allows for 100% for Mustang, 75% for most of the Myagdi area, 50% for most of Gorkha area and none for Kulekhani. For calculations here an average of 75% remote area allowance is assumed for RCUP. But the allowances will be given according to HMG's classification.

4/ Travelling and daily allowance assumed at 40% of the base salary. Our recommendation would be to consider levels of TA and DA currently provided by AFROSC.

5/ Salary for nursery foreman included inthe forestry section.

Summary Chart for Extension Component of R.C.U.P.

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	Year 1			Year 2			Year 3			Year 4			Year 5			Total costM$	2nd 5 year 1/			3rd 5 year 2/		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
A. Personnel																						
Panchayat level Extension Personnel																						
J.T.A. (1/Panchayat, Base salary + 50% project allowance + remote area allowance)	1.5M	5	4.7	3.3M	11	10.3	5.1M	17	15.9	7.5M	25	23.4	10.5M	35	32.7		105M	350	249.3	129M	86	400
J.T. Jorester/Soil Conservationist	1.5M	5	7.3	3.3M	11	15.9	5.1M	17	24.6	7.5M	25	36.1	10.5M	35	50.5		105M	350	387	129M	86	621
Conservation assistant 1/ ward (Part time)	9M	45	3.4	19.8M	99	7.4	30.6M	153	11.5	45M	225	16.9	63M	315	23.7		630M	3150	181	774M	774	290
Security Guard/Attendant	1.5M	5	2.0	3.3M	11	4.4	5.1M	17	6.8	7.5M	25	10	10.5M	35	14		105M	350	107.1	129M	86	172
Catchment Area Personnel Catchment Cons. Officer	.9M	3	7.2	1.5M	5	12.1	1.5M	5	12.1	1.5M	5	12.1	1.5M	5	12.1		7.5M	25	60.5	7.5M	5	60.5
Typist	.9M	3	3.4	1.5M	5	5.6	1.5M	5	5.6	1.5M	5	5.6	1.5M	5	5.6		7.5M	25	28	7.5M	5	28
Security Guard	.9M	3	1.2	.3M	5	2	1.5M	5	2	1.5M	5	2	1.5M	5	2		7.5M	25	10	7.5M	5	10
National RCUP Extension Personnel Extension and Education Coordinator	.3M	1	2.1	.3M	1	2.1	.3M	1	2.1	.3M	1	2.1	.3M	1	2.1		1.5M	5	10.5	1.5M	5	10.5
Public Information Coord.	.3M	1	2.1	.3M	1	2.1	.3M	1	2.1	.3M	1	2.1	.3M	1	2.1		1.5M	5	10.5	1.5M	5	10.5
Media Assistant (Drafts Man.)	.3M	1	0.9	.3M	1	0.9	.3M	1	0.9	.3M	1	0.9	.3M	1	0.9		1.5M	5	4.5	1.5M	5	4.5
Printing Assistant	.3M	1	0.9	.3M	1	0.9	.3M	1	0.9	.3M	1	0.9	.3M	1	0.9		1.5M	5	4.5	1.5M	5	4.5
Typist (For centre, no remote area)	.3M	1	0.8	.3M	1	0.8	.3M	1	0.8	.3M	1	0.8	.3M	1	0.8		1.5M	5	4.0	1.5M	5	0.0

1/ For the second 5 year period the staff increment sequence will be same as the first five year sequence.
2/ In 3rd five year period whole staff will be working from the eleventh year.
M Denotes thousands of person days of employment.

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year		
	Year 1			Year 2			Year 3			Year 4			Year 5			Total cost in M $						
C - Supplies	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
Seeds (Not included in other subject matter act. plans)																						
Sprayers			5			11			17			25			35				70			86
Dusters (NRS 500/Duster)			0.5			1.1			1.7			2.5			3.5				7			8.6
Pruning & Grafting Equipment			0.5			1.1			1.7			2.5			3.5				7			8.6
Planters			1			2			3			5			7.0				14			17.5
Chemicals (Fertilizers & Pesticides for demonstration purposes only)			0.5			1			2			3			4.5				5			14
Office Supplies (Stationery, etc.)			3			4			5			6			7				12			18
Publications, Printing, ink supplies			5			10			15			20			30				45			90
Paper: Bimonthly periodical			5			6			7			8			9				50			100
Bulletins (Ave. 5 bulletins/yr)			5			5			5			5			5				25			50
Posters (5 posters/yr. 4,000 copies each)			3			3			3			3			3				15			15
Adult Education Modules (10 modules/yr. 5,000 copies each)			10			10		10	10		5	5		5	5			25	25		25	25

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year		
	Year 1			Year 2			Year 3			Year 4			Year 5			Total costM$						
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
Inservice Training for Ext. Staff																						
1. Cross-discipline training - Compensation for travel and honorarium for 15 speakers @ NRS 12,000 speaker				2	15	1.5	2	15	1.5	2	15	1.5	2	15	1.5	6	10	15	7.5	10	15	7.5
- Travel & lodging allowande for extension attendants. Travel NRS 150 + lodging & food NRS 450				15	11	0.6	15	17	0.9	15	25	1.2	15	35	1.8	4.5	268	15	11.4	1430	15	21.5
- Contingency - receptions short trip etc. 15% of travel and lodging						0.1			0.1			0.2			0.3				1.7			3.3
2. <u>Refresher Training</u> Compensation & travel for 30 speakers @ NRS 1200/speaker							2	30	3										6			6
- Travel & stay for participants travel NRS 150 + lodging NRS 1800/ attendee				60	17	2.8											60	105	16.3	60	86	28
- Tours of demonstration areas (as shown)						3													9			11
- Contingency 15% of travel and stay						0.4													2.5			4.2

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	Year 1			Year 2			Year 3			Year 4			Year 5			Total	2nd 5 year 1/			3rd 5 year 2/		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	cost in M $	1	2	3	1	2	3
Equipment for Public Information																						
Offset Printing Machine					1	50																
Mimeographic Machine (Lithograph)		1	2.5																			
Photo Copies		2	10																			
Photographic Equip. Camera enlarger, etc.						5																
Graphic Supplies & Equip.			2																			
Collators, binding machine						1																
<u>Voice Communication</u>																						
Single side Band Communication		4	6		4	6		2	3													
System (2 per Catchment, 1 at National Level)																						

APPENDIX P

ENVIRONMENTAL INFORMATION MANAGEMENT

Prepared by: Jane Bergsten, SECID

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INTRODUCTION

While the main focus of the Resource Conservation and Utilization Project (RCUP) is to reduce soil erosion by means of reforestation, better range management, improved agricultural practices, etc., the ultimate success of the project will be measured not only in terms of the actual reduction in soil erosion brought about during the course of the 15 year program but in the degree to which permanent desirable changes have been brought about in the behavior and lifestyles of the populace involved. Only by sufficiently educating, motivating, and involving the population of the project areas, by making sure the project is truly "their" project, can one be assured that the improvements netted by the project will be permanent and continue on even after the project termination 15 years hence. It is for that reason that a major emphasis must be placed on measuring the attitudes, felt needs, knowledge, practices, and physical and social well being of the population of the project area. Without their desire to continue to make improvements even after the active phase of the project is over, the project cannot be truly a success.

MONITORING

There will be two basic types of monitoring that will be required, that associated with the land and that associated with its inhabitants.

The monitoring of the land will involve the measurement of the physical characteristics of the project areas at given points in time as well as the measurement of the amounts and kinds of intervention activities that were implemented. Some measurements will involve the entire RCUP area and others, only the specific sites where intervention is active. Examples of these monitoring activities would be the measurement of the number of hectares of range in use, classified by its condition; the number of different types of seeds and seedlings that were planted during the year, etc. This type of monitoring of the physical characteristics of the project areas would, therefore, produce both quantitative and qualitative descriptions of the area and the changes that have occurred.

The monitoring of population characteristics will involve the measurement of such items as family income, attitudes concerning a specific type of intervention, concerns about the effects of the intervention on the well being of the family, etc. Such measurements will be taken periodically in order to make estimates about the RCUP area as a whole and in order to get readings on the populace of the specific sites in which active intervention is taking place.

The monitoring of physical characteristics is discussed in more detail in the next section and the monitoring of population is discussed in the section following that.

PHYSICAL MONITORING

Because the RCUP is a demonstration project and not a research project, the emphasis will not be on measuring the degree of effectiveness of one intervention activity against an alternative. Rather, intervention activities will be introduced in order to bring about a desired effect and measurement will be taken to determine whether the desired effect has been achieved. Therefore, experimental design, which would be very much a part of a comparable research project, should be employed only if one or both of two conditions exist:

1. There is a need to determine the relative effectiveness of one or more intervention procedures in order to decide how to proceed.
2. There is a need to demonstrate to the villagers the superiority of particular intervention procedures.

The effectiveness of the RCU Project will be somewhat dependent upon the adaptability and flexibility of the program. Any measurement procedures involved should be adapted to the particular site and the particular program so that the measurement procedure, in and of itself, does not become an undue burden. Because of this needed flexibility, a rigid measurement program cannot and should not be delineated at this time. Instead, guidance for an overall measurement program will be described and examples will be presented as an aid to its implementation.

Specific site and program monitoring

For each specific site where an intervention program is to be implemented, the physical status of the area prior to intervention, the amount and kind of intervention activity, and the physical status after intervention need to be determined. The measurement and monitoring program should be as supportive and informative as possible and any associated disruption of the intervention program should be kept to a minimum. Suggestions of the types of physical monitoring that should take place are contained in the Extension Report of the project paper, as well as in other reports, and will not be repeated here. Examples of some measurement procedures and ways by which a measurement program can be adapted to the particular features of different sites will be provided.

Example 1

The intervention program in Village A involves pasture improvement through introduction of a different variety of grass and controlled grazing. The following measurements could be taken.

a. Before measurements. X hectares of pasture in poor condition containing Y variety of grass and supporting Z head of cattle at near starvation level.

b. Intervention measurements. Planting of (1/c). X hectares of land in grass Y', each quarter. Selective grazing on (1/k). X hectares of land each week. S kilograms of seed and H hours of labor involved in replanting activity.

c. After measurements. X hectares of pasture in good condition containing Y' variety of grass and supporting Z' head of cattle in good condition.

The measurement program for pasture improvement might involve only the somewhat crude measurements described in Example 1. More detailed measurement might be a burden to the project and unnecessary in terms of documenting the success of the project and demonstrating the advantages of using grass variety Y' and controlled grazing.

Every attempt should be made to generate measurement statistics in standard units suitable for aggregation, even if different data collection methods are used. Examples 2 and 3 below demonstrate how this could be accomplished relatively easily in two different types of situations. The standard measurement units desired are number of kilograms of rice grain and number of kilograms of fodder produced.

Example 2

In Village A, one hectare usually planted with rice strain R is selected for conversion to rice strain S. At harvest time for R, the number of porter loads of rice harvested is determined. For a random sample of porter loads, the weight of the rice straw for fodder and the weight of the rice grains are determined. This procedure yields data sufficient to estimate the total production of rice and of fodder by weight. Similar measurements would be taken for the production of rice strain S when it is harvested.

Example 3

In Village B, an area consisting of one-hundred ropanis of paddy is selected for conversion from rice strain R to rice strain S. In this case, perhaps a random sample of ropanis would be selected for measurement, the weight of the rice straw for fodder and of the rice grain could be determined for the sample ropanis, and an estimate of straw and grain weight could be made for the total production of the one-hundred ropanis of paddy. Similar procedures would be used to estimate the total production of rice strain S when it was harvested, most probably using the same random sample of ropanis.

Note that two different methods were used in the two villages, methods felt to be the most feasible in each village. Nevertheless, estimates in terms of a standard unit, in this case weight in kilograms, can be made for each village, making aggregation possible.

The resource statistician for the RCUP, in consultation with the RCUP National Director, the catchment conservation officer, and panchayat conservation staff, will determine the types of measurements to be taken and the methodology to be used, and will design the measurement forms to be completed. In addition, persons responsible for taking and recording the measurements will be designated and instructed. The type of person so designated might vary from village to village and among the types of intervention programs. In one situation the local extension person might be designated, in another perhaps a research assitant to the resource statistician might be detailed from the central office to the site for a measurement period, e.g. at harvest time. Always, the aim should be easily understood and easily implemented measurements.

The resource statistician will be responsible for the collection, aggregation, and reporting of the physical characteristics of the project sites and the amount and type of intervention. Such reports would be prepared at least annually, and probably more frequently during the early years of the project.

RCUP area monitoring

When the RCUP program implementation phase begins, additional reconnaissance of the entire area will be made for the purpose of selecting additional project titles and for determining baseline data on the physical characteristics of the project area. In addition, the Agricultural Resource Inventory System (ARIS) will be able to provide specific detailed information on the physical characteristic of the RCUP area by means of their remote sensing techniques. Their documentation, together with visitation, serial reconnaissance, and aerial photography, should provide sufficient information to establish baseline data and to monitor the changes occurring within the project area as a whole. The effect of the RCUP on the entire project area can be determined by the comparison of the baseline data with comparable data obtained at the end of the 15 year project period.

POPULATION MONITORING

The rugged and varying terrain of Nepal, from the tropical forests in the south to the snow capped mountains in the north, make it one of the most spectacularly beautiful countries in the world. This same rugged and varied terrain combined with monsoonal rains, limited roadways, and limited communication facilities make it one of the most difficult places in the world in which to conduct personal interview surveys.

Because of the remoteness of the villages and the lack of mass communication media, village populations have remained culturally and linguistically distinct. The lack of familiarity with survey research, and the current custom of public interviewing, in which a respondent is queried in the presence of the entire family at a minimum, and perhaps in front of the entire village or a major portion of it, serve to inhibit an open, honest interview. In order to overcome these difficulties, much work needs to be done in the development of survey methodologies capable of providing useful, accurate data. The presentation in this section and in the following three sections is dictated by the limitations of survey research in Nepal at this point in time.

Gabriel Campbell, *et al*[1/] have described the great inconsistency that can

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1/ Campbell, J. G., Stone, L., and Shrestha, R. The Use and Misuse of Social Science Research in Nepal. Research Centre for Nepal and Asian Studies, Tribhuvan University, 1979.

be expected between information collected by means of a personal interview survey and that obtained using more personal, intensive techniques. In addition, interviewer and supervisor observations point to misunderstandings and misinterpretations on the part of respondents, which have alerted the survey administrators to the limitation of the survey data. Considerable research is necessary in order to develop the instrumentation and methodology needed for personal interview surveys in Nepal. This research will be initiated by the expatriate social scientist and continued by the Nepali social scientist and their staff, and supported by an economist and a team of survey statisticians. The work to be accomplished is described in this section, the proposed staffing in the next section, followed by a section describing the training requirements.

Specific site and program monitoring

In order to begin program implementation at a specific site, it will be advantageous to have a reading on the practices, expectations, attitudes, concerns, and characteristics of the population to be affected. Such a reading can be provided during the initial stages of the project by the social scientist and social science assistants after intensive personal interaction with the villagers. In addition, as a result of this interaction, it is hoped that survey instruments can be developed with their assistance so that interim and final measurements can be made using quantitative survey methodology. The development of survey instruments and methodology will be undertaken with the participation of the project economist and the team of survey statisticians. As the methodology is developed during the course of the RCUP, the period of intensive involvement by the social scientists at the specific project sites will continually decrease, so that by the later part of the 15 years project, it is anticipated that it would be quite brief. In addition, with the improvement in survey methodology, the initial measurements, as well as the interim and final measurements, can be made using quanatitative survey techniques. It is proposed that in addition to the initial and final measurements, periodic interim measurements be taken as needed, so that the progress of the project, as measured by its effect on the village population, can be monitored.

RCUP area monitoring

A baseline survey was conducted in the fall of 1978, during which time interviews were obtained from a random sample of approximately 625 families located in 44 wards in 22 panchayats within the 4 RCUP areas (Kulekhani, Gorkha, Mustang, and Myagdi). Using the survey data, estimates of demographic, economic, and agricultural characteristics of the population of the RCUP area will be made.

The baseline survey, conducted simultaneously for the RAD and RCUP, was a monumental undertaking that was designed and carried out with great thought, care, and skill by a very dedicated staff. The staff is made up of young, bright, trained professionals who were somewhat short on experience at the outset, but who have demonstrated, in addition to much enthusiasm, a great desire to learn the most appropriate and efficient sampling, survey, and statistical procedures. The author, during her two-month stay in Nepal, has had considerably rewarding interaction with the survey staff, and would highly recommend that they be given additional training and maintained on the team of survey statisticians so that the RCUP can make maximum use of their experience with the baseline survey and their sharpened skills.

A critical evaluation of the baseline survey is presented here in order to delineate the limitations of the baseline survey data and to provide a guide for further research and improvement of survey instrumentation and methodology.

The design of the RCUP baseline survey is aimed at the provision of estimates of characteristics of the household population of the entire RCUP area. Surveys of this scope cannot be used to monitor panchayat level intervention, and that is why specific site monitoring is proposed in the preceding section.

1. The sample

The sample of households was selected in three stages, using equal probability to select panchayats within each of the 4 RCUP districts, selecting with equal probability 2 out of the 9 wards in each sample panchayat, and randomly selecting a pre-specified number of households for interviewing from each sample ward. The number of sample panchayats and number of sample households were set so as to yield a sample proportionately allocated according to the estimated population of the 4 districts. The sample yielded a prespecified total number of interviews, and in order to accomplish this, the probabilities of selection were allowed to vary. The sample weights that must be used in order to provide for unbiased estimates do not vary greatly.

If careful investigation of weighted and unweighted estimates demonstrates that the bias is of a trivial magnitude, the weighting process can be discontinued, and the biases accepted.

It is recommended that for future surveys of this type, selection of clusters be made with probability proportional to size (PPS) and selections within clusters with probability inversely proportional to size. Size measures, in the case of the baseline survey, would be the estimated number of households in the cluster. In this way a larger cluster would have a greater probability of selection, but once selected, the households within it would have a smaller conditional probability of being selected. By balancing the probabilities of selection at the different stages, an equal probability sample of households can be selected and at the same time, control can be maintained over the allocation of the sample and its total size. The use of PPS in situations where relatively good measures of size are available can provide for more precise results, (i.e. estimates with smaller errors) and also provide for easier tabulation procedures because of the self-weighting property of an equal probability sample.

2. Instrumentation

A wide variety of subjects were covered in the baseline survey, resulting in a long questionnaire and lengthy interviewing. There is evidence that the questions were not always properly interpreted and honestly answered by the respondents. The following comments might prove helpful in further research on questionnaire development:

a. Questions should be worded in a simple, conservational style that can be easily and clearly understood by all types of respondents. Because of the culturally and linguistically distinct groups in Nepal, translation into the local dialect may often be necessary. Standardization will be a problem, but must be carefully maintained.

b. Transition statements and questions should be included in the questionnaire so that the respondent is guided gently from one area of querying to the next.

c. The use of several contingent questions can often yield more accurate information than one global one, and provide for a more relaxed, conversational type of interview.

3. Interviewing procedures

Public interviewing is to be avoided. Perhaps when the interviewer arrives in a sample village, some time can be spent establishing rapport with the villagers. After this has been accomplished and the purpose of the survey explained, one or two public interviews could then be taken using volunteers, to satisfy the curiosity of the villagers. The actual survey interviews would then be conducted in private, apart from other family members. Allowing a person in the village to make the random selections publically is a very clever idea that was used on the baseline survey. It is recommended that it be incorporated into future sampling procedures whenever feasible.

The research leading to the development of better data collection procedures should include investigating the use of female interviewers and the use of interviewers from the local area.

4. Estimation and computation of sampling errors

The author has been working with the survey staff on estimation procedures and sampling error computation procedures that will reflect the full complexity of the sample design. However, it does not appear that the data are also subject to large nonsampling errors, and they also should be taken into consideration in interpreting the data and explaining the limitations of the data derived from the baseline survey.

In addition to the baseline survey, it is suggested that two additional area-wide surveys be made during the life of the RCUP. An interim survey, to be conducted at some time during the period 1983-1985, after effective survey methodologies and instrumentation have been developed, and a final survey to be conducted a year or two prior to the completion of the 15 year project. Both of these surveys should be designed for efficiency in estimating population characteristics, practices, expectations, attitudes, and concerns at a given point in time, and in estimating changes that have occurred in these attributes during the periods between surveys. Because of the anticipated improvement in instrumentation and methodology, some measures of change occurring since the baseline survey will reflect changes in survey processes. Because of this, extreme care must be taken in the construction of the questionnaires used in later surveys, and in interpretation of comparison results between surveys.

STAFFING

The staffing requirements for the monitoring task are presented graphically in Figure 1. Overall direction and management will be provided by the Project Director. No permanent expatriate staff is being recommended for this task, other than that of the social scientist whose duties and qualifications are described in the Rural Sociologist's report. Expatriate input is recommended, however, in the form of an expatriate survey statistician consultant to be provided once a year during the early stages of the project, less frequently during the latter part. The consultant and project director would provide the coordination of the measurement activities at the onset, and these would gradually be taken over by the project measurement coordinator, who would be designated as the measurement activities develop. The resource statistician, the survey economist, and the social scientist should be given first consideration for this position. It is essential, however, that the person designated as coordinator have a good grasp of the entire range of the monitoring and measurement activities.

The resource statistician would be concerned with the measurement of physical characteristics.

In addition to the duties detailed in the report by the rural Sociologist, the social scientist would be involved with research that would provide baseline measurements of population characteristics of the villagers in the early project sites, and would participate in the development of survey instruments and methodology for use at later stages.

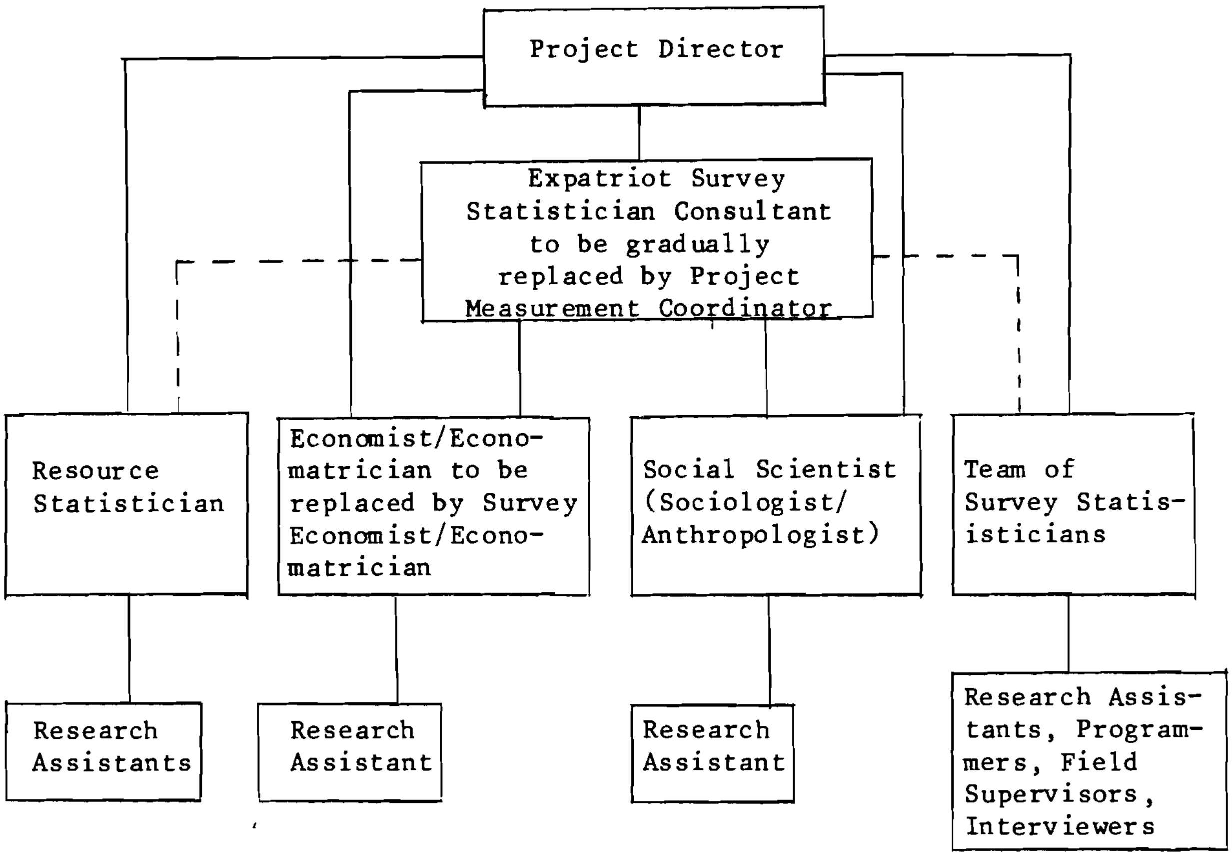

Figure 1

Staffing Requirements for the Monitoring Task

Economic input would be provided by the quantitively oriented economist at the early stages of the project and later, by an economist trained in the collection and analysis of, and projection using, economic survey data.

It is anticipated that much of the methodological research and instrument development and all of the survey design, sample design and selection, and data collection, tabulation and analysis activities will be carried out by or under the direction of the team of survey statisticians assigned to the RCUP. Because a variety of skills and experiences is called for, it is recommended that such a team be trained and designated to carry out RCUP activities, but be available to participate in other related projects as well, e.g., RAD. The designated team members would thus constitute a survey research methodology group that could be administratively attached to an organization such as the Agricultural Projects Services Centre (APROSC), with specific detailing of some or all of the members to RCUP activities for varying periods of time, depending on the needs of the project.

The suggested staffing is based on a philosophy of maximum use of the personnel in the host country, providing for the meaningful on-the-job training of nationals, and providing expatriate input at a level great enough to provide the needed support and guidance but still low enough so as not to jeopardize the host country direction of the monitoring activities.

The specific job descriptions for the progressional staff required for the monitoring activities are as follows:

1. National Director, RCUP

In addition to duties specified elsewhere, the national director will, with the assistance of the expatriat survey statistician, be responsible for coordinating the project measurement activities during the early stages of the project. The director will eventually appoint a project measurement coordinator, giving first consideration to the professionals involved in RCUP measurement activities. In addition, the director will be responsible for developing personnel review procedures and forms, and providing for an annual review of the performance and achievements of each RCUP staff member. The annual review should be aimed at providing the staff member with an honest evaluation of performance during the preceding year and guidance for improving future performance.

2. Expatriat survey statistician consultant

Ph.D. level statistician with at least 10 years of survey experience covering all phases of survey design, implementation and analysis. Should have particular expertise in survey sample design and selection and statistical annalysis and interpretation of data collected using complex sample designs. Duties will include assisting in setting up measurement and monitoring procedures and forms for the measurement of physical characteristics of the RCUP area, assisting in developing methodological studies aimed at the design of valid and reliable survey instruments and procedures, assisting in the design and selection of survey samples, and the analysis and interpretation of survey data. During the first six years of the project, must be available for up to four months project work each year, up to three months of which would be providing consultation in Nepal. For remaining nine year period of project, work demands would be at approximately one-third to one-half that level.

3. Resource Statistician

M.A. level statistician with at least one year of experience. Duties will include designing procedures and forms for the measurement of the physical characteristics of the RCUP area, monitoring, collecting, and aggregating the data, and preparing periodic reports summarizing the physical status of the RCUP area and the activities and accomplishments of the project.

4. Economist/economatrician

Quantitatively oriented M.A. level economist with at least one year of experience in survey research. Will participate in methodological studies aimed at designing valid and reliable survey instruments. These tasks could be performed by the project economist until the survey economist/economatrician is trained and available to begin work on the project.

5. Survey economist/economatrician

Ph.D. level, quantitatively oriented economist with training and experience in the collection, analysis, and interpretation of economic survey data. Will participate in methodological survey research, instrument development, and monitoring the conduct of RCUP surveys. Will relate ecologic, economic and social data to provide a better understanding of the total effect of the RCUP. Using RCUP data as a base, will make projections of the effect the implementing of such a project in other parts of the nation would have on the vital, economic, and social characteristics of those areas.

6. Social Scientist (sociologist/anthropologist). In addition to duties and qualification specified elsewhere, the quantitatively oriented social scientist will participate in baseline measurement in specific site locations during the early stages of the project. Will assist in survey methodological research with particular emphasis on questionnaire development and the development of effective interviewing procedures.

7. Team of survey statisticians

M.A. level survey statisticians with advanced training and experience in survey research, survey sample design and selection, and analysis of data based on complex sample designs. Will participate in methodological survey research including instrument development and data collection procedures, will be responsible for the design, sample selection, data collection, data processing, and statistical analysis of all RCUP surveys. Some knowledge of computer programming is highly desirable.

8. Programmers

Although the computer center that is used for data processing for RCUP may have its own staff of computer programmers, the team of survey statisticians will probably have need of programmers of its own as well. These programmers will do the programming tasks needed for processing, tabulating, and analyzing RCUP survey data, and will provide programming support to the other measurement professionals.

9. Research assistants, field supervisors and interviewers

B.A. level professionals. For field supervisors, prior survey or interviewing experience highly desirable. For research assistants and interviewers, prior experience helpful but not necessary. A positive attempt should be made to have both female and male professionals and to hire people from the local areas.

TRAINING

The training program that is advocated covers three levels: (1) academic training leading to a graduate degree from a foreign university and practical experience obtained during the stay abroad, (2) on-the-job training on the RCUP, with the help of the expatriat survey statistician, and (3) additional training obtained by visiting organizations which are doing related work in other countries, attending professional meetings, seminars, and short courses.

1. Graduate Degree Training

a. Survey economist. An M.A. level economist with at least one year of experience in survey research to earn a Ph.D. degree and obtain on-thejob advanced training in survey research, analysis of economic survey data, and projections using such data.

For more than 30 years the University of Michigan's Survey Research Center has had an excellent program in conducting and training professionals in survey research in the field of economics. In addition, the consortium consisting of the Big Ten Universities plus the University of Chicago provides for taking courses and working with the professors of other member universities. Because the Survey Research Center's program is so pertinent and because the University of Michigan, with its consortium affiliation, provides for such a wide variety of courses and academic encounters, it is strongly recommended that the University of Michigan be selected, that courses in Survey Research be included in the student's program, and that the student work part time at Survey Research Center while working on the degree.

It is anticipated that such a program would take approximately 3 1/2 years to complete.

b. Survey statisticians. Statisticians with the equivalent of an American B.A. and at least one year of experience in survey research to obtain an M.A. in survey research or a related field. Suggested programs include: (1) an M.A. program at the University of Michigan, including courses in Survey Research and part time work at Survey Research Center (particularly the Sampling Section) for practical training, (2) one of the five Statistical Training Programs offered by the U.S. Bureau of the

Census as part of the combined degree program with George Washington University or Georgetown University.

It is recommended that at least eight statisticians be trained during the first 8 years of the RCUP, with approximately two statisticians being out of the country for training at any one time. Because the need for survey statisticians in Nepal can be expected to increase markedly in the next few years, some eventual attrition of team members to other government agencies is to be expected. It is important to construct a team with a wide background, and even if team members move on to other agencies, their availability for consultation on projects will still be an asset to the RCUP.

It is strongly suggested that each candidate take courses in survey sampling and in computer programming, that at least three candidates receive extensive training in survey sampling, at least two in computer programming, and at least one in each of the three areas: agricultural surveys and censuses; population statistics and demographic surveys; and economic survey and censuses.

2. On-the-job training will be provided with the assistance of the expatriat statistician consultant whose wide range of expertise and experience will supplement that of the host country staff, providing guidance and support. It is anticipated that as the survey statisticians receive advanced training in survey research and return to project work in Nepal, they will be able to provide training to junior level professionals by means of on-the-job work experiences, symposia, seminars, or university level teaching.

3. Professional enrichment. Supplementary training and continuing education should be encouraged and provided for. This should include visiting organizations and countries involved in related work, and attending symposia, professional meetings and short courses. This should be available during the succeeding years. Opportunity for continuing education is essential if the staff is to maintain a high level of professional expertise.

THE DECENNIAL CENSUS

While decennial censuses may have originally been designed to obtain population counts for political and taxation purposes, they have developed throughout the centuries into a procedure for obtaining valuable information for planning, research, governmental, and commercial purposes. Providing access to good statistics about the nation as a whole and its many subparts is a service that a national government can and should provide, so that it and its many governmental organs can operate efficiently and effectively.

Good census information at a national, regional, panchayat, and ward level will be an aid to the management and measurement aspects of the RCUP and will be essential to making projections of the likely impact of such a project if it were extended to other parts of the nation.

In addition to providing for the traditional population counts by place, sex, age, ethnicity, marital status, etc., census information related to the following subject areas should be provided as well:

a. Educational level: e.g., literacy, number of years of schooling completed, whether currently enrolled in school, etc.

b. Economic level: e.g., family income, family expenditures, whether in labor force, type of occupations, etc.

c. Vital information: number of children ever born during previous fixed period, number now alive, number of deaths occurring during previous fixed period, etc.

d. Agricultural activities in which engaged, etc.

It is recognized that in a mass data gathering effort such as the decennial census, it is desirable to have a short questionnaire containing items that are clearly understood by the populace at large. Brevity can be achieved, when there is a large number of items to be included, by means of a subsampling procedure. For example, in every fifth household questionnaire Form A could be administered; in another similar 20 percent sample of household, questionnaire Form B could be administered, etc. In this way, data could be gathered that would provide for statistics even at the ward level, without an undue burden on the respondents.

In order to insure that clear, easily understood questions are used, substantial pretesting and developmental work must be done in advance of the census.

It is also important that census reporting units be defined and remain constant over long periods of time. The Central Bureau of Statistics should be encouraged to define small permanent enumeration districts preferably using physical boundaries, to tabulate data for these units, and to make available maps showing the delineations of the boundaries of these enumeration districts. Users would then be able to make proper use of census data, determine change between census periods, and determine the exact physical area to which the statistics apply.

With the enormous amount of activity taking place in Nepal, involving not only the Nepali government itself but many other governments as well, good statistics related to a variety of subject areas are essential. His Majesty's Government would be providing a great service to itself, to its employees, and to others involved in improving the physical condition of the nation and the well being of its populace by collecting such data and making them available to users.

The RCUP is therefore encouraged to make its data needs known to the Central Bureau of Statistics so that these needs, along with the needs of other organizations, can be taken into consideration during the planning stages of the 1981 census.

COMPUTERS

The computer situation in Nepal is critical. The National Computer Center has an IBM 107 computer with a 16 K capacity. Between recurrent computer breakdowns and power outages, it is non-functional a large proportion of the time. This, together with its limited capacity, suggests an inadequate capability of handling large data processing projects.

The RCUP tabulation of the baseline survey data will be contracted out to a firm, yet to be chosen, in India. While providing a temporary answer to the computer crisis, this arrangement will not be very convenient over the entire 15-year period of the project.

While the RCUP cannot create and maintain a computer facility, consideration should be given to participating with other projects in lending support to the creation and maintenance of such a facility. Because of the apparent inability of the current power sources and facilities to provide uninterrupted power, supplementary power sources must be maintained if a computer center is to operate efficiently.

A SPECIAL NOTE ON WOMEN AND CHILDREN

While travelling in the Kathmandu valley and the central hill region of Nepal, one is struck by the fact that most of the people working in the fields are women, and most of these tending animals are children. Indeed, Bista[2/] states that over half of the farmwork in these regions is done by women.

Because the RCUP focuses heavily on agricultural activity in the central hills, it is important that adequate consideration be given to the roles of women and children in this project. The fact that culturally women and children have different status levels and educational backgrounds than men indicates that different programs for educating and involving the former two groups may be called for.

Women's Program

One professional Nepal woman described the lot of women in agriculture by saying "The woman grows the cabbage but it is the husband who wins the prize for it." Such need not always be the case.

A first step in the direction of having an affirmative action program can be made in project staffing. A positive attempt should be made to recruit women at all levels of the RCUP, including expatriate participation, professional project staff, academic training, lower professional levels such as junior technicians or survey interviewers, and workers. A project that is to include a program for women should have as a minimum, recognizable female representation on its staff. In addition, because half of the population of Nepal is female, one would judge that in all fairness a reasonable proportion of any project staff should be from that sex group.

A second step should be the development of special non-formal education-training programs for women. Culturally, women play a different role in Nepal than men. Educationally, the current literacy rate among women 10 years of age and over is estimated to be 5%, which is less than one-sixth the

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2/ Bista, L. B. Role of Women in Agricultural Development. Women in Nepal. International Women's Year Committee, Bhrikuti Mandap, Kathmandu, Nepal. January, 1976.

rate of 33% estimated for men in the same age group.[3/] This would suggest that the most effective techniques for educating and involving women in RCUP activities will not necessarily be the same as they are for men. A special non-formal education program designed with the specific needs and educational level of village women in mind would permit an effective involvement of women in the program. A program including continual positive feedback and encouragement for its female participants is needed; special recognition can be made for women who participate in the project interventions. If, given the cultural ideal of female modesty, individual recognition would make village women uncomfortable, perhaps they can be recognized for the honor which they have brought to their families by their conscientious work.

The precise shape and content of special educational/training programs for women cannot, and should not, at this point, be definitively stated. There are two reasons for this. First, the exact structure of an appropriate and effective program will have to vary with the cultural and ecological variation of the country. One type of program will not be appropriate for the whole country. Second and related to the first point, is the fact that in order to evolve effective programs, it will be essential to involve the women of each locality in the design process. It should be emphasized that although the exact dimensions of a women's component cannot at this point be detailed, it is clear that such a program is crucial to the effectiveness and overall community acceptance of RCUP activities.

The setting up of such a program will require some creative involvement on the part of the extension personnel, education specialists, and the project social scientist. In addition, a women's component should be recognized as a defined part of the RCUP be specifically designating these responsibilities to someone on the professional staff, preferably a woman.

Children's Program

Approximately 29% of the population of Nepal is in the age range 10-24 years, and another 36% is in the age range 25-59. Therefore, if one considers the active agricultural labor force to be those people from 10-59 years of age, 45% of it is between 10 and 24 years of age.

If the RCUP trained only 10-year-olds in the methods and procedures

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[3/] Acharya, Meena. Statistical Profile of Nepalese Women -- A Critical Review. Unpublished manuscript, 1979.

consistent with good resource management, at the end of the 15 year project almost half of the agricultural labor force would have been trained. Such an opportunity should be actively exploited. Some ideas about providing resource conservation training are listed below:

1. A program aimed at school children could be developed. Rather than having a strict academic orientation, it should be set up as an enrichment program. Perhaps the first year primary students could be taught about tree planting and maintenance by an extension technician using attractive, informative visual aids. Comic book type educational material could be provided each child, and the class could plant a seedling and care for it. Later each child could be given a seedling of his or her own to plant and care for. Prizes could be awarded at the end of the year for various performances: best cared-for tree, tallest tree, fattest tree, prettiest tree, etc.
2. The program could proceed to other resource conservation subjects for the succeeding school years: proper terracing, animal care, etc. Always, the program should be enjoyable, varied, and colorful. Perhaps class visits to sites where activities consistent with good resource management are being employed could be used for demonstration purposes. The school program could be planned so that by the time a child had completed five years of school, he or she would have been exposed to the entire range of resource conservation training. Of course, the program could then be repeated on a more advance level.
3. A comparable program for children not in school should be planned and implemented at least as long as a sizeable proportion of children are not attending school. Something comparable to the American 4-H program might be developed.
4. Perhaps UNICEF has a related program. If so, that organization may be able to offer assistance and guidance.
5. Again, responsibility for developing and operating such educational programs should be specifically designated to an RCUP professional staff member.

<u>Staffing and Training</u>

I would suggest that a Nepali be designated as having responsibility for setting up and carrying out training programs for women and for children. Sufficient funds should be allocated for this professional: (1) to receive any supplementary training that is needed (eg. training in educational media); (2) to visit other countries to observe their methods of handling similar extension projects; and (3) to be able to request assistance in the form of expatriat consultants.

EARLY WARNING SYSTEM

The author believes that the development of an early warning system related to floods, production, erosion, etc. does not directly relate to the other measurement and monitoring activities and should not be handled by that staff.

The panchayat project director should have the responsibility for determining whether any intervention activity could, under any foreseeable set of circumstances, cause a threat to life or property. Where such a threat could conceivably occur, the director should provide for early warning system and provide for the protection for the threatened populace and property.

1 - Person months of training, 2 - Unit of work to be done, 3 - Cost in ($000)

	Year 1			Year 2			Year 3			Year 4			Year 5			To-tal	2nd 5 yr.			3rd 5 yr.		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
1 Survey Economist	6	-	9	12		16	12		18	12		22										
8 Survey Statisticians	12		27	24		51	12		30	24		56	12		33		60		167			
English language training for 9, 20 hrs/week for 6 mo./person	18		22				12		18				12		22		12		26			
Continuing education			10			13			13			15			17				85			85

RCUP COSTS

Measurement & Monitoring

1 - Person months of employment, 2 - Unit of work to be done, 3 - Cost in ($000)

Proposal Project	1st 5 year program															2nd 5 yr.			3rd. 5 yr.		
	Year 1			Year 2			Year 3			Year 4			Year 5								
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Expatriot Survey statistician consultant	4		41	4		44	4		47	4		51	4		55	12		180	8		135
Measurement coordinator							3		2	4		2	6		4	30		18	30		21
Resource Statistician	12		5	12		5	12		6	12		7	12		8	60		55	60		70
Economist	6		3	6		3	6		3	12		7									
Survey Economist													12		7	60		54	60		70
Survey Statisticians	24		10	24		11	24		12	24		14	48		32	168		145	192		210
Computer Programmers	12		5	12		5	12		6	12		7	24		16	120		105	120		130
Research Assistants	24		4	24		4	36		7	36		8	48		12	264		100	264		120
Field Supervisors				12		5	12		5	12		6	48		28	96		70	96		85
Interviewers				30		10	30		11	30		12	30		14	200		100	200		130
Secretaries, clerks	36		8	36		9	36		10	36		11	36		12	240		105	240		140
Paper, printing, computer cards, tapes, disk packs, computer time, miscellaneous expenses			50			60			70			80			90			500			500

APPENDIX Q

PROGRAM GUIDE FOR RCUP OUTPUT

TABLE OF CONTENTS

Appendix Q

PROGRAM GUIDE FOR RCUP OUTPUT

These output tables summarize by years the RCUP program developed by the Design Team. It has been discussed with the various departments involved and reflects dialogues the Design Team has had with the local people to determine their desires. It is a guide. Years one and two are more solid than years 3, 4, and 5. As RCUP is implemented and the two-way dialogue between local requirements and national programs takes place, it is expected that the guide will undergo a series of updatings. The second and third five-year projections are only indicators at this period in time.

The first five-year program is mainly an institutionalizing phase of a 15-year plan. It initiates the building-block process of getting resource-management information for management planning, implementing conservation techniques and methods, training/educating to understand resource conservation and utilization problems and programs, and founding the infrastructure to support decentralization and spearhead people's involvement.

The program is outlined under descriptive headings and shows the lead executing agency which will have prime responsibility for coordination. While certain activities naturally fall under the direction of a given agency because of policy, it is fully expected that coordination will take place. For example, the location of Horticulture Nurseries in Mustang will have to be coordinated with the windmill and test-drilling activity to ensure a water supply, and with streambank stabilization and stream channel control, if the nurseries are to be located on alluvial fans or terraces along streams and rivers.

These guide outputs have been coordinated with HMG/N's five-year plan, both the present fifth and future sixth plan, making the outputs complementary to the various programs.

Following are specific notes:

Training. Long- and short-term goals for all allied fields associated with the RCUP are shown under this heading. Individual program activities may recommend certain training; however, no distinction is shown here. Individual project requirements are to be fully analyzed before allocating participant seats. The seats available here accommodate the opportunity for B.Sc., M.Sc., and Ph.D. level instruction not provided for by in-country institutions as related to RCUP.

There is opportunity for both long- and short-term study in India under the PL 480 program. No output is shown here. However, RCUP will coordinate needs with USAID/N-HRD in the opportunity to utilize the PL 480 program.

Building. The program of building construction follows the development of the activity management plans. Targets shown may have to be changed if building material shortages continue, staff members are slow in being assigned, and designs are not approved.

PROGRAM GUIDE FOR RCUP OUTPUT

October 1, 1979

PROGRAM CATEGORY	Unit of Accomplishment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and 1/ Comments
1. Inventory and Monitoring											
A. Hydrologic Survey	Hectares	0	32,000	100,000	109,585	110,000	351,585	161,077	0	512,662	DSWC and DIHM
	Area Report	0	0	1	1	1	3	1	0	4	DSWC and DIHM
B. Geology Survey	Hectares	32,000	100,000	109,585	110,000	110,000	461,585	51,077	0	512,662	DSWC and BM
	Area Report	0	0	1	1	1	3	1	0	4	DSWC and BM
C. Soil Survey	Hectares	32,000	100,000	109,585	110,000	110,000	461,585	51,077	0	512,662	DSWC and DA
	Area Report	0	0	0	1	2	3	1	0	4	DSWC and DA
D. Land Capability Survey	Hectares	Aerial	32,000	100,000	109,585	110,000	351,585	161,077	0	512,662	DSWC and Others
	Area Report	Photography	1	1	1	1	4	1	1	6	DSWC and Other
E. Erosion Hazard	Hectares	0	32,000	100,000	109,585	110,000	351,585	161,077	0	512,662	DSWC, BM, DH, & DA
	Reports	0	0	1	1	1	3	1	0	4	DSWC, BM, DH, & DA
F. Impact Evaluation	Plots	4	4	4	4	4	20	20	20	60	DSWC
G. Adaptive Research	Studies	2	2	2	2	2	8	8	10	26	DSWC
H. Documentation	Photo Points	40	80	80	80	80	360	400	400	1,160	DSWC
	Movie	1	1	1	1	1	5	2	2	9	DSWC
I. Farm Planning	Hectares	0	250	500	700	1,000	2,450	5,000	5,000	12,450	CCO and ADC
2. Watershed Management											
A. Terrace Improvement	Hectares	10	30	40	40	60	180	575	575	1,330	CCO
B. Trail Improvement	Kilometers	2	5	6	6	6	25	25	25	75	CCO
C. Community Water Source Protection	Hectares	58	58	58	58	58	290	378	377	1,045	CCO
D. Major Gully Control on Range Lands	Number	1	2	3	3	4	13	7.5	7.5	28	CCO

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years					Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and 1/ Comments
		1	2	3	4	5					
E. Land Slide Rehabilitation	Number	0	1	1	2	1	5	5	5	15	CCO
F. Streambank Stabilization											
(1) Gabions	Kilometer	0	0.1	0.2	0.2	0.1	0.6	0.2	0.2	1	CCO
(2) Riprap	Kilometer	0.4	0.4	0.4	0.4	0.4	2	0.5	0.5	3	CCO
G. Flood Plain Tree Planting	Hectares	50	50	50	50	50	250	175	175	600	CCO
H. Stream Channel Control	Meters	0	0	0	250	250	500	0	0	500	CCO
I. Road Slope Stabilization	Kilometers	0.8	0.8	0.8	0.8	0.8	4	0	0	4	CCO
J. Catchment Ponds (Hill Top)	Numbers	1	3	6	10	15	35	30	50	115	CCO
K. Climatological Stations											
(1) New	Numbers	0	3	3	1	0	7	0	0	7	DIHM and DSWC
(2) Old	Numbers	0	5	6	3	0	14	0	0	14	DIHM and DSWC
L. Stage Recorders	Numbers	0	1	3	0	0	4	2	2	8	DIHM and DSWC
M. Snow Management Stations	Numbers	0	0	0	1	0	1	1	1	3	
N. Windmills	Numbers	0	0	1	1	2	5	3	3	11	CCO
O. Test Drilling	Numbers	0	6	6	6	6	24	0	0	24	CCO
P. Diversions	Numbers	0	0	0	2	3	5	3	2	10	CCO

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and Comments 1/
3. **Forest Management**											
A. Nursery Establishment											
(1) Central	Numbers	4	0	0	0	0	4		0	4	DFO
(2) Panchayat	Numbers	9	9	9	8	7	42	18	0	60	DSWC
B. Panchayat Forest Establishment											
(1) Fuel Wood	Hectares	12.5	45	96.5	149.5	200	503.5	1,599	1,029.5	3,132	CCO
(2) Fodder	Hectares	12.5	45	96.5	147	195.5	496.5	1,599	1,029.5	3,125	CCP amd AD
C. Distribution of Community and Individual Plantings	Numbers	20,000	84,000	147,000	210,000	273,000	734,000	1,365,000	1,365,000	3,464,000	CCO
D. Panchayat Protected Forest Est.	Hectares	1,988	1,820	1,762	2,043	1,650	9,263	4,750	0	14,013	DFO and CCO
E. Lease Forest Establishment	Hectares	0	12	20	20	20	72	100	150	372	DFO
F. Private Forest Establishment	Hectares	0	50	50	50	50	200	300	500	1,000	DFO and CCO
G. National Forest Plantation Establishment	Hectares	–	225	470	780	880	2,355	3,940	4,260	10,555	DF and DFO
H. Forest Demarcation	Kilometers	240	480	700	880	1,000	3,300	6,650	6,450	16,400	DFO
I. Management Plan Preparation											
(1) National Forests	Hectares	0	34,291	33,293	0	0	67,584	0	0	67,584	DF & FSE includes Vegetation Survey
(2) Panchayat Protected Forests	Hectares	0	1,238	2,177	2,115	1,983	7,513	6,500	0	14,013	DFO, DF, and DSR

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years					Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and 1/ Comments
		1	2	3	4	5					
J. Management Plan Implementation											
(1) National Forest	Accumulated Hectares	0	0	34,291	67,584	67,584	67,584	67,584	67,584	67,584	DFO
(2) Panchayat Protected Forest	Accumulated Hectares	0	0	1,238	3,415	5,530	5,530	14,013	14,013	14,013	DFO
K. Working Scheme for Panchayat Forest	Numbers	9	9	9	8	7	42	18	0	60	CCD
L. Research Trial Plots	Numbers	0	40	60	80	80	260	245	245	750	DF and FSR
M. Demonstration Sawmills	Numbers	0	1	1	1	1	14	0	0	4	DFO
N. Charcoal Development	Plants	0	0	0	0	0	0	4	0	4	DFO
4. Energy											
A. Stove Improvement	Numbers	30	40	40	40	40	190	200	200	590	CC and CCO
B. Solar Demonstration											
(1) Drying	Numbers	0	2	4	6	8	20	0	0	20	CC and CCO
(2) Water Heating	Numbers	0	3	6	12	24	45	0	0	45	CC and CCO
C. Bio-Gas Installation	Units	10	20	20	25	25	100	120	120	340	UNM and CCO
D. Micro-Hydro Plants											
(1) Installations	Numbers	Survey	Design	1	2	1	4	5	6	15	CC and CCO
(2) Maintenance	Numbers	0	0	0	3	4	4	9	15	28	LC

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years					Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and Comments 1/
		1	2	3	4	5					
E. Bridges											
(1) Foot - 10 meter (Wood)	Numbers	0	2	1	1	1	5	10	10	25	LC and LDD
(2) Suspension	Numbers	Survey	Design	3	2	0	5	5	5	15	DR from separate USAID project.
F. Multi-Purpose Impoundment	Numbers	Survey	Design	1	0	0	1	0	0	1	DSWC, CCO and CC
5. Irrigation											
(1) Over 50 hectares	Schemes	Design	2	2	1	1	6	0	0	6	DIHM
(2) Under 50 hectares	Schemes	Design	11	9	8	4	32	0	0	32	LDD (20 schemes) & CCO (12 schemes)
(3) On-farm Water Management	Hectares	Design	363	352	246	181	1,142	0	0	1,142	CCO and DA
6. Drinking Water											
(1) Large Size (1,500 + Population)	Numbers	Design	3	3	2	2	10	2	-	12	DWS
(2) Small Size (1,500 - Population)	Numbers	Design	9	10	10	10	39	31	-	70	LDO
7. Community Livestock - Range - Pasture Management											
A. Forage Crop Development	Hectares	2	14	29	64	130	239	844	1,511	2,594	DADO and LDC
B. Improved Private Pasture Development	Hectares	0	9	38	82	149	278	1,354	1,408	3,040	DADO and LDC

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years					Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and 1/ Comments
		1	2	3	4	5					
C. Improved Pasture Development on Terrace Risers and Bunds	Hectares	0	3	20	58	132	213	1,634	1,853	3,700	DADO and LDC
D. Range Management											
(1) Subtropical - Warm Temperate	Hectares	0	13	40	79	132	264	462	595	1,321	CCO and DADO
(2) Cool Temperate - Subalpine	Hectares	0	21	63	127	211	422	681	1,012	2,115	CCO and DADO
(3) Steppe	Hectares	0	18	52	105	175	350	612	788	1,705	CCO and DADO
E. Pasture Development in Planted Plantation	Hectares	0	50	75	100	125	350	500	750	1,600	CCO, DA and DF
F. Forest Pasture Development	Hectares	0	28	72	134	191	425	1,625	1,109	3,159	CCO, DFO and DADO
G. National Forest Grazing Management	Hectares	-	-	-	-	47	47	139	280	466	DFO and LDC
H. Improved Pasture and Range Management Research & Studies	Numbers	3	5	6	7	9	30	30	30	90	LDC, CCO and DFO
I. Distribution of Improved Animals											
(1) Buffalo Bulls	Head	0	12	12	16	20	60	60	60	180	LDC and LD
(2) Cattle Bulls (Jersey Cross)	Head	0	14	53	44	89	200	200	200	600	LDC and LD
(3) Goat											
(a) Jamunapati	Head	0	20	0	0	0	20	0	0	20	LDC and LD
(b) Buck	Head	0	0	20	40	30	90	210	300	600	LDC and LD

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Years	Third Five Years	15 Year Total	Executing HMG/N Agency and 1/ Comments
(4) Sheep											
(a) Exotic Breed	Head	0	40	0	0	0	40	0	0	40	LDC and LD
(b) Cross	Head	0	10	20	10	10	50	50	50	150	LDC and LD
(c) Kage Cross	Head	0	10	10	10	10	40	40	40	120	LDC
(5) Poultry	Numbers	0	2,500	4,500	5,500	7,500	20,000	20,000	20,000	60,000	LDC
J. Castration											
(1) Unproductive Male Cattle	Numbers	0	50	400	1,000	1,000	2,450	3,000	4,000	9,450	LDC
(2) Distribution of Castrator	Numbers	0	5	10	45	45	105	120	200	425	LDC
K. Animal Health											
(1) Haemorragae Septicaemae											
(a) Buffalo	Numbers	0	5,000	6,000	7,000	10,000	28,000	24,000	25,000	77,000	LDC
(b) Cattle	Numbers	0	7,000	8,000	18,000	27,000	60,000	58,500	60,000	178,500	LDC
(2) Rinder Pest											
(a) Buffalo	Numbers	0	3,500	6,500	12,500	17,500	40,000	48,000	50,000	138,000	LDC
(b) Cattle	Numbers	0	6,500	14,700	24,800	34,000	80,000	30,000	55,000	165,000	LDC
(3) Drenching (Twice per Year)											
(a) Sheep-Goats	Numbers	0	12,000	23,500	40,000	61,000	137,000	157,000	170,000	404,000	LDC
(b) Cattle-Buffalo	Numbers	0	13,000	27,000	47,000	59,000	146,000	148,000	164,000	458,000	LDC

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years					Five Year Total	Second Five Years	Third Five Years	15 Years Total	Executing HMB/N Agency and Comments
		1	2	3	4	5					
(4) Dipping-Spraying of Sheep-Goats	Numbers	0	12,000	25,000	30,000	70,000	157,000	160,000	170,000	487,000	LDC
L. Dipping Tank Installation	Numbers	8	9	10	12	9	48	0	0	48	LDC
M. Water Trough Installation	Numbers	73	89	88	92	58	400	0	0	400	LDC
N. Equipment Distribution											
(1) Shearing Scissors	Numbers	0	20	50	70	95	235	260	330	825	LDC
(2) Hoof Cutters	Numbers	0	40	50	70	100	260	260	330	850	LDC
(3) Livestock First Aid Kits	Numbers	67	112	133	156	126	594	594	594	1,782	LDC
O. Livestock Production Studies	Numbers	1	1	4	4	4	14	20	20	54	LDC
P. Credit Provision											
(1) Purchase of Buffalo Cow	Numbers	0	50	100	150	100	400	400	400	1200	ADB and C
(2) Chaff Cutter	Numbers	0	0	45	50	60	155	180	200	535	ADB and C
(3) Cream Separator	Numbers	0	4	4	4	4	16	20	20	56	ADB and C
(4) Poultry Farms	Numbers	0	0	0	0	2	2	4	5	11	ADB and C

PROGRAM CATEGORY	Unit of Accomplishment	First Five Years 1	2	3	4	5	Five Year Total	Second Year Total	Third Year Total	15 Years Total	Executing HMG/N Agency and Comments
8. Agronomy, Extension and Research											
A. Improved Varieties											
			Shown as accumulating by Years					Non-Accumulated			
(1) Paddy	Hectares	205	812	1,706	2,863	4,089	4,089	5,707	6,922	16,718	DADO
(2) Wheat	Hectares	182	729	1,533	2,554	3,649	3,649	4,942	6,035	14,626	DADO
(3) Maize	Hectares	497	2,113	4,438	7,397	10,567	10,567	13,585	16,412	40,564	DADO
(4) Millet	Hectares	31	125	283	488	721	721	853	1,040	2,641	DADO
(5) Barley	Hectares	1	5	16	31	49	49	72	100	211	DADO
(6) Pulses	Hectares	2	16	46	74	103	103	185	272	560	DADO
(7) Potato	Hectares	31	120	242	384	542	542	921	1,282	2,745	DADO
B. Extension											
(1) Minikit Distribution	Numbers	216	838	1,776	3,009	4,197	10,036	10,036	10,036	30,108	DADO
C. Research											
(1) Cropping System Verification Trials	Numbers	4	15	25	40	50	134	167	167	468	DADO and ICP
(2) Varietal Trials	Numbers	11	34	67	97	122	331	331	331	933	ICP and DADO
(3) Storage Trials	Numbers	0	13	15	13	16	57	66	66	189	DADO
D. Seed Production											
(1) Paddy	Tons	2.5	11	20	34	45	112.5	141	176	429.5	C and DADO

PROGRAM CATEGORY	Unit of Accomplishment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Years	Third Five Years	15 Years Total	Executing HMG/N Agency and Comments 1/
(2) Maize	Tons	0	7.5	21	38	52	118.5	148	185	451.5	C and DADO
(3) Wheat	Tons	7	26	57	90	145	325	406	508	1,239	C and DADO
(4) Potatoes	Tons	7	27	55	83	112	284	355	444	1,083	DADO and C
E. Credit Provision	Households	1,978	5,933	10,981	16,302	20,556	55,750	64,112	70,523	190,385	ADB
9. Horticulture											
A. Sapling Distribution	Numbers	15,900	26,700	36,900	52,900	76,400	208,800	403,800	365,350	977,855	DA
B. Kitchen Garden Vegetable Production	Households	1,580	1,981	2,772	2,772	2,772	11,877	22,210	22,210	56,297	DA
C. Fruit Nursery Establishment	Numbers	2	2	2	2	0	8	0	0	8	DA
10. Fisheries Development	Projects	1	0	0	2	0	2	0	0	2	DA
11. Training											
A. Soil and Water Conservation											
(1) Professional for one week	Sessions	0	2	2	2	2	8	10	20	38	MFTW
(2) Technicians for five weeks	Sessions	0	1	1	1	1	4	5	5	14	MFTW
(3) Conservation Assistants for 8 weeks	Sessions	0	1	1	1	1	4	5	5	14	MFTW

PROGRAM CATEGORY	Unit of Accomplishment	First Five Years 1	2	3	4	5	Five Year Total	Second Five	Third Five Years	15 Years Total	Executing HMG/N Agency and Comments [1/]
(4) Conservation Education	No. of people	10,000	20,000	25,000	30,000	30,000	115,000	150,000	200,000	465,000	CCO and MFTW
(5) Participant Training (includes allied fields)											
(a) Long Term	Numbers	10	15	15	15	15	70	25	25	120	DSWC
(b) Short Term	Months	12	24	36	36	36	144	100	100	344	DSWC
(6) Formal In-Country											
(a) Certificate	Numbers	231	283	300	320	390	1,524	1,600	1,700	4,824	TU
(b) Diploma	Numbers	-	40	75	109	115	339	340	340	1,019	TU
B. Community Livestock-Range Pasture Management											
(1) Agriculture Assistant Preparation	Numbers	67	112	133	156	126	594	0	0	594	DA
(2) Agriculture Assistant Refresher Training	Numbers	0	67	112	133	156	568	594	594	2,124	DA
(3) Farmers (Formal)	Numbers	40	90	140	190	210	670	1,050	1,050	2,770	DA
(4) JT, JTAs, and Stockmen	Numbers	17	37	65	92	114	325	325	325	975	DA
(5) JTA Preparation	Numbers	15	15	17	18	-	65	-	-	65	DA
(6) Farmers Contracts	Numbers	32,160	85,920	149,760	224,640	285,120	647,700	700,000	800,000	2147600	DA
(7) JT In-Service	Numbers	5	5	5	5	2	22	27	34	83	DA

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Yers	Third Five Years	15 Years Total	Executing HMG/N Agency and Comments
(8) JTA's											
(a) Initial	Numbers	15	15	15	15	25	85	85	85	255	DA
(b) In-Service	Numbers	10	10	15	15	15	65	81	102	248	DA
(9) Village Agriculture Assistants	Numbers	60	60	100	120	125	465	570	716	1,751	DA
(10) Farmer (Formal)	Numbers	50	50	75	100	100	375	554	1,154	2,083	DA
(11) Storage											
(a) JT's	Numbers	5	5	6	-	6	22	30	30	82	DA and AIC
(b) JTA's	Numbers	10	10	15	13	16	64	89	89	242	DA and AIC
(c) Village Agriculture Assc.	Numbers	100	100	124	132	138	594	600	600	1,794	DA and AIC
(d) Farmer (Formal)	Numbers	70	70	100	140	140	520	652	780	1,952	DA and AIC
(12) Farmer-Villager Contacts	Numbers	12,000	12,000	14,880	15,840	16,560	71,280	78,240	93,600	243,120	DADO
(13) Cooperating Managers Training	Person Months	5	10	8	12	4	42	10	10	62	CD
(14) In-Service Training For Nursery Staff	Numbers	10	10	10	10	10	50	11	11	72	DA
12. Building Starts											
A. Forestry											
(1) Forest Project Office including Officers and Staff Quaters	Numbers	0	2	2	0	0	4	0	0	4	DFO, DF and CC

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Years	Third Five Years	15 Years Total	Executing HMG/N Agency and Comments 1/
(2) Ranger Office and Quarters	Numbers	0	2	2	2	0	6	0	0	6	DFO and CC
(3) Foresters Quarters	Numbers	0	6	6	6	6	24	0	0	24	DFO and CC
(4) Guard Quarters	Numbers	0	8	8	8	8	32	16	0	48	DFO and CC
(5) Nursery Office and Stores											
(a) Central	Numbers	0	2	2	0	0	4	0	0	4	DFO and CC
(b) Panchayat	Numbers	9	9	9	8	7	42	18	0	60	CCO and CC
B. Soil and Water Conservation	Numbers	0	4	4	4	0	12	0	0	12	CCO
C. Livestock and Pasture											
(1) Livestock Development Center Office	Numbers	Design	4	0	0	0	4	0	0	4	DA
(2) Livestock Development Sub-Center/Quarter	Numbers	Design	4	5	5	7	21	0	0	21	DA
(3) Quarter Type (A)	Numbers	Design	4	0	0	0	4	0	0	4	DA
(4) Quarter Type (B)	Numbers	Design	8	0	0	0	8	0	0	8	DA
(5) Quarter Type (D)	Numbers	Design	2	0	0	0	2	0	0	2	DA
(6) Ram Shed	Numbers	0	3	2	0	0	5	0	0	5	DA
(7) Store House/Office	Numbers	Design	2	0	0	0	2	0	0	2	DA

PROGRAM CATEGORY	Unit of Accomplishment	First Five Years					Five Year Total	Second Five Years	Third Five Years	15 Years Total	Executing HMG/N Agency and Comments 1/
		1	2	3	4	5					
D. Agronomy, Extension and Research											
(1) ADO Offices (A Type)	Numbers	Design	1	0	0	0	1	1	0	2	DA
(2) Quarters											
(a) A Type	Numbers	Design	3	0	0	0	3	0	0	3	DA
(b) B Type	Numbers	Design	1	4	0	0	5	5	0	10	DA
(3) Sub-Center Office/Quarters Complex	Numbers	Design	4	5	5	7	21	21	0	42	DA
(4) Godowns	Numbers	0	2	5	5	4	16	3	0	19	AIC-from USAID separate funded project.
(5) Research Farm Quarters and Threshing Floors	Numbers	0	1	0	1	3	5	0	0	5	DA
E. Horticulture											
(1) Fruit Nurseries Building Complex	Numbers	2	2	2	2	0	8	0	0	8	DA
(2) Mist/Shed Houses	Numbers	0	1	0	1	0	2	0	0	2	DA
(3) Green House	Numbers	0	0	1	0	0	1	1	1	3	DA
(4) Natural Cold Rooms	Numbers	0	0	2	2	2	6	6	0	12	DA

PROGRAM CATEGORY	Unit of Accomplish-ment	First Five Years 1	2	3	4	5	Five Year Total	Second Five Years	Third Five Years	15 Years Total	Executing HMG/N Agency and Comments[1/]
(5) Semi-Commercial Processing Plants/Cold Storage	Numbers	0	0	0	0	0	0	2	0	2	DA
(6) Mini-Processing Plants	Numbers	0	0	0	0	0	0	1	0	1	DA

Executing Agency abbreviations

AD = Agronomy Division
ADB = Agriculture Development Bank
ADO = Agriculture Development Office
AIC = Agriculture Inputs Corporation
BM = Bureau of Mines
C = Cooperatives
CC = Contract Consultant
CCO = Conservation Office, DSWC
CD = Cooperative Department
DA = Department of Agriculture
DADO = District Agriculture Development Office
DF = Department of Forests
DFO = Divisional Forest Office
DI = Department of Irrigation
DIHM = Department of Irrigation, Hydrology, and Meterology
DR = Department of Roads
DSWC = Department of Soil and Water Conservation
DWS = Department of Water and Sewerage
FSR = Forest Survey and Research
ICP = Integrated Cereals Project
LC = Local Community
LD = Livestock Division
LDD = Local Development Department
LDC = Livestock Department
MFTW = Ministry of Forest Training Wing
PDV = Potato Development Program
TU = Tribhuvan University
UMN = United Mission of Nepal

9/29/79

APPENDIX R

SOIL AND WATER CONSERVATION REPORT

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SOIL AND WATER CONSERVATION REPORT

CONTENTS

PART I. SOIL AND WATER CONSERVATION BENEFITS

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PART I

SOIL AND WATER CONSERVATION BENEFITS

A. Summary

The RCUP proposal will return benefits in four major areas: soil and water conservation; agricultural improvement; energy and health; education and other social areas.

The Soil Conservation Service (SCS) consultants have considered only soil and water conservation benefits, which include: range, pasture and forest production improvements; soil erosion control; and reduction in human labor and livestock energy requirements.[1/]

Benefits are estimated at NR 16,479,000 annually, excluding labor benefits (see Table 9). Several assumptions were made and may need to be changed as more reliable data become available.

1/ Projects proposed by RCUP design team papers by Carter and White were used. Procedures recommended by Thorud, *et al.* and Vickery, *et al.* were used.

I. IMPROVED PASTURE DEVELOPMENT

(6200 ha. - Kulekhani, Lower Gorkha and Lower Myagdi areas)

A. Increased Forage Production

Current forage production for unmanaged native pasture is estimated at 1.2 MTDW/ha/yr. (See Table 1). With a pasture improvement program, including seeding and deferred-rotation, production should increase to 6.2 MTDW/ha/hr after a 2-year establishment period.

Fresh forage value is considered at Nr 1.5/20 KgGW[1/]. Air dry weight is 20% of green weight. The increased forage value with project is estimated at Nr 1875/ha/yr.[2/]

B. Without a project, the continued soil erosion will reduce forage production by 1% year. (This is based on a soil loss of .19 cm/ha/yr or 2.7 cm/ha in 15 years. Assuming that pasture land has 20 cm of productive top soil, it is then reasonable to expect a 1%/year forage reduction because of soil loss).

C. Decreased Labor

Forage harvest on managed pasture will decrease labor requirements. The project will create high yielding pasture closer to farmsteads and villages. The labor requirements for unmanaged pasture yielding 1.2 MTDW/ha are estimated at 4 hrs/20 KgGW. For managed pastures producing 6.2 MTDW/ha the labor harvest requirements are 1 hr/20 KgGW.

Assuming that 50% is hand harvested, the estimated average harvested feed requirement of a model unit consisting of 3 livestock units (LU) is 24,630 KgGW/yr. To harvest this amount, the labor needs for an unmanaged pasture would be 4,926 hours, while on a managed pasture 1231 hours will be needed, or a saving of 3695 hours or 370 days using a 10 hour day. (For 3 LU) the 6200 ha produce

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1/ RCUP pasture livestock staff propose Nr 2.5/20 KgGW. FAO and WB Reports - Based on livestock returns - range from Nr .65 to 1.5/20 KgGW. Based on labor requirements, the value ranges from 2.0 to 5.0/20 KgGW.

2/ Although it is assumed that forage production will remain the same for the next 15 years, it is recognized that unpalatable invader species will increase and will decrease usable forage. This amount is difficult to determine and not considered in benefits.

enough forage to support 2265 LU. At 123 man days saving/LU, the total hand harvest labor savings is 278,595 man days/yr. or Nr 1,950,200/yr.

It is assumed that herding of animals is currently practiced for 50% of the area. In areas where herding is required it is assumed that labor needs will be 50% less. If one man can herd 10 LU and the livestock will be herded 50% of the time, 20,622 man day/yr will be saved; or Nr 144,354. This is based on decreased herding time requirement due to the increase in vegetation production with the project.

The total labor saving for pasture improvement is 299,217 man days/yr. or Nr 2,094,600/yr.

D. Decreased Livestock Trailing

Trails are major contributors to soil erosion. By encouraging more hand harvesting of forage, livestock trailing can be reduced. Reduced livestock trailing will not only deminish trampling of vegetation, soil compaction, and increased water runoff and soil erosion, but will also decrease the traveling energy requirement of the animals. Such energy can then be used for more milk (estimated to be a 15% increase) and meat production. Stabled animals will allow more accessible manure for use in increasing crop production.

It is estimated that 40% (906 animals) of the animals supported by improved pasture are adult female cattle and buffalo. If 30% (271 animals) of these are producing milk at 1.5 liters/day with a value of Nr 3/liter then the annual value is Nr 445,118/yr. Thus the 15% increase would equal Nr 66,768/year. Meat and manure increases are not considered in this analysis.

II. RANGE IMPROVEMENT

Proposed Project - Mustang 5200 ha.

A. Increased Forage Production

Current forage production for unmanaged native range in the Upper Mustang dry area is estimated at .14 MTDW/ha/yr. With a range improvement program including patch seeding and deferred rotation, grazing production should increase to .50 MTDW/ha/yr after a 3 year establishment period.

Forage production currently in the Mustang sub-alpine and cool temperate areas are 3.0 and 2.0 MTDW/ha/yr respectively. With the project, this will increase to 6 and 4 MTDW/ha/yr. respectively after a 2 year establishment period.

The average production for the 3 areas is 1.7 MTDW/ha/yr. With the current practices and 3.5 MTDW/ha/yr. for improved practices with project, the increase would be 1.8 MTDW/ha/yr. If green forage is worth Nr 1.5/20 KgGW or 4 KgGw, then one can expect a Nr 675/ha/yr increase Nr 3.510,000/yr. Table 1 shows estimated pasture and range production.

B. Soil Loss

Soil loss on unmanaged range land is estimated at 35 MT/ha/yr. With the project, soil loss from erosion will be reduced to 7 MT/ha/yr (Table 2).

High soil losses will continue without the project and forage production will be reduced by 1% per year (See IB).

C. Decreased Labor

Increased forage production on improved range lands will decrease the required herding time. Based on the increased forage production of 2.05 times, labor herding time will be decreased by 50%. At current production, it is estimated that the 5200 ha. range land will support 2690 LU and if one man can herd 20 LU, then 24,046 man days would be saved (Nr 171,800/yr).

D. Decreased Livestock Trailing and Grazing

Forage will be more accessible and the animal will meet its vegetation requirement more readily. Trailing and grazing will be reduced and can be converted to increased milk and meat production. Using the same concepts as for pasture, the benefits are Nr 79,215/yr. (See I D and III B).

III. TRAIL IMPROVEMENT

Proposed Project - Kulekhani - 12.5 km. trail drainage, regrading/rerouting and artificial revegetation

Myagdi - 12.5 km. trail drainage

In the Kulekhani area assume that the regrading, rerouting and artificial revegetation is applied on the same length as the old trail, or 12.5 Km., and if the average width is 1.5 m, the total area then would be 1.875 ha. In the Myagdi area assume that the proposed drainage treatment is on one half the trail area; then the area is .94 ha. Assuming the above, a total area of 2.82 ha. will be treated over the 15 year project period.

A. Land Loss

The trail land value is Nr 60,000/ha, and 2.82 ha. would be lost in 15 years; Therefore, the land loss value would be Nr 11,280/yr.

B. Decreased Labor Requirement

Regrading and rerouting will reduce labor and energy requirements for both humans and animals.

Assume that 100 people travel the existing trail each day in the Kulekhani area and that they spend 2/3 of a day on the 12.5 Km. Also assume that project treatment will reduce labor requirements by 10%; then the expected benefits at Nr 7/day would be Nr 16,863/yr.

IV. CRITICAL AREA TREATMENT

A. Proposed Treatment

1. Range Denudation Control

Kulekhani	10,000m	gully	repair	and	artificial	revegetation
Gorkha	"	"	"	25 ha.	"	"
Myagdi	"	"	"	50 ha.	"	"

2. Landslide Control

Kulekhani 15 ha. artificial revegetation.

Land loss and landslides in the critical areas covered under range denudation control will continue at rapid rates without a project. Existing gullies will expand, landslides be triggered and new gullies developed.

Landslides vary considerably in the amount of potential soil erosion and loss of productive land, ranging from lands becoming completely barren with high rates of soil erosion to lands continuing in production with slight to moderate erosion rates.

Assuming that the 30,000m of gullies in each of the three range denudation areas have an average width of 15m, then the total treatment area is 135 ha. of gullies with an average erosion rate of 200 MT/ha/yr.; with an average soil density of 1.45 tons/cu.m., the lost soil volume would be 138 cu.m/ha/yr. If one meter average depth is eroded from gully edges, then each hectare would lose 138 sq.m. or 1.38% of the land would be lost each year. For the 135 ha. project area this would amount to 1.86 ha/yr. and for the 15 year period it would be about 28 ha.

Assuming that the average land value is Nr 40,000/ha before the soil loss occurs and is valued at Nr 10,000/ha after, then Nr 30,000/ha can be attributed to the land that is lost, or Nr 55,800/yr.

V. FOREST IMPROVEMENT PROGRAM

Proposed Project (See Tables IV and V)

Several forest program studies, reports and project proposals have been developed for Nepal during the last 20 years. This has resulted in many forest improvement projects being implemented.

Recent project proposals that appear to be realistic guides for the RCUP proposals are the APROSC, World Bank and FAO proposals.[1/]

A. Increased Woodland Production

1. Fodder

Current forage production for the Panchayat Forest Plantation (PFP) areas is estimated at 7000 KgGW/ha/yr. Assume that current land use is pasture or range and forage is mainly grass. The forage value at Nr 1.5/20 KgGW is Nr 525/ha/yr.

With a project, tree fodder will yield 20,400 KgGW/ha in 6 years (which is first year of harvest) and 40,800 KgGW/ha in 10 years and will remain at the same level of production throughout the project. Using a weighted average, fodder production for the 15 year project period is 21,760 KgGW/ha/yr.

The value of tree fodder is considered higher than grass (Nr 3/25 KgGW), because it is more in demand during the dry period, has a higher TDN value than grass, and is more difficult to harvest.

Using the above figures, the fodder benefits are Nr 2,611/ha/yr. Above benefits were developed for the PFP. In addition to the tree fodder, it is anticipated that grass fodder will be produced and hand harvested between the trees during the first five year period. This will give an added benefit of Nr 40/ha/yr.

1/ Feasibility study of Integrated Rural Development Project in Mahakali Hills, APROSC - HMG/WBRD #1, Nov. 1978. Draft report of the Nepal Community Forestry Development Project, FAO/WB # 16/79 Nep 12 April 1979.

2. Fuel Wood

Current grass fodder production on the land proposed for the Panchayat forest fuelwood plantation is considered the same as for the fodder plantations: 700 KgGW/ha/yr or Nr 525/ha/yr. Fuelwood is valued at Nr 10/30 KgDW.[1/]

Fuelwood production in the Kulekhani, Gorkha and Lower Myagdi areas is estimated at 10MT[2/] in 8 years, 25MT in 14 years, and 60MT in 20 years. In the Upper Myagdi and Mustang areas, the production is considered at 10MT after 10 years, 25 MT after 18 years and 60 MT after 25 years.[3/] Taking a weighted average for the above, it would range from 4.90 to 8.86MT/ha. Based on the area of each, the weighted average is 7.73/ha/yr or Nr 1718/ha/yr.[5/] (The Upper Myagdi and Mustange areas comprise 28.5% of the total area). Additional values of Nr 40/ha/yr will be obtained from grass production for the first 5 years (see fodder).

3. Timber Production

It is estimated that a well managed forest site will range in yield from $9m^3$ to $16m^3$/ha/yr after 40 to 50 years.[3/] The average is considered to be $12m^3$/ha/yr after a 45 year period. If timber is valued at Nr 106.8/m^3[4/], then the managed forest value is Nr 1282/ha/yr.[5/]

Current production is $2m^3$/ha/yr or Nr 214/ha/yr, for a difference of Nr 1068 with project.

About half of the panchayat protected forests in the project area are meeting the current population woodland demands while the other half are not, and are beginning to disappear. Regarding these forests that are not meeting the demand, over half are not meeting 50% of the current population needs.

It is estimated that population demands will cause about 20% of the total forest to disappear in 15 years. Assuming that the present average growing stock is $40m^3$/ha and that the annual increment is $2m^3$/ha/yr then additional

1/ Government recognized value, 1m of air dry fuel weighs 600 Kg. (FAO report lists cattle dung and kerosene substitution value at Nr 22.5/30/Kg.)

2/ Green Weight; average density is estimated at 900 Kg/m^3.

3/ RCUP staff estimation and APROSC - HMG/WBRD #1 and FAO/WB #16/79 NEP 12 11 April 1979.

4/ Royalty Stump rate

5/ Thinning value included as part of yield.

benefits of Nr 498/ha/yr for timber or Nr 934/ha/yr for fuelwood may be claimed for 20% of the national and panchayat forest that are scheduled for management.

B. Soil Loss

Soil loss on unmanaged forest lands and lands proposed for forest planting is estimated at 32MT/ha/yr. With an improved forest program, the soil loss from erosion will be reduced to 6MT/ha/yr.

It is assumed that without project, the continued soil depletion will reduce forage fuel and timber production 1%/year. For the managed national forests and panchayat protected forests, it is estimated that production loss without the project is occurring at the rate of 0.2% of the current production per year. (See improved Pasture Development I B).

C. Decreased Labor Requirements

It is assumed that labor requirements to get fuel, fodder, and timber will be reduced at least 60% (See I C).

VI. ROAD STABILIZATION

Project Proposal - Kulekhani

Hydroseeding 24 ha., planting 25 ha., and drainage 2.0 Km.

An estimated soil loss of 150MT/ha/yr is presently occuring. With the project the soil loss can be reduced to 12MT/ha/yr.

Considering the 50 ha project area, 6900MT/yr is prevented from being lost. Assume that 33%[1/] or 2277MT/yr reaches the Kulekhani reservoir.

Expected benefits are unknown at this time; however, the sediment deposition in the Kulekhani reservoir will reduce the storage capacity and shorten its storage life. By reducing sediment yield to future reservoir sites, the project will make possible less-costly future reservoir designs.

A further assumption can be made that 33% of the road sediment is dropped on the cropland and will reduce crop production. If the deposition has an average depth of .05M on the cropland then 3.14 ha per year will be covered. It is assumed that 50% of the crop will be damaged. If the average annual gross crop value is Nr 3500/ha/yr, then the crop loss for the 3.14 ha is Nr 5500/yr.

The remaining 34% of the sediment will be deposited in the channel before it reaches the reservoir and may cause flooding or channel meandering. It is assumed that a 12 meter wide strip along the channel will sustain crop production damages each year. This would equal 1 ha per year or Nr 3500/ loss annually.

1/ Laban, Peter

VII. IRRIGATION

The benefits for irrigation provided by the project come from (1) increased net returns from more intensive cropping; (2) increased net returns from changes to higher value crops (for example, changing from ghaiya to paddy); and (3) increased net returns from higher crop yields.

Table 7 shows the estimated cropping intensity increases 0.52 crops per year when changing from rainfed crops to full irrigation and 0.36 when changing from rainfed to seasonal irrigation. If half the area irrigated by the project is fully irrigated and half is seasonally irrigated, the average cropping intensity for the land irrigated by the project would increase by 0.44 crops per year.

Table 8 shows the estimated land use, by percent for each crop, without and with the project. The portion of cropland used for crops with higher net returns is expected to increase with the irrigation provided by the project.

The estimated net returns for without project and with project conditions are shown in Table 8. The expected increases result from a combination of higher yields and higher percentages of higher value crops.

The weighted average estimated net value of production with the project is Rs. 989/ha/yr, and without the project it is 522. The increase attributed to project-provided irrigation is Rs 467/ha/yr.

The estimated increased cropping intensity is 0.44 crops per year, and the estimated net value of production increase is Rs 467/ha/yr. Combining increased yields and intensities, the estimated total increase in net return is 4.67 x 1.44 = Rs 672/ha/yr due to irrigation provided by the project.

VIII. TERRACE IMPROVEMENT

A. Proposed Project

Kulekhani 200 ha., Gorkha 500 ha., Myagdi 200 ha.

The areas selected for project implementation are terraced areas where crop yields are declining and where small landslides and sheet and gully erosion are occurring.

B. Crop Improvement[1/]

The current crop production for the above three areas is estimated at an average gross value of Nr 2500/ha/yr.[2/]

It is assumed that the specific proposed project areas are yielding 65% of average terraced area and thus the gross value of Nr 1875/ha/yr will be used.

With the project, it is assumed that the improved terrace lands will reach at least the average yield of the surrounding areas, which is considered as Nr 5997/ha/yr gross value.[3/] It is further assumed that 50% of this with-project increase on the project lands can be attributed to terrace improvement.

The gross value difference of Nr 2061/ha/yr can be considered a benefit for the proposed terrace improvement.

C. Soil Loss

It is estimated that 90% of the project implementation will be on sloping terraces that have a soil loss of 40 MT/ha/yr. which can be reduced to 13 MT/ha/yr with a project.

The remaining 10% of the project will be on level terraces where the soil loss is currently 12 MT/ha/yr. and which can be reduced to 6 MT/ha/yr.

Without the project, it is estimated that crop yields will be reduced by 1%/yr. Assuming that the current average annual gross value is Nr 1875, then the reduction would be Nr 19/ha/yr.

1/ This proposal is for 900 hectares and does not consider the other 51,000 hectares of cropland in the 4 catchment areas. Additional crop improvement benefits should be realized on the other crop land through an Extension Soil Conservation Program. This should amount to a 12 to 15% increase for the 15 year period or perhaps a 1%/yr.

2/ RCUP staff estimates a without project net average crop return of Nr 875/ha/yr or 35% of the gross.

3/ RCUP staff estimate.

D. Decreased Labor

The regrading and retreading of the terrace will decrease the labor required for maintenance. It is estimated that the labor requirements will be reduced by 25%. It is assumed that terrace operation will require the same time. If 10 man days per year are needed to maintain 1 hectare of terraces, then the project would save 2.5 man days/ha/yr. At Rs 7/man day, the savings are Rs 17.5/ha/yr.

IX. WATER DEVELOPMENT IMPROVEMENT[1/]

Project Proposal:

Spring development and improvement sites (White's proposal)

Spring development 400 sites (Carter's proposal)

Assume that these are different sites and that the total is 565 Projects.) Domestic and livestock benefits from water developments and improvements will come mainly from decreased labor and energy expended by humans and livestock.

Assume that a module of five families with 6 members each and owning 2.8 livestock units each that use each spring development. Also assume that 50% of the animals' water requirements are currently carried by family members.

Assume further that the current water hauling requirements are 3 hr/family/day or a total of 546 days/year/per module using a 10 hour day.

Assume with project that 30% of the water haulding labor requirements will be eliminated or a saving of 164 mandays/yr/spring.

With 565 springs, benefits of 92,660 man days labor savings could be obtained. At Rs 7/man day, the potential benefits are Rs 648,600 per year.

1/ Irrigation and other benefits beyond domestic and livestock water are not considered.

X. SEDIMENT DEPOSITION

Eroded soil will deposit itself and cause various types of damages. The reduction in these damages can be used as benefits with a project. There are three major locations where eroded soil is deposited: (1) areas close to where the soil becomes displaced and where the terrain slope is reduced, (2) within the drainage and stream channels, (3) in deltas, impoundments, and major river ways Laban [1/] reports that 33% of the sediment will be in the third category.

Assuming that eroded soil occurs in the project area according to the above, then it can be assumed that about 1/3 will be deposited near the eroded site, 1/3 deposited in drainage and stream channels within the catchment area and 1/3 will pass beyond the catchment area.

Table IX displays the depoited soil in the first and second category (see above). Several assumptions are made in developing the table and are listed in the footnotes.

If these assumptions are reasonably accurate, the expected benefits are Nr 1,370,800/year.

1/ Laban, Peter, Field measurement on erosion and sedimentation in Nepal, Sep. 78 IWN/WP/O.

XI. IMPOUNDMENT BENEFITS AND ADVERSE EFFECTS

A. Benefits

1. Reduction of Sediment Delivered to Stream Channels and Flood Plains Downstream from Impoundment Sites. If benefits are claimed for reduced sediment delivered to impoundment sites due to conservation land treatment in catchment areas of impoundment sites, impoundments can be designed with less sediment storage capacity. Benefits are of two types: reduction of infertile overwash (deposition) on agricultural land and reduction in flooding caused by sediment-choked channels.

Estimated magnitude of infertile overwash reduction benefits. Of the sediment leaving a site without an impoundment, an average of five to 15% will be deposited on agricultural lands downstream as infertile overwash of sands and gravels, permanently reducing the productive capacity of the land. If a deposition depth of 0.15 meters reduces the productive capacity of agricultural land by 75% (reducing net value of production to zero or less), each cubic meter of infertile deposition prevented will prevent a 100% net value of production loss on 6.7×10^{-4} hectares of land. If the average net return on floodplain agricultural land is \$115 per hectare per year, the yearly benefits from infertile deposition reduction may be calculated as follows:

$$\left.\begin{array}{l}\text{Annual}\\ \text{Net}\\ \text{Benefit}\end{array}\right) = 0.5^{1/} \times 0.1^{2/} \times (6.7 \times 10^{-4}) \times \$115 = \$.00385 \left(\begin{array}{l}\text{per cubic meter of}\\ \text{reservoir sediment}\\ \text{storage capacity}\end{array}\right.$$

For a typical reservoir such as the hypothetical site on Ludi Khola (catchment area 13.8 km^2), the estimated design sediment storage volume might be typically about 75 watershed millimeters[3/], or 1,017 m^3 for this site. Benefits for reduction of infertile overwash downstream from this site are estimated to be:

$$1{,}017{,}000 \text{ m}^3 \times \$.00385 \text{ annual benefit per m}^3 = \$3915$$

1/ Throughout the design life of the reservoir, an average of 50% of the total sediment storage capacity of the reservoir will hold sediment (0% at the beginning, 50% at midlife, and 100% at the end of the design life).

2/ Of the sediment prevented from moving downstream, an average of 10% is estimated to be potential infertile overwash.

3/ From Field Measurements on Erosion and Sedimentation in Nepal, Dept. of Soil & Water Conservation, September, 1978: Silt discharges from five measured areas in the Kathmandu valley ranged from 10.27 to 57.64 tons per hectare per year, with the average (weighted by area) being 21.91. At an estimated average density of 1.45 tons per cubic meter, this is equivalent to .0755 meters depth from a catchment area in 50 years, the estimated useful life of an impoundment.

This is equivalent to \$284 per km^2 of impoundment catchment area per year.

Estimated magnitude of channel sediment reduction benefits. Of the sediment passing a site without an impoundment, an estimated average of about 10% will be deposited downstream in the channel within the area where benefits are assessed. Without rather detailed studies of specific sites, it is not possible to accurately estimate the magnitude of benefits from reduced flooding by keeping sediment out of the channel. An evaluation of benefits that does not include channel sediment reduction benefits shows monetary benefits on the low side or being "conservative." These benefits are not estimated here because of lack of data.

2. Reduction of Peak Flood Flows. Benefits are reduction of damages to agricultural land (floodplain scour or erosion, land loss from stream/bank erosion, terrace damage, etc.), reduction of damages to improvements on the land (trails, bridges, fences, buildings, etc.), and secondary benefits (e.g., reduced interruption of farming operations, transport, and travel due to flooding). The major benefit is that of crop damage reduction. Other minor and secondary benefits may be estimated at about 15% of crop damage reduction benefits.

A typical impoundment that includes floodwater retention storage will eliminate channel flooding for a short distance downstream from the impoundment and the flood reduction will be diminished in proportion to the distance downstream. Flood damage reduction is also, in general, proportional to the portion of the catchment area controlled by impoundments compared with the total catchment area where benefits are being evaluated.

Without rather detailed hydrologic studies, flood damage reduction benefits cannot be accurately estimated. Flood reduction results from complex interactions influenced by the nature of storms, timing of peak flood flows, channel and floodplain conveyance capacities at various points in the flood damage area, and the locations and capacities of reservoirs. To formulate an efficient project of flood control using reservoirs, various combinations of reservoirs at different locations are studied to determine their effects on flood damages.

In selecting impoundment sites for this project, flood control efficiency will not be the only consideration. Other factors will be studied, such as geologic suitability of sites, accessibility for construction, and nearness to areas of water needs.

Assuming impoundment sites will be at locations that are somewhat less than optimum for flood control, and assuming a rather low concentration of impoundments, a rough, first-out estimate of flood damage reduction will be made for the Daraundi catchment area. The results are assumed to be applicable to other catchment areas.

A system of impoundments (in the size range of 20 to 50 surface hectares at normal pool elevation) is assumed to control 20% of the 597 km^2 Daraundi catchment area. The total catchment area controlled by impoundments would then be 120 km^2. Assuming only a moderate flood control efficiency for the impoundment system, a floodwater damage reduction of 25% is estimated.

Estimated magnitude of floodwater damage reduction benefits. The Daraundi catchment area average annual crop loss due to floodwater damage is estimated at $46,000 (Table X). A 25% reduction equals $11,500 crop damage reduction benefits. Adding 15% for miscellaneous and secondary floodwater damage reduction benefits yields $13,230 average annual flood control benefits. This is equivalent to $110 per km^2 of catchment area controlled by impoundments of $22 per km^2 of the total Daraundi catchment area.

Value of water storage. Water stored in impoundments may be used for various purposes: irrigation, fish production, domestic and livestock water supplies, hydroelectric power generation, etc. For estimating benefits, the value of water storage capacity for other purposes is assumed equal to the value of water storage capacity for irrigation purposes. The value of water storage capacity is assumed equal to the value of the same water volume used for irrigation. The water storage capacity of an impoundment is assumed to be filled and completely used once each year. Therefore the yearly benefit from water storage is assumed equal to the value of the same volume of water used for irrigation.

Estimated magnitude of water storage benefits. The value of water used for irrigation is assumed to equal the sum of three sources of irrigation benefits: (1) increased net returns form more intensive cropping; (2) increased net returns from higher crop yields; (3) increased net returns from changes to higher return crops (for example, changing from ghaiya to paddy).

Table VII shows the estimated cropping intensity increases 0.52 crops per year when changing from rainfed crops to full irrigation and 0.36 when changing from rainfed to seasonal irrigation. If irrigation water is used to provide half the irrigated area with full irrigation and half with seasonal irrigation, the average cropping intensity for the land irrigated by the project would increase 0.44 crops per year.

Table VIII shows the estimated land use, by percent, for each crop--without and with the project. The portion of cropland used for crops with higher net returns is expected to increase with the irrigation provided by the project.

The estimated net returns for without project and with project conditions are shown in Table VIII. The expected increases result from a combination of higher yields and higher percentages of higher value crops.

The weighted average estimated net value of production with the project is Rs. 989/ha/yr, and without the project it is 522. The increase attributed to project-provided irrigation is Rs. 467/ha/yr.

The estimated increased cropping intensity is 0.44 crops per year. The estimated increase in net value of production is Rs. 467/ha/yr for the same cropping intensity as without the project. Combining increased yields and intensities, the estimated total increase in net return is 467 x 1.44 = Rs.672/ha/yr due to new irrigation with the project.

The average irrigation water use is estimated to be 14,000 m^3/ha/yr for full irrigation and 9m000 m^3/ha/yr for seasonal irrigation. If half the irrigated area is fully irrigated and half the area is seasonally irrigated, the average water use is 11,500 m^3/ha/yr.

The value of water used as irrigation is therefore estimated to be Rs. 672 $\div$ 11,500 = Rs.0584/m^3.

For a hypothetical reservoir design in the Daraundi catchment, irrigation (or other) water storage capacity is estimated at from 613,000 m^3 to 1,402,000 m^3, depending on reservoir design and cost. The estimated benefit to be derived from this storage capacity is $3008 to $6880 per year. This is equivalent to $218 to $499 per km^2 of catchment area.

B. Adverse Effects

1. Downstream Erosion. With an impoundment to trap sediment, water leaving an impoundment site will contain less sediment than water without an impoundment. If the water leaving an impoundment contiaas less sediment than it is capable of carrying under the flow conditions, it will tend to

erode the channel through which it flows. If the stream channel is unable to resist the erosive force, it will be increased in size and/or altered in shape. A small amount of cropland could be lost to production due to channel erosion. Flooding would decrease because of an erosion enlarged channel.

It is estimated that both channel erosion and decreased flooding will be small, and that the benefit due to decreased flooding would offset the land loss due to channel erosion.

2. Loss of Agricultural Production on Land Occupied by Impoundments. This adverse effect is accounted for in the cost of the land occupied by impoundments.

C. Summary

Estimated yearly benefits per square kilometer of impoundment catchment area are summarized below:

Downstream sediment reduction ------------	$ 284
Flood control ----------------------------	110
Water storage ----------------------------	218[4/] to 499[4/]
Total ------------------------------------	$ 612 to 893

Table 1

Forage Production for Pasture & Range

Area	Ha.	Without Project		With Project	
		MTDW/ha 1/	NR/ha 2/	MTDW/ha 1/	NR/ha 2/
Kulekhani Lower Gorkha Lower Myagdi	5000	1.2	450	6.2	2325
Upper Mustang	1000	.14	52	0.5	180
Mustang Sub-alpine meadows	1000	3.0	1125	6.0	1815
Mustang cool temperature	1000	2.0	750	4.0	1500
Total	8000	6.34	2377	16.7	5886

1/ FAO unpublished report; Trisuli WRDP. FAO/IBRD, Vol. III, July 1974.
2/ Based on NR 1.5/20 kg green weight and dry weight being 20% of green weight.

Table 2

Soil Erosion Estimates 1/, 2/

Land Use	Metric Tons/Ha/Yr	
	Without Project	With Project
Range Land	35	7
Pasture	20	6
Trails	160	10
Critically Eroded Areas	200	15
(Range denudation, landslides)		
Forests	32	6
Terraces (Level)	12	8
Terraces (Sloping)	40	13
Roads	150	12

1/ Estimates based on field observation of Kulekhani and Gorkha project areas plus a review of resource reports and studies.
2/ Kandel, G. P., June 1978, Report on Suspended Sediments in Kathmandu Valley.

Leban, P., Sept. 1978, Field Measurement on Erosion and Sedimentation in Nepal.

Table 3

Labor Requirements for Livestock Forage & Water Needs 1/

	Without Project		With Project	
	Hours	NR 6/	Hours	NR 6/
Forage Hand Harvested	2545 2/, 3/	2482	886 4/, 7/	620
Herding While Grazing 5/	1820	1274	0	--

1/ Based on model unit for six cattle and two buffalo.
2/ Based on ½ of animal forage needs being hand harvested.
3/ Four hours to harvest 20 kg GW.
4/ One half hour to harvest 20 kg GW.
5/ Animals being grazed on pasture and range 50% of the time.
6/ Ten-hour day at NR 7/day.
7/ Based on all animal forage needs being hand harvested.

Table 4

Forest Project Overall Treatment

	Area in Hectares				
Treatment Type 4/	Kulekhani	Gorkha	Myagdi	Mustang	Total
National Forest Management	8,421	25,670	26,895	6,420	67,606
Panchayat-Protected Forest Management	1,750	7,165	3,155	1,943	14,013
National Forest Plantation 1/	430	3,715	4,080	2,380	10,605
Panchayat Forest Plantation Fuelwood 1/	397	1,431	821	484	3,133
Panchayat Forest Plantation Fodder 2/	397	1,431	821	477	3,126
Private Planting 3/	616 1/	1,706	585	193	5,422 5/
Demarcation	1,935	6,565	5,965	1,935	16,400
Nursery Establishment	7	29	14	10	60

1/ 2,500 trees planted/ha.
2/ 816 trees planted/ha.
3/ Computed on 816 trees/ha.
4/ Treatment includes weeding, thinning and casualty replacement.
5/ RCUP livestock staff propose 7,293 ha.

Table 5

Forest Improvement Benefits with Project[1/]

Project Treatment and Product[2/]	Area in Hectares	Value of Increased Field	
		Rs/ha/yr	Total Rs/yr (Thousands)
P.P.F. Fodder	3,126	2,651	8,287
P.P.F. Fuelwood	3,133	1,758	5,508
N.F.P. Timber[3/]	10,605	1,282	13,596
Private Planting[4/]	5,422	2,343	12,704
N.F. Management[5/]	67,606	1,865	126,085
P.P.F. Management[6/]	14,013	2,291	32,104
Total			198,284

1/ Raw data not adjusted for delayed accrual of benefits and other economic considerations.

Table 6

Forest Project Proposals by 5-Year Intervals

	Area, 5-Year Periods & Ha											
	Kulekhani			Gorkha			Myagdi			Mustang		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
National Forest Management	8,621	--	--	25,670	--	--	2,690	--	--	6,398	--	--
Panchayat Plantation Forest Management	1,500	250	--	3,415	3,750	--	1,600	1,500	--	943	1,943	--
National Forest Plantation	225	205	--	825	1,390	1,500	945	1,565	1,520	360	780	1,240
Panchayat Forest Plantation Fuelwood	136	240	30	139	720	582	86	433	302	65	215	206
Panchayat Forest Plantation Fodder	136	240	30	139	720	582	86	433	302	65	215	206
Private Planting	53	208	242	74	510	808	28	183	266	8	55	95
Demarcation	485	700	750	1,065	2,500	3,000	1,065	2,200	2,700	460	725	750
Nursery Establishment	7	--	--	17	12	--	10	2	2	8	1	1

Table 7

Estimated Cropping Intensity Increases Due to Irrigation[1/]

	Kulekhani		Gorkha		Myagdi		Mustang		4-Area Total or Average
	2/	3/	2/	3/	2/	3/	2/	3/	
Type of Irrigation									
Full	1.89	6	2.00	3	1.58	.25	1.54	6.0	
Seasonal	1.80	10	1.66	6	1.55	.8	1.40	.7	
Rainfed	1.73	9	1.15	5	1.32	9.5	1.00	1.6	
Wtd. Average	1.80	-	1.38	-	1.34	-	1.33	-	
Area in Hectares									
Cultivated	7,780		27,166		11,696		5,113		51,755
Fully Irrigated									1.634
Seasonally Irrig.									2,537
Rainfed									3,251
Average Intensity Calculation									
Fully[5/]	882		1,630		46		472		3,030
Average[6/]									1.85
Seasonal[7/]	1,400		2,706		145		50		4,301
Average[6/]									1.69
Rainfed[8/]	1,211		1,562		1,467		82		4,322
Average[6/]									1.33

Summary

1. Cropping intensity increase from rainfed to full irrigation equals 1.85 - 1.33 = .52 increase.
2. Cropping intensity increase from rainfed to seasonal irrigation equals 1.69 - 1.33 = .36 increase.

1/ Cropping intensity, percent irrigated, and cultivated area and irrigated area figures are without project.
2/ Cropping intensity.
3/ Percent of cultivated area under irrigation.
4/ Excludes fruit crops.
5/ Percent cultivated area under rainfed irrigation times cultivated area times cropping intensity.
6/ Total from line above divided by hectares irrigated.
7/ Same area as for rainfed (see footnote 6) but with increased cropping intensity due to full irrigation.
8/ Same area as for rainfed (see footnote 6) but with increased cropping due to seasonal irrigation.

Table 8

Estimated Cropping and Income Changes
on Cropland Due to Project
--Provided Irrigation on Land Is Currently Rainfed

Project Region and Tot. Cult. Land Area	Crop	% of Existing Rainfed Cropland		Net Value of Production (Rs/ha)		Weighted Average Net Value of Production	
		Without Project	With Project	Without Project	With Project	Without Project	With Project
Myagdi 11,696 ha	Corn	12.5	11.7	394	470		
	Ghaiya	7.5	--	30	--		
	Paddy	24	49.2	2,811	3,586		
	Wheat	4	16.6	200	1,004		
	Fallow	25	17.5	--	--		
	Millet	11	--	166	208		
	Pulses	11	--	550	652		
	Other	5	5	67	563		
	Total or Wtd. Avg.	100	100			719	1108
Mustang 5,113 ha	Barley	--	30	3,863	4,501		
	Buckwheat	30	25	915	1,181		
	Wheat	--	15	803	1,241		
	Fallow	65	15	--	--		
	Oil Seeds	5	5	252	331		
	Other	--	10	1,047	1,142		
	Total or Wtd. Avg.	100	100			288	790
Gorkha 27,166 ha	Paddy	5	48.3	2,385	3,318		
	Ghaiya	15	--	36	--		
	Wheat	5	30	200	481		
	Fallow	22.5	5	--	--		
	Corn	12.5	1.7	166	912		
	Oil Seeds	12.5	5	1,051	1,103		
	Millet	15	-	107	--		
	Barley	7.5	-	46	--		
	Pulses	--	5	1,557	1,655		
	Other	5	5	545	870		
	Total or Wtd. Avg.	100	100			327	812

1/ Total N.C.P. due to all project inputs.

2/ With all inputs except irrigation remaining the same as without project. (Irrigation is estimated to account for 30% of the total per hectare increase in net value of production with project.)

Table 8 (Continued)

Project Region and Tot. Cult. Land Area	Crop	% of Existing Rainfed Cropland		Net Value of Production (Rs/ha)		Weighted Average Net Value of Production	
		Without Project	With Project	Without Project	With Project	Without Project	With Project
Kulekhani 7,780 ha	Paddy	32.5	50	1,889	2,887		
	Fallow	20	5	--	--		
	Wheat	5	25	24	694		
	Oil Seeds	17.5	5	1,468	1,509		
	Corn	5	--	1,070	--		
	Millet	7.5	--	730	--		
	Pulses	7.5	--	836	--		
	Ghaiya	5	--	36	--		
	Potato	--	15	4,941	6,886		
	Total or Wtd. Avg.	100	100			1,057	1,558
Weighted Average for Four Project Areas						522	989

1/ Total N.C.P. due to all project inputs.

2/ With all inputs except irrigation remaining the same as without project. (Irrigation is estimated to account for 30% of the total per hectare increase in net value of production with project.)

Table 9

Estimated Crop Losses from Sediment Deposition

.sting Land : on Proj. :ated Areas	Range Improvement	Pasture Improvement	Forest Improvement	Sloping Terraces	Level Terraces	Critical Areas	Trail Improvement
:a in ha.	5,200	6,200	103,905	810	90	120	3
›sion without 'roject[1/]	35	30	32	40	12	200	160
›sion with 'roject[1/]	7	6	6	13	8	15	10
›sion ₹eduction[1/]	28	24	26	27	4	185	150
›sion ₹eduction[2/]	145,600	148,800	2,701,530	21,870	360	22,220	450
;ED. DEPOSITION:							
Range and 'asture	15	15	15	15	0	15	15
Cultivated ,and	18	18	18	18	33	18	18
Stream :hannels	33	33	33	33	33	33	33
: of Project ›rea	34	34	34	34	34	34	34
). DEPOSIT. VOL.:							
Range and 'asture[3/]	15,100	15,400	279,500	2,260	0	2,300	47
Cultivated ,and[3/]	18,100	18,500	335,400	2,710	80	2,800	56
Stream :hannels[3/]	33,100	33,900	614,800	4,980	80	5,100	102
)P DAMAGE:							
Range and 'asture[4/]	7.6	7.7	139.8	1.1	0	1.2	0.02
Cultivated ,and[5/]	36.2	37	671	5.4	0.2	5.6	0.11
m Stream 'loods[6/]	6.6	6.8	122	1.0	0.02	1.0	0.02

(Continued)

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Table 9 (Continued)

ısting ɜ on Project ɜated Areas	Range Improvement	Pasture Improvement	Forest Improvement	Sloping Terraces	Level Terraces	Critical Areas	Trail Improvement
ɪ.P.[7/]:							
Range and Pasture[8/]	1,080	1,080	1,080	1,080	1,080	1,080	1,080
Cultivated Land[8/]	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Flooded Land[8/]	2,500	2,500	2,500	2,500	2,500	2,500	2,500
ɪ.P. LOSS:							
Range and Pasture[9/]	12,310	12,470	226,480	1,780	0	1,940	30
Cultivated Land[10/]	45,250	46,250	838,750	6,750	250	7,000	140
Flooded Land[10/]	8,250	8,500	152,500	1,250	30	1,250	30
:al Losses[12/]	65,810	67,200	1,217,730	9,780	280	10,190	200
:al Losses[13/]	5,530	5,650	102,290	820	20	860	20

Metric tons per hectare per year.
Total tons per year.
Cubic meter per year at 1.45 tons per m^3 average density.
Hectares per year at 0.20 m average deposition depth.
Hectares per year at 0.05 m average deposition depth.
Hectares per year with 1 m^3 sediment causing 2 m^2 flooding every two years.
Gross value of production.
Rs. per hectare per year average.
Rs. per year at full crop loss first year and half crop loss second year.
' Rs. per year at half crop loss for one year.
' Full crop loss every two years (or half crop loss each year).
' Rs. per year average.
' Dollars per year average.

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Table 10

Estimated Flood Damages
in the Daraundi (Gorkha) Catchment Area

Total land flooded from major stream = 685 ha.

Frequency of flooding estimates:

80% chance of flood (crops 1 year in 5):	10% of area =	68.5 ha.
67% chance of flood (crops 1 year in 3):	30% of area =	205.5 ha.
50% chance of flood (crops 1 year in 2):	60% of area =	411.0 ha.
		685.0 ha.

Calculation of average net returns per ha. of land subject to flooding (when crops are not flooded):

Wheat:	38% improved at Rs. 373/ha/yr	= Rs.	142
	62% local at Rs. 127/ha/yr	=	79
	Total (Wheat)	= Rs.	221/ha/yr
Rice:	11% improved at Rs. 2,584/ha/yr	= Rs.	284
	89% local at Rs. 1,773/ha/yr	=	1578
	Total (Rice)	= Rs.	1862/ha/yr

Estimated 30% flooded crop is wheat and 70% is rice:

30% x Rs. 221 + 70% x Rs. 1,862 = Rs. 1,370 = $115/ha/yr

Calculation of average annual loss of net returns due to floods (based on frequency of flooding):

0.8 chance of loss x 68.5 ha x $115/ha	= $	6,302
0.67 chance of loss x 20,505 ha x $115/ha	=	15,834
0.5 chance of loss x 411 ha x $115/ha	=	23,633
Total average annual crop loss	$	45,769
	Use $	46,000

Table 11

Summary of Estimated Project Benefits[1/]

Project Activity and Quantity	Benefits in Thousands of Rupees Per Year: Increased Production	Decreased Soil Loss	Decreased Sediment Deposition	Subtotal	Decreased Labor
Pasture Improvement (6,200 ha.)	11,691.8[3/]	27.9	67.2	11,786.9	2,094.6[4/]
Range Improvement (5,200 ha.)	430.0	33.2	65.4	528.8	171.8
Trail Improvement (2.8 ha.)	-	11.3	0.2	11.5	1.7
Critical Area Treatment (120 ha.)	-	55.0	10.2	65.2	-
Forest Improvement (103,905 ha.)	198.3	24.3	1,217.7	1,440.3	-
Terrace Improvement (900 ha.)	1,854.9	18.6	10.1	1,883.6	15.8
Road Stabilization (50 ha.)	-	-	9.0	9.0	-
Water Developments (565 developments)	-	-	-	-	648.6
Irrigation (1,122 ha.)	754.0	-	-	754.0	-
Total	14,929.0	170.3	1,379.8	16,479.3	2,932.5

1/ Benefits are estimated to be the same each year for the 15-year evaluation period. The useful lines of the improvements are expected to be more than 15 years. Impoundment benefits are not included.
2/ At seven rupees per 10-hour day.
3/ 11,625.0 increased forage production and 66.8 increased milk production.
4/ 1,950.2 hand harvesting savings and 144.4 herding labor savings.
5/ 351.0 increased forage production and 79.2 increased milk production.
6/ Herding labor savings.

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PART II

PROCEDURES, METHODOLOGY AND STAFFING FOR RCUP SOIL SURVEY PROGRAM

Table of Contents

PART II

PROCEDURES, METHODOLOGY AND STAFFING FOR RCUP SOIL SURVEY PROGRAM

Preface

This report lists and explains soil survey operational procedures which are unique to the requirements of the RCUP and to the working arrangements between the Division of Soil Science and Agricultural Chemistry, APROSC, and Forest Resources Survey Office.

The procedures and methodology for the RCUP soil surveys that are briefly outlined in this report will serve as a building block for developing a more comprehensive procedures handbook during the training and early implementation stages of the survey. Soil survey procedures outlined in the USDA National Soils Handbook and USDA Agricultural Handbook No. 18, 1951, and subsequent revised chapters, should be consulted and followed as a general guide in cases not addressed by this report. In addition, each soil scientist concerned with field mapping should be familiar with the principles of airphoto interpretation and characteristics of airphotos as outlined in another USDA-Soil Conservation Service publication, Agricultural Handbook No. 294, Aerial-Photo Interpretations in Classifying and Mapping Soils, 1966.

Comments and suggestions from Purna L. Maharjan, in charge of the soil survey, Department of Agriculture, and Dr. A. B. Karki, Govind Sharma, and Chiranjivi Sharma, soil survey team, APROSC, and Kedaar Prajapati, Forest Resources Survey Office, were quite valuable in drafting this report.

I. PREAMBLE

The Resource Conservation and Utilization Project which is under design by APROSC/SECID team for HMG and USAID is an attempt to attack the critical and complex problems of resource conservation and utilization through a series of integrated technical plans designed for local adaptation.

The increase in population within the last three to four decades has placed many burdens on agriculture. The result of this pressure on agricultural land is that more intense and varied uses of land are being made by farmers. As the pressure for land increases, many situations develop where soil capabilities are not commensurate with the uses being made of them. In order to plan wisely for the future allocation of land and to efficiently utilize its maximum capability, it is necessary to obtain an inventory of soil resources of Nepal.

Farmers are aware that certain soils on their farms possess different properties affecting lime and fertilizer responses, drainage, erosion potential and productivity for crops, pasture and forest. Many of the properties of soils which determine their characteristics are readily apparent to the soil scientist. A knowledge of these properties allows him to predict the behavior of a soil under various conditions.

Soil surveys are made for a number of practical purposes. Among the common objectives are rural land classifications for rainfed and irrigated crop production; land appraisal; selection of new lands for settlement; land-use planning at local, regional and country levles; assessment of potentialities of special crops; forest management; and designing and constructing airports, highways, urban and industrial structures; waste disposal facilities and recreational developments.

An effective and useful soil survey is designed to meet the specific objective for which it is organized and funded. The basis for design is the list of soil interpretations and their refinement or precision required to satisfy the survey objective.

Soil surveys correctly designed and carried out will be sought after eagerly by all who plan and manage the earth's soil resources.

II. OPERATIONS

A. Memorandum of Understanding

Soil surveys and related work are carried out cooperatively with other agencies in HMG, and other agencies involved in resource related projects. Procedures for coordinating soil surveys of cooperating agencies will be developed by cooperative arrangement and "memorandum of understanding." The memorandum of understanding serves to record the purpose of the soil survey, describe the area, list cooperators and their responsibilities, and set down specifications for making, interpreting, and publishing.

The draft of the memorandum of understanding is reviewed by the cooperating agencies, then prepared in final form and signed by appropriate officials of the cooperating agencies.

A new memorandum of understanding is needed when a significant change is made in the work area, i.e., area to be mapped is changed, purpose of inventory is changed or publishing plans are changed. (See attachment #1, Draft Memorandum of Understanding for cooperating agencies in Nepal.)

B. Management

Operation and management of soil inventories has as a major objective to ensure that high quality soil surveys are made for the lowest possible cost. Activities for management include: (1) determining workloads; (2) determining work flow; (3) scheduling; and (4) following up on goals and changing priorities.

Soil surveys are made in a progression of steps graphically illustrated by a soil survey flow chart (see Attachment #2).

III. PREMAPPING ACTIVITIES

A. Plan of Soil Survey Activities.

A plan of soil survey operations should be prepared for each of the four project areas. Each plan outlines the work to be done and an estimate of the time to complete it, including goals for both mapping and supporting soil survey activities such as soil survey investigations and laboratory tests that are to be made during the course of field mapping operations, as well as for training of new soil scientists.

In developing a plan of operations, considerations should be given to:

1. Coordinating woodland, range, biology and engineering with soil surveys;
2. Maintaining scientific and cartographic quality;
3. Training soil scientists (both participant training and on-the-job training); and
4. Training users of soil surveys, both within and outside of RCUP and DSWC, so that use will be made of the information assembled in soil surveys.

B. Preparing Field Sheets

Base maps for progressive soil surveys are primarily of two kinds: (1) rectified photobase maps (high-altitude photography) and (2) orthophoto base maps (high-altitude photography) with displacement of images removed.

Clean all field sheets with a solvent such as Robinol so that drawn lines and symbols will adhere to the photo service.

All photos should be indexed and stored flat, either vertically or horizontally. Photos to be used for field sheets should have the following kinds of annotation:

1. Soil survey boundaries;
2. Match lines and areas to be mapped;
3. Matching photos should be identified along flight lines and across adjacent flight lines; and
4. Stamped on the back for survey area, scale, surveyed by, and date.

A small-scale index map which can be copied should be made. An index map can serve as a base map in plotting progress in mapping.

Topographic maps published by the government of India are available in RCUP files. Elevations, relief, aspect and drainage are examples of many of the kinds of land-form analyses that are made from these maps. In addition, they are useful in plotting geographic locations as reference data on field sheets.

C. Reference and Background Materials

Before the start of the preliminary field study, all available reference materials dealing with soils, geology, climate, vegetation, and agriculture is collected, reviewed and summarized.

Land use information and trends are helpful in the design of mapping units.

Use of reference material increases accuracy and efficiency of soil surveys. Kinds of reference material to search for are:

1. Older soil surveys of survey area;
2. Soil surveys of adjoining areas;
3. Major land resource maps;
4. General soil maps;
5. All available air photo or remote sensing imagery;
6. Topographic and slope maps;
7. Maps and texts on geology and geography;*
8. Maps and texts on water resources;
9. Maps and texts on vegetation and land use;
10. Climatic maps and data;
11. Census reports;
12. National, regional or district land-use plans and regulations;
13. Project work plans;
14. Bulletins and reports of agriculture research;
15. Those of college or university students;
16. Scientific and technical journal articles; and
17. Forest inventories;

*Geology maps, legends, descriptive materials and analysis results often require reinterpretation to be adopted as input to a soil inventory. The RCUP staff geologist has the responsibility to provide expert guidance and to work closely with the RCUP soil scientists in evaluating the data in terms that relate directly to soil survey and interpretations for RCUP. Their primary concerns in this evaluation will be the lithology and composition of soil forming materials, geomorphic processes, stability of sloping soils, ages and relationships between present and past weathering surfaces within the region.

D. Equipment for Soil Surveys

A general listing would include:

1. Pens--rapidiograph, 00, 0, 1, 2.
2. Ink--Koh-i-noor type or Pelikan
3. Soil sampling tools

bucket auger	field PH kit
soil probe	spot plates
tile spade	munsell color book
chisel pointed pick	soil analysis portable field lab
altimeter	soeves
planimter	soil thermometer
clinometer	stereoscope, pocket
compass (magnetic)	stereoscope, mirror-type
hand lens	soil sample bags

Soil laboratory equipment labs will need some updating of supplies and equipment to accomplish soil characterization studies.

E. Initial Field Reconnaissance

Active participants should include the RCUP field soil scientist, APROSC soil scientist, as many of the survey crew as possible, and specialist in forestry, range and geology. The reconnaissance work should be guided by the basic purpose of the RCUP and the interpretations of the soil survey that are required to meet the needs of RCUP.

Survey crews should discipline themselves to take good, complete field notes. They should not hesitate to record commonplace relationships among soils, soil-forming factors or soil behavior, as well as the unusual. Readily observable relationships are frequently forgotten when field notes are not made.

The geologist will assemble all existing information and geologic maps for the survey area. High altitude photography and topographic maps will be used to develop recognition keys to identify surfacial geologic materials and landforms, and relate them to the occurance of soil materials. The geologist and survey crew should spend enough time in the field to check the validity of these relationships. The field soil scientist should make certain all members of the survey crew understand the significance of these relationships and how to identify them on the ground and on airphotos or topographic maps.

Members of the field crews should not limit their observations to soil landform relationships during the initial investigative phase. They should be aware of the various farming, forestry and pasture management practices in the survey area and how soils are affected by them and vice versa. Also, vegetative types and relationships to soils and landforms should be observed and documented to assist in mapping and determining potential productivity.

F. Design of Mapping Units

The field soil scientist will coordinate the reconnaissance inputs from the forester, other soil scientists, range specialists and geologists. He should also encourage participation by user groups, RCUP field and supervisory personnel, DSWC personnel, extension specialists and agents and soil conservation committee members concerning the kinds of information they need for good conservation practices.

A mapping unit is a kind of soil area that is defined and described in terms of a related set of soil properties and other associated characteristics. It is sufficiently different in use and management and/or potential productivity from all other soil areas to be uniquely identified on the soil map. Each individual soil area that is shown and symbolized on the soil map is a soil delineation. A soil-mapping unit consists of the aggregate of all soil delineations identified as the same by a common symbol and name. The minimum size delineation for contrasting soils or miscellaneous areas (rock outcrop, etc.) will be of a size that will satisfy the needs of the users (final map scale, decided by an interdisciplinary group, will largely determine minimum size of delineations, probably in the area of one to two hectares). Spot symbols are used on soil maps to indicate contrasting soils or miscellaneous areas less than one hectare in size.

Knowing what interpretation will be required for the survey area plus the background information from existing studies and the information from the initial field reconnaissance, soil scientists, foresters, range specialists, geologists and engineers can begin to design mapping units for the survey. It will be the responsibility for the field soil scientists to identify and describe the taxonomic units and phases, inclusions, etc. that make up the soil component of the mapping unit. The geologist will be responsible for schematic maps and diagrams of various soil landscapes and the identification and description of landforms. Foresters and range specialists will have primary responsibility for the range and forestry practices. Engineers will assist in interpreting engineering uses of soils in the survey area.

Mapping units designed by this procedure should be considered tentative. The mapping unit should undergo considerable fieldtesting to determine their mapability, especially in terms of reliability of delineations. Enough areas should be mapped during this testing phase to determine complexity of mapping-unit patterns and the kinds and extent of inclusions. This information is required to assess the need to design complex mapping units or arrange for special symbols.

IV. FIELDMAPPING PROCEDURES

Basic field procedures and mapping techniques used in the RCUP surveys are outlined in the Revised USDA Soil Survey Manual.

A. Initial Field Review

A field review will be scheduled after the tentative mapping legend has been fieldtested.

B. Descriptive Legend

To satisfy the objectives of both the RCUP and The National Soil Survey Program, the descriptive legend must provide the following information: (1) the description and data required to identify, classify and correlate the soils; (2) identification legend; and (3) conventional and special symbols legend.

1. Description and Classification of Soils

Description and classification of the soils are required in each soil survey.

The taxonomic unit description should: (1) describe the setting and give a few of the major features that characterize the unit; (2) name a few taxonomic units in the survey area that are morphologically similar to or geographically associated with the unit being described; (3) describe the pedon in technical terms; and (4) give the range in characteristics for the series as it occurs in the survey area.

Mapping-unit descriptions should include describing the setting and giving a few of the major features that characterize the soil: (1) soil features include depths, slope (name), drainage class, special surface features (stones, rock outcrops, coarse fragments, gullies, dissections, erosion effects), size and shape of individual areas; (2) setting includes slope charactersistic (configuration, length, pattern eveness, aspect) and position on the landscape; (3) describe the soil in nontechnical terms; (4) give mapping inclusions by percent or size and location in the landscape; (5) give important soil properties and qualities such as permeability, AWC runoff, tilth, shrink-swell potential, root zone depth, reaction, organic matter content, natural fertility, seasonal highwater table, unusual plant nutrient deficiencies or poor response to soil amendments; (6) give use and potential use; (7) discuss management of the soils for relevant uses--give suitability, major hazards, management problems and practices to help overcome them for cropland, pasture, forest and range; and (8) discuss these soils potential for some important engineering uses and give cause of limitations plus suggest ways to help overcome limitations.

2. Identification Legend

The identification legend (consisting of a list of symbols to identify the soil mapping units plus the name for each mapping unit) is prepared and approved during the initial field review. The legend is prepared from mapping units proposed by the field soil scientist during test mapping and verified during the review. All mapping units must be described before they can be approved and included as part of the legend.

3. Conventional and Special Symbols Legend

A list of conventional symbols to identify man-made works and structures, boundaries and drainage, and a list of special symbols to identify areas of soil, special features or kinds of miscellaneous areas that are too small to be delineated at the scale of mapping.

C. Security Negatives

Completed field sheets should be sent to the topographic survey department on a routine basis for copy as security negatives. The number of uncopied field sheets that are kept in the field office file should not exceed three months mapping. The original field sheets and a copy will be returned to the project office after security negatives are made.

D. Field Procedures

Revised Soil Survey Manual and Agricultural Handbook 294 cover basics of field survey operations and procedures and air-photo interpretations.

V. SAMPLING SOILS

Soil sampling is a continuing process from beginning to end of a field survey. Soils are identified, characterized, classified and behavior predicted on the basis of the data from selected samples, observations and experience.

A. Taxonomic Units

Taxonomic units should be described and sampled over the geograhpic range within a survey area. Complete a detailed soil description on each pit and keep it in a reference file. This kind of information is needed in assessing the environmental factors on productivity and reliability of the mapping unit to reflect productivity.

B. Soil Samples

Soil samples obtained in bulk from representative sites can be used for several kinds of analyses during the course of the survey. The field survey leader should develop a laboratory work plan for systematic soil sampling as early as possible. The initial review is a good time to initiate a sampling program. Much followup time can be saved if representative pits are sampled properly when they are open.

C. Sample Size

A minimum of 1.5 liters is needed for bulk samples for tray display, correlation and laboratory analysis. The laboratory will require one liter for complete characterizations. Single determination for specific purposes may require 0.5 liters or less.

D. Drying and Storing

Bulk samples for correlation and local use should be air dried as quickly as possible in a dry, well ventilated room.

E. Identification

All samples should be identified by soil, location, date of collection and keyed to a detailed soil profile description that includes the soil landscape description. Soils stored in bags or containers should have labels on the outside and a card identification in the bag or container.

G. Labeling Soil Samples

Soil samples will be labeled by a standard system. The label includes the year in which the sample is collected, the location, the individual pedon and the soil horizon. Example: S79 KUL 3-5 identifies a special sample collected in 1979 from Kulekhani and the sample is the third pedon of the series of special samples taken in 1979 and the fifth horizon sampled.

H. Bagged Samples

Soil samples in bags or other containers should have a tag inside the bag or container and a tag attached to the outside. The tag should have the following sample identification information:

1. Sample number (S79 KUL 5-1);
2. Soil name (Chiltang silt loam); and
3. Horizon and depth (A2--0--15 cm).

VI. DETERMINING INTERPRETATIONS

Soil interpretations are developed for the uses expected to be important or potentially important to users of soil-survey information. The following listing gives types of interpretations that can be developed for detailed planning purposes:

1. Use and management of the soils;
2. Yields per hectare of crops and pasture;
3. Land capability classification by major management concerns of erosion, wetness, soil-related problems and climate;
4. Rangeland productivity and characteristic plant communities;
5. Woodland management and productivity;
6. Woodland understory vegetation;
7. Wildlife habitat potentials;
8. Recreational development;
9. Engineering properties and classifications;
10. Physical and chemical properties of the soils;
11. Soil and water features, e.g., hydrologic group, flooding, high water table, etc.
12. Sanitary facilities;
13. Building site development;
14. Construction materials, e.g., roadfill sand, gravel, topsoil; and
15. Water management, e.g., pone reservoir areas, embankments, dikes and levees, drainage, irrigation, terraces, diversions and grassed waterways.

VII. SOIL SURVEY ORGANIZATION

The RCUP staff provides administrative and technical direction and coordination to field-survey crews working in the four areas. The RCUP staff also coordinates the survey program with the Department of Agriculture, Department of Forests, Department of Soil and Water Conservation, APROSC, and other RCUP technical and operational support personnel.

The soil scientist advisor is responsible for the overall administration and direction of the soil-survey program. He coordinates and directs the design, development, implementation and operation of the RCUP soil survey.

Soil-survey field crews have as soil survey coleaders HMG and Peace Corp BSc graduates. One junior technician assistant is assigned to each crew. The organizational structure of the survey crews and their relationships to the RCUP staff are outlined in the RCUP soil survey organizational chart (Attachment #3).

Attachment #4 gives information on the soil survey costs.

Attachment #1

MEMORANDUM OF UNDERSTANDING

BETWEEN

DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

DEPARTMENT OF AGRICULTURE

AND

AGRICULTURAL PROJECTS SERVICE CENTER

MINISTRY OF FOOD AND AGRICULTURE

AND

THE FOREST RESOURCES SURVEY OFFICE

DEPARTMENT OF FORESTRY

AND

DEPARTMENT OF SOIL AND WATER CONSERVATION

MINISTRY OF FORESTRY

RELATIVE TO SOIL SURVEYS

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding is between The Department of Soil and Water Conservation, hereinafter called The Department; The Division of Soil Science; The Forest Resources Survey Office, hereinafter called The Forestry Resources Office; and The Agricultural Project Services Center, hereinafter called The Service Center.

This Memorandum recognizes the joint and individual responsibilities of the four parties in making cooperative soil survey in Nepal. These surveys are part of the National Soil Survey Program. Soil surveys as used in this memorandum include the determination of important characteristics of soils; the classification of soils into defined and described taxonomic units; the establishment of the limits of these taxonomic units; the plotting of the soil boundaries on maps; the description and correlation of these map units; the interpretation of the maps and other data obtained in the surveys; the publication of the maps; the publication of reports; and investigations in soil genesis, morphology and classification.

General Purposes

Soil surveys are needed to determine accurately the nature, distribution and extent of the various kinds of soils. They contribute to a knowledge of the soil resources of Nepal. Combined with the information on the properties, interrelationships and behavior of soils obtained through research and through the experience of engineers, farmers, range specialists, forest land managers and others, they provide a geographical basis for efficient and prudent use of soils. They provide data on which to base decisions for planning in both urban and rural areas.

This Memorandum is to:

1. Provide for cooperative efforts in the development and utilization of soil surveys in Nepal;
2. Assure that all phases of the soil survey program, including that for forested lands, are given adequate attention; and
3. Strive for maximum utilization of resources of all parties working toward a common goal.

It is MUTUALLY AGREED that:

1. Soil surveys are to be made cooperatively according to sound scientific and technical standards in accord with a national system of soil classifications, correlation and nomenclature as developed by The National Soil Survey Program;
2. All new cooperative soil surveys conducted in Nepal by the parties to this Memorandum shall be carried out in accordance with procedures contained in this Memorandum. When soil surveys are initiated outside the procedures contained in this Memorandum, the initiating agency shall inform the other signatories to the Memorandum of such plans before the survey is started;
3. Parties to this Memorandum shall expedite soil surveys made within the terms of the Memorandum and will seek to continually improve their quality and usefulness to the end that the resources available for soil surveys will make the maximum contribution feasible to all potential users, including farmers, land use planners, engineers, sanitarians, land appraisers, land developers, recreation and park planners, architects, foresters, range specialists, wildlife specialists and others;
4. Parties to this Memorandum shall cooperate in establishing and updating priorities of areas needing soil surveys and in scheduling surveys according to agreed upon criteria, including adequate lead time;
5. Parties to the Memorandum will cooperate in keeping soil survey activities within the framework of The National Soil Survey Program, including soil correlations and interpretations.
6. Parties to this Memorandum shall cooperate in initial, progress and final soil-survey field reviews and in legend review in progressive survey areas according to their interests or degree of participation in the survey;
7. All parties to this Memorandum will cooperate in informing the public regarding progress of soil survey operations and about the use of published soil surveys;

8. All parties to this Memorandum will cooperate in the preparation of educational materials such as brochures, pamphlets, circulars, and similar material about soils and their use;
9. This Memorandum of Understanding is to define in general terms the basis on which the agencies concerned will cooperate and does not constitute a financial obligation to serve as a basis for expenditures. The responsibilities assumed by each of the cooperating parties are contingent on funds being available from which expenditures may legally be made. Each party will administer its own funds in accord with its rules and regulations;
10. Parties to this Memorandum shall be free to use in official correspondence any of the results obtained in the surveys made under this agreement giving due credit to the other agencies. Publications may be independent or joint as agreed upon. In case of failure to agree as to the manner of publication or to the interpretation of results, any of the cooperating agencies may publish data or reports after due notice and submission of the proposed manuscript to the others. In such instances, the agency publishing the data will assume full responsibility for any statement on which there is a difference of opinion;
11. Adminstrators from each agency signatory to this Memorandum will appoint apprppriate staff members to constitute a technical committee and meet at least once each calendar year. Members of the staffs of these agencies and other interested people shall also be invited to participate. This technical committee will act on matters incident to the purpose of this Memorandum; will consider recommendations for meeting the needs of users of soil-survey information; and will appoint advisory committees as needed. Each year the committee will elect its chairman. The committee will review progress of the soil survey program and present annual plans, with schedules, and make recommendations for improvement of the overall program; and
12. This Memorandum of Understanding shall become effective when signed by all signatories and shall remain in effect indefinitely, but may be modified by mutual agreement among the parties in writing. It may be discontinued at the request of any party. Requests for termination or any major change shall be submitted to the other parties not less than 60 days in advance of the effective date desired.

Under the PROVISIONS OF THIS MEMORANDUM, THE DIVISION OF SOIL SCIENCE AGREES:

1. Provide leadership in soil characterization by providing facilities, supplies and personnel for procuring laboratory data in Nepal, in addition to that provided by The Department and Forest Resource Office as needed for interpretations, classification and correlation.
2. Provide leadership in soil correlations and interpretations within The Division of Soil Science soil-survey areas in preparation of standard soil-series descriptions and interpretation sheets and preparing soil survey manuscripts for publication, all in cooperation with the signatory agencies;
3. Provide leadership in carrying out the initial, progress and final field reviews within The Division of Soil Science in cooperation with the other agencies of this agreement;
4. Provide leadership in the development and amendment of the mapping legend for each Division of Soil Science survey being surveyed cooperatively within the standards of The National Soil Survey Program;
5. Provide leadership in and cooperate with other agencies in informing the public regarding progress of soil-survey operations and about the use of published soil surveys;
6. Provide leadership and cooperate with other agencies in the preparation of educational materials such as brochures, pamphlets, circulars and similar material about soils and their use;
7. Cooperate in establishing and updating priority lists of soils to be studied for charcterization or special studies;
8. Cooperate in the development and amendment of the mapping legend for each progressive survey being conducted cooperatively within the standards of The National Soil Survey Program.
9. Cooperate in preparing soil profile descriptions and mapping unit descriptions and in the sampling of soils for research, educational and interpretive purposes; and
10. Provide training for soil scientists employed by The Division of Soil Science and other agencies as appropriate.

Under the PROVISIONS OF THIS MEMORANDUM, THE FORESTRY RESOURCES OFFICE AGREES TO:

1. Provide leadership in assembling soils and productivity information for Nepal soils with the goal of improving the standards and guidelines for soil survey in forested areas and providing the best possible woodland interpretations;
2. Cooperate in soil characterization studies to identify soil features that are predictive of forest production and mangement opportunities and by providing facilities and personnel for procuring laboratory data for forest soils in addition to that provided by The Division of Soil Science and The Department;
3. Provide leadership in the development and amendment of the mapping legend for each progressive survey in forested areas being surveyed cooperatively within the standards of The National Soil Survey Program;
4. Cooperate in preparing soil-profile descriptions and mapping-unit descriptions and in sampling of soils for research, educational and interpretive purposes;
5. Provide leadership in the preparation of interim and final soil survey reports for soil surveys in forested areas;
6. Provide training for soil scientists employed by the Forestry Resources Office and other agencies as appropriate;
7. In His Majesty's Government's National Forests, cooperate with other parties to this Memorandum in the development and amendment of the mapping legends, within the standards of The National Soil Survey Program;
8. Cooperate with other parties to this Memorandum in all other aspects of soil survey operations, including the preparation of soil survey manuscripts and soil correlation;

Under the PROVISIONS OF THIS MEMORANDUM, THE SERVICE CENTER AGREES TO:

1. Provide leadership in The Service Center soil surveys in carrying out the initial, progress and final field reviews in cooperation with the other agencies to this agreement;
2. Provide leadership in soil correlations and interpretations within The Service Center soil survey areas in the preparation of standard

soil-series descriptions and interpretation sheets and preparing soil-survey manuscripts for publication, all in cooperation with signatory agencies;

3. Develop work plans and amendments when needed for Service Center areas being surveyed, within the standards of The National Soil Survey Program;
4. Provide leadership in the development and amendment of the mapping legend for each Service Center survey being surveyed cooperatively within the standards of The National Soil Survey Program;
5. Provide leadership in training soil scientists employed by The Service Center and other agencies as appropriate;
6. Cooperate in establishing and update priority lists of soils to be studied for characterization or special studies;

Under the PROVISIONS OF THIS MEMORANDUM, THE DEPARTMENT AGREES TO:

1. Provide leadership in Resource Conservation and Utilization soil surveys in carrying out the initial, progress and final field reviews in cooperation with the other agencies to this agreement;
2. Provide leadership in soil correlations and interpretations within Resource Conservation and Utilization soil-survey areas in the preparation of standard soil-series descriptions and interpretation sheets, and preparing soil-survey manuscripts for publication; all in cooperation with signatory agencies;
3. Develop work plans and amendments when needed for Resource Conservation and Utilization areas being surveyed within the standards of The National Soil Survey Program;
4. Provide leadership in the development and amendment of the mapping legend for each Resource Conservation and Utilization survey being surveyed cooperatively, within the standards of The National Soil Survey Program;
5. Provide leadership in training soil scientists employed by Resource Conservation and Utilization and other agencies as appropriate;
6. Provide leadership in encouraging district soil and water conservation committees through The National Soil and Water Conservation Committee to support the soil survey and its uses;

7. Cooperate in establishing and updating priority lists of soils to be studied for characterization or special studies;

Signed ______________________________ Date ______________________________

Director General
Department of Agriculture

Signed ______________________________ Date ______________________________

Chief Conservator of Forests
Department of Forestry

Signed ______________________________ Date ______________________________

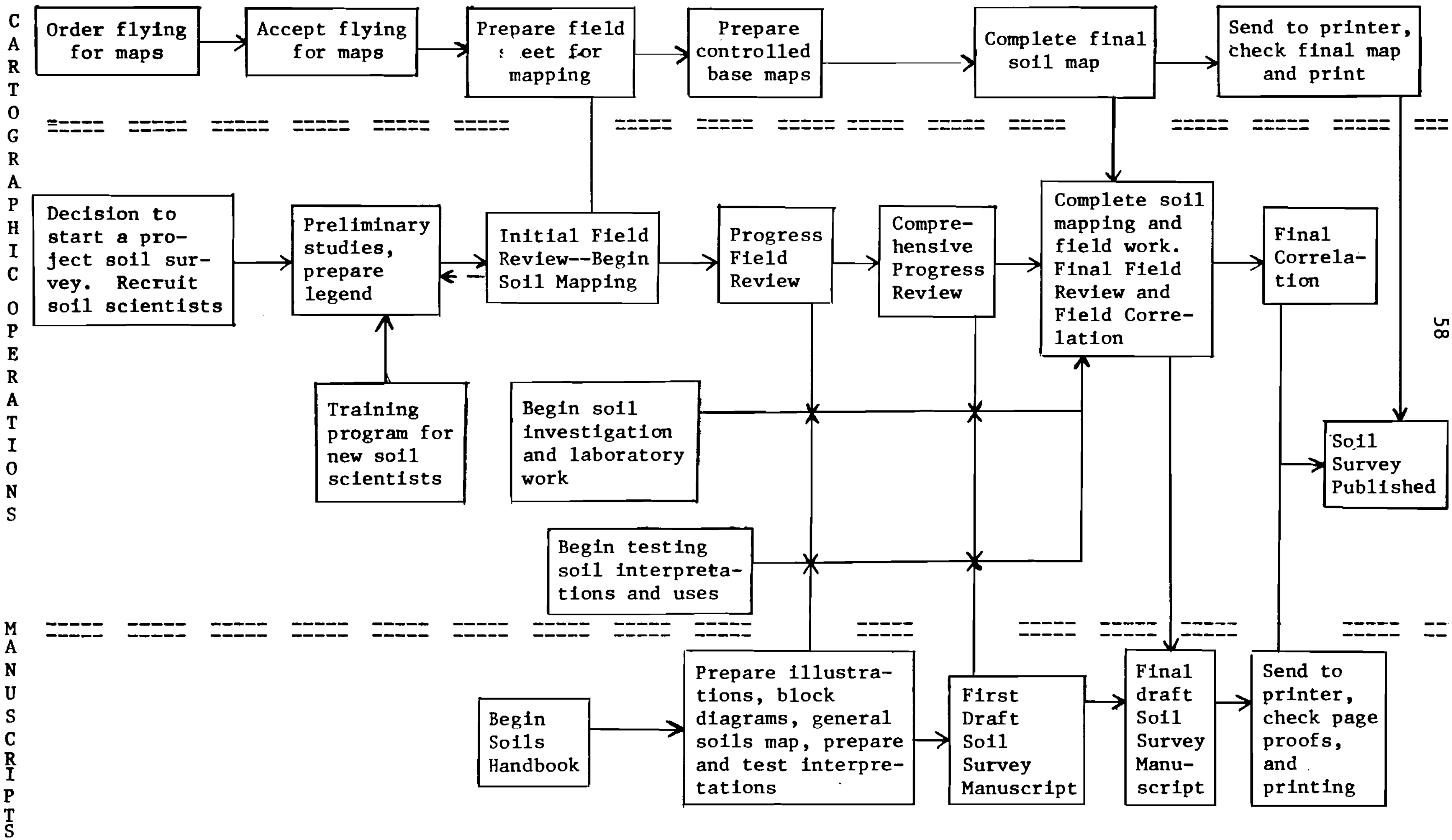
Director General
Department of Soil and Water Conservation

Signed ______________________________ Date ______________________________

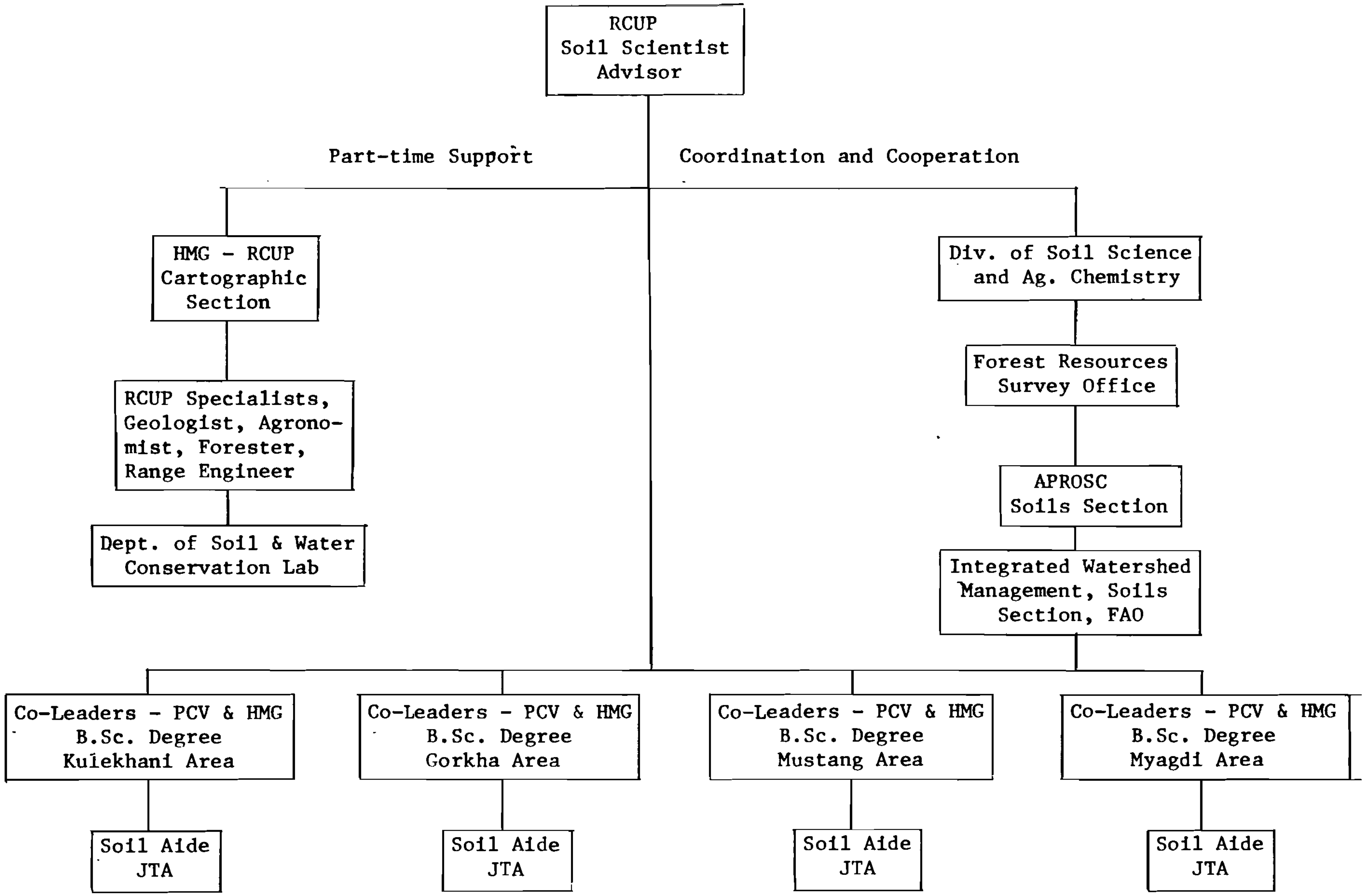
Executive Director
Agricultural Projects Service Center

Attachment #2

SOIL SURVEY FLOW CHART



SOIL SURVEY ORGANIZATION AND STAFFING



Attachment #4

Soil-Survey Costs

1st Year			2nd Year			3rd Year			4th Year			5th Year			To-tal
1/	2/	3/	1/	2/	3/	1/	2/	3/	1/	2/	3/	1/	2/	3/	
2,111	32,000 ha	50	3,432	100,000 ha	20	3,432	109,585 ha	20	3,432	110,000 ha	20	528	Publ Rpt.	90	200

1/ Person days of employment.
2/ Progress.
3/ Cost in thousand dollars.

Cost includes: professional, technical, unskilled labor; soil survey field equipment; lab equipment; and publishing and cartographic costs for soil-survey reports.

PART III

IMPOUNDMENTS AND FERRIES

Table of Contents

I. IMPOUNDMENT SITE SELECTION CRITERIA
(For Sites Over About One Sq. Km. Drainage Area)

Reservoir site selection should be based on a consideration or evaluation of the items outlined below. For some selection criteria, information will not be readily available for evaluations. For those items, sites might be considered equal in suitability pending further information. A site's lack of suitability or a single important item may cause it to be rejected. The list may not be inclusive; other items influencing selection may become apparent during site evaluations and designs. Certain items will be judged more important than others in making selection decisions. Sound judgment is needed in in-site evaluations and in placing relative importance on each item. The items outlined below may be used as a guide or checklist in stimulating thinking and discussions before final site selections. Some favorable or adverse site conditions may be translated into decreased or increased installation and/or maintenance costs, making economic evaluations an important basis for site selection.

1. Needs and Potential Uses in Area of Site
   - a. Domestic and livestock water supply;
   - b. Irrigation water supply;
   - c. Hydroelectric power;
   - *d. Fish production;
   - e. Flood control;
   - f. Sediment reduction in critically eroding areas; and
   - g. Recreation and tourism.
2. Site Location Suitability
   - a. Nearness to areas of need;
   - b. Accessibility for construction, maintenance, fishing;
   - c. Socioeconomic disruptions at impoundment site;
   - d. Preferences of local residents;
   - *e. Environmental effects of impoundment installations;
3. Physical and Economic Site Suitability
   - a. Water yield potential;1/
   - b. Reservoir sedimentation potential;1/

c. Dam-site and reservoir waterholding potential1/;

d. Fill material availability and suitability;2/

e. Ratio of watershed size (or watershed potential) to impoundment volume needed;

f. Dam site foundation suitability;

g. Presence of geologic anomalies such as faults;

h. Lanslide potential;

i. Earthquake potential;

j. Safety classification based on downstream damage potential in the event of dam or spillway failures;

*k. Runoff water quality (existing or with planned watershed land treatment, e.g., livestock exclusion).

l. Comparative unit costs or other indicators of economic suitability such as item e above, fill volume to storage ratio, etc.

*These (and perhaps other) items may need to be estimated to be approximately equal for each site unless specific information is available for an individual site. More precise evaluations may be warranted later.

1/ Depends on watershed land use, soils, slopes, watershed shape, etc.

2/ Nearness to site, imperviousness, rock sources etc.

II. RECOMMENDATIONS ON TYPE OF LARGER IMPOUNDMENT

A. Use of Hydraulic Design Classification

The impoundments should be combination storage and detention facilities of permanent storage for sediment and water and temporary storage for flood runoff. Temporarily stored water would be released through an ungated outlet at controlled rates. Other stored water would be released through gated outlets at times and rates to satisfy the intended uses. The dams should be designed not to be overtopped. Maximum design flows would be carried through rock and/or vegetated earth emergency spillways located in the abutments at the ends of the dams or through a concrete gravity or concrete chute section in a rockfill or earthfill dam.

B. Construction Materials Classification

The dams should be constructed of the most readily available materials at the sites. With the apparent general scarcity of earth-borrow materials, rolled earthfill dams may not be feasible at most sites. Rock materials from emergency spillway excavations, gravel, deposition areas, quarries or other sources may need to be used in conjunction with an impervious earth membrane. If emergency spillway excavation is too costly because of the steepness of abutments or the nature of the materials in them, concrete gravity or concrete chute spillway sections may need to be used.

III. COST DISCUSSION--LARGER IMPOUNDMENTS

To gain insight about the range of expected costs of impoundments, a site on the Ludi Khola with 13.8 square km catchment area was studied. Basic information was developed from a 100-foot contour interval map with a scale of 1:63,360. The estimates made from the basic information are therefore preliminary only. The sediment storage requirement was estimated to be 75 watershed millimeters. Normal pool sizes that were considered vary from 19 to 23 hectares, corresponding to 45 to 100 watershed millimeters of impoundment volume. Flood storage of 70 to 100 watershed millimeters was included in each hypothetical design.

For the rolled earthfill or rockfill dams studied, estimated fill volumes for the site range from 900,000 to 2,400,000 cubic meters, according to the storage volumes provided. Construction costs are estimated to range from $2,900,000 to %5,400,000. Site investigations, designs, construction inspection and contract services costs are estimated to be $740,000 to $1,000,000. From cursory land value discussions, land costs appear to range from $70,000 to $100,000. Total installation costs of impoundments at the site appear to range from about $3,750,000 to $6,500,000. Yearly maintenance costs for the dam and reservoir area (averaged over the useful life of the facility) are estimated to range from $11,000 to $15,000. At five percent interest and a useful impoundment life of 50 years, the average annual cost would total $216,000 to $371,000.

Unit costs for the site studied are estimated to range from $.90 to $1.10 per cubic meter of water storage capacity in the normal pool plus flood pool. Total installation costs, when applied to the water storage capacity of the normal pool only, are estimated to range from $2.30 to $2.70 per cubic meter. For each square kilometer of catchment area, total annual costs (amortized installation plus maintenance costs) are estimated at $15,700 to $26,900[1/]).

Since the cost estimates are based on very limited data, they should be regarded as preliminary and for discussion only, and not accurate measures of final costs for the site studied.

1/ At an interest rate of five percent and an estimated useful life of impoundment of 50 years.

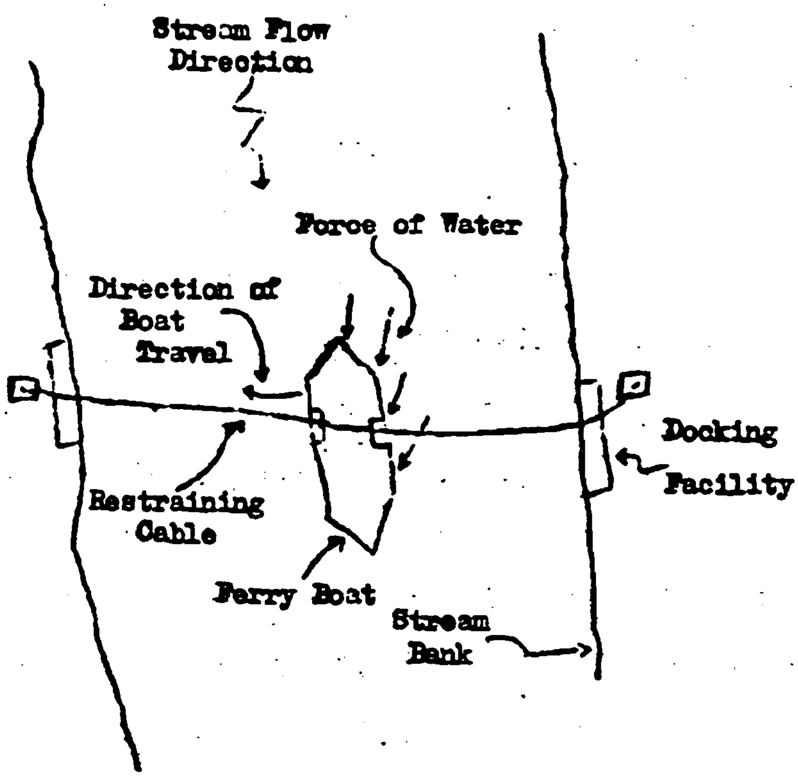
Economies of scale would likely apply to reservoir sites with larger catchment areas. For example, the Phewa dam site near Pokhara has an estimated construction (only) cost of $2,640,000. This is about $.20 per cubic meter of active storage in the reservoir. (latest indications are that final costs will substantially overrun the estimate.) The catchment area of the site is 120 square kilometers and the maximum pool area is 670 hectares. Accordingly, it may be expected that larger impoundment sites (with catchment areas of about 50 square kilometers and over) would cost less per unit volume of storage capacity.

IV. RECOMMENDATION ON WATER-POWERED STREAM FERRIES

Water-powered stream ferries appear to have application on larger streams in the project areas where aerial cables or suspension foot bridges are used or planned. A ferry can be built and operated at a small fraction of the cost of a suspension foot bridge and more safely than an aerial cable of the type now in use in some locations. A ferry provides employment for operators, is readily relocated if traffic needs or stream conditions change, and can successfully be operated at varying stream-flow rates.

Numerous favorable ferry locations appear to exist on streams of about 30 to over 100 meters wide. At some sites, the stream channel may need to be prepared for ferry operation by removing any large rocks or other obstructions. Ferries are normally located in straight stream segments devoid of excessive turbulence or related hazards.

A water-powered ferry is operated by placing a restraining cable across the stream at approximately water level. The upstream end of the ferry is inclined in the direction of boat travel, and the force of the water acting on the boat's sides, bottom, and keel drives it across the stream. The sketch illustrates the principles of operation.



Ferry size should reflect passenger and freight requirements and stream conditions at the site. On streams used for recreation or other boating, warning signs should be placed upstream from the ferry site. Design should include provisions to lower the restraining cable to pass stream traffic or when the ferry is not in use.

A pilot program, with expert design, construction and operation help, should be used until Nepalese become experienced in using water-powered ferries. The program could then be expanded as needs warrant.

PART IV

GORKHA TRIP REPORT

(July 11 & 12, 1979)

Table of Contents

SCS Consultants to RCUP

John Firebaugh, John Geter,

Deane Harrison and Gerald Richard

I. PURPOSE OF TRIP

Helicopter overflight of the Daraundi catchment area to acquaint SCS Team with overall land use, topography, drainage patterns, problems and opportunities. One major objective was to select a possible typical tributary catchment area that could be used as a "first-start" project for resource conservation and utilization.

II. TIMING AND PERSONNEL INVOLVED

John Geter, SCS Team Leader, and John Firebaugh, Design Engineer, were accompanied by Mervin Stevens, Soil and Water Conservation officer, USAID, and Krishna Manandhar, Irrigation Engineer, HMG, on July 11 leaving Kathmandu at 10:30 and returning at 13:00. On July 12, Dean Harrison, Resource Planner, and Gerald Richard, Soil Scientist, were accompanied by Edward Vickery, Executive Director, SECID, and Krishna Manandhar, Irrigation Engineer, HMG, leaving at 10:30 and returning at 13:30.

III. GENERAL

As a whole, it was observed that the land and associated resources of the Daraundi catchment area have not been as severely exploited as those of the Kulekhani area and as much as the area observed on the road trip to Kulekhani and the helicopter trip to Daraundi. Much of the area appeared to have an adequate vegetative cover of brush, timber or grass, although probably in a poor state of utilization. Critical erosion areas were considerably fewer in number and smaller in size than those observed on other field trips. Extensive areas of range pasture and grazing livestock were not observed. In the one area visited on the ground, it was learned that livestock were confined to stables and fed hand-harvested forage. Even though erosion conditions in the Daraundi catchment area may not be as severe as observed elsewhere, it does present an excellent opportunity to implement a resource conservation and utilization program that can reverse the trend of adverse resource exploitation. In fact, as a "first-start" project, it is probably best to select an area less severely exploited because the adverse exploitation will be much easier to reverse and positive results will come quicker and will be more dramatic.

The following observations by items are presented:

A. Impoundment Structures

1. Large Tributary Impoundments.

The drainageways appear to present physical opportunities for multiple purpose impoundments structures, many without major inundation of crop land. The most serious problems will be the availability of fill material and site locations for emergency spillways. Neither of these problems could be analyzed on the field trip. It appears for the cost, construction methods, minimization of emergency spillway problems, and machinery availability and use, that flood-water retarding-type structures would be the most practical. Flood-water retarding structures incorporate relatively small conduits of concrete or concrete pipe in conjunction with high volumes of temporary runoff storage and simple emergency spillways.

The large tributary impoundment would have many beneficial uses such as power generation, irrigation, water supply, flood reduction, sediment control and fishery.

2. Small Tributary Impoundments.

Opportunities also exist for smaller upland storage impoundments. These would be located on smaller tributaries or at the upper ends of large tributaries where topography permits. It is envisioned that such impoundments would be less than 0.4 hectares in size with maximum depths less than five meters. The primary purpose of these impoundments would be water supply for households and livestock, but could have many other beneficial uses such as erosion and sediment control for pre- and post-monsoon irrigation of small areas, fishery and torrent control.

These small tributary structures could be constructed by local labor with technical assistance from RCUP. The only nonsite construction material needed would be pipe for principal spillway and water drainage.

Availability of fill material and site location for emergency spillways would be the major problems.

3. Hilltop Ponds.

Hilltop and ridgetop ponds also appear to have good potential. There are many cases where a saddle or other gentle sloping exists along a ridge top that provide an opportunity for small ponds for livestock and domestic water supply. These ponds and their associated earthfill embankments would be contructed utilizing the cut and fill methods. The embankment would be constructed from earth material excavated from the impoundment area. Water would fill the excavated area and also be impounded against the embankment. This method greatly increases the storage volume over the simple excavated pit.

Each pond would require a collection system of diversions to divert runoff water from a properly-sized catchment area into the pond. To reduce sediment and other pollutants from entering the pond, the entire catchment area should have an excellent vegetative cover. Livestock exclusion from the catchment area would be an essential practice.

It is envisioned that these ponds would be leass than 0.1 hectare in surface area and less than three meters maximum depth. One such pond could easily store 75,000 liters and provide household and livestock water for one family during the dry season as well as being a convenient storage during the monsoon.

Ponds could be constructed with local labor with minimal other inputs. Once the construction techniques are demonstrated and some expertise developed with the local farmers, the ponds could be constructed with limited technical assistance.

This same type of construction may also be used on the hillsides where the slopes are flat enough to permit such construction. The extreme upper end of drainways would be the areas of highest potential.

Site selection for water holding capability would be a major consideration.

B. Irrigation Potentials

It appears that areas readily adapted to irrigation have already been developed. However, with the abundant water supply, many more different areas could be developed. Impoundments for irrigation have already been discussed. In addition to impoundments, stream diversion development has good potential. A concerted effort should be made to at least utilize all perennial streams. Nonperennial streams could also be developed for paddy irrigation during monsoon and irrigation for seeding of wheat and subsequent irrigations as long as the water supply is available.

C. Cropland Erosion and Control

Cropland erosion was observed to be critical. All hillside cropping is on steep slopes and soil movement is extremely high, possibly 25 m^3/ha per year or higher. Most if not all of the cropland is being used beyond its capacity to sustain production. Breaking natural slopes by bench terracing is the only possible salvation for continued crop production, and it is an acute need. Erosion from poorly contructed risers and sloughing of risers contribute considerably to soil movement. Any program to construct bench terrace should include sloping of the risers to at least 0.5:1. An added beneficial effect of sloped risers would be the addition of area for production of forage grasses. On steep slopes, the surface areas of risers can equal or exceed the area in the bench, but the riser has to have a slight slope to sustain growth to grasses.

D. Agricultural Crop Production

It was apparent that crop land was in a continuous grain-type rotation and production extremely low. In fact, in a number of cases it is hard to visualize how the production can greatly exceed seed used and thus how continued cropping is feasible. Several things contribute to the low production: (1) The greatest problem is the low fertility of the cropland. Erosion and reshaping has eliminated the topsoil. Production in the subsoil without proper soil amendments is like it is anywhere in the world, very poor; (2) Nothing is being done from the cropping-system standpoint to improve the fertility. The small amount of manure or compost applied does little good. It is doubtful that more than 2.0 tons per hectare are available where twenty-five tons would be in the order of need; (3) Few legumes were observed in production; (4) Corn plant population was observed to be very low and decreases rapidly with increased slope of the bench terraces. The only source of seed is from native stock and has degenerated to a very low quality. Improvement in cropping systems, terracing and increased fertility could return benefits several times greater than cost.

E. Range, Pasture and Grazed Woodland

One brief cursory review of the Daraundi catchment area revealed some serious soil erosion problems on range, pasture and grazed woodland. Much of the area is too steep to permit livestock grazing without causing soil loss.

A range and pasture management system is vitally needed on all the grazed area. Based on proper vegetation-soil survey, the system should include a deferred-rotation grazing and hand-harvest system, livestock exclusion from seriously eroded areas and improved supplemental feed production programs in the farming areas.

Few areas were noted that needed grass reseeding. It was felt that the majority of areas would recover and heal with proper protection and managed grazing systems. Some of the more critical erosion areas will need gully plugs and hillside stabilization structures.

A program of hand harvesting should be encouraged on lands having slopes over 50%. Enrichment planting of fodder, fuel and timber trees are needed on much of the area. Complete plantations are needed in some areas.

Forage production can be increased from 300 to 400% by applying basic management principles.

Livestock improvement program offers an excellent opportunity to increase income as well as improve the protein, mineral and vitamin level of their diet.

F. "First-Start" Observations and Recommendations

The trip to the area provided an opportunity to observe the many conservation problems and opportunities of the area, and to firm up a previous conviction that a proper approach to developing resources of the area would be to start with a small typical area. Successful expansion could then develop or be directed from this area as trained persons become available and techniques are developed.

It might appear to be only a planned slow start, but it is sincerely believed that within a few years the successes and benefits obtained would cause a snow-falling effect and rapid expansion would be possible. On the other hand, starting with the entire catchment area and having few, if any, significant successes in the first few years would endanger acceptance and limit expansion.

Many tributaries to the Daraundi Kali were observed from the helicopter with a number of impoundments physically possible. Two tributaries were examined in more detail.

The Jhela Kholi in Simjung Panchayat offers an opportunity for water impoundment and could tie into an irrigation project already identified for development, but it is located in the upper part of the area and offers few advantages.

The Ludi Kholi in Taranagar, Bungkot, Raneswara, Ghairung and Bhogteni Panchayats probably offer the best opportunity for multiple impoundment. There is also a wide range of agricultural activities in the area and consequently a large number of beneficiaries. A large area of rice production was observed in the river bottom that could greatly benefit from dry season irrigation. An additional crop per year might be possible from this irrigated area if year-round water supply was available.

The upland area is reasonably well protected with vegetative cover, and excessive erosion was not observed. However, it was severe enough to warrant a conservation program to protect the impoundments, ensuring a prolonged life and enhancement of overall resource utilization.

The size and shape of the Ludi catchment area is similar in many respects to the larger Daraundi catchment area. Developing and implementing a resource conservation and utilization program on this smaller typical catchment area would be a good "first-start" opportunity offering several advantages.

It would be an area small enough to manage by the limited number of people (local and expartriate) available. It would offer similar opportunities and problems found in the larger area and give everyone an opportunity to gain experience, try out methods, and work out "bugs" in program efforts.

It is the most accessible of the areas observed, with a new road being constructed through the area. Accessibility is important because of the need to transport material and machinery for construction. Also, there will be a large number of people involved in the "first-start" effort that will need ready access to the project area. Accessibility is necessary in providing the visibility and demonstration effect which is a most essential feature of a "first-start" effort.

Much resource inventory information is needed on the Ludi catchment area and other potential catchment areas before a decision and selection can be made. Certainly the selected area should provide the opportunity to initiate most of the recommended conservation measures. It should also be where local farm leadership is strong and there is support for the program.

A complete resource development plan for the selected area should be developed based on a resource inventory and opportunities for conservation and utilization.