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AGRICULTURE

TECHNICAL ANALYSIS

RAPTI DEVELOPMENT PROJECT

1987 - 1995

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## 1. REVIEW OF EXPERIENCE TO DATE

### 1.1 Rapti Phase I Achievements

Activities under the agriculture sector in the Rapti Project have included support and training numerous agencies involved in agricultural productions, including:

- the five district Agriculture Development Offices, for support to additional JT/JTAs, new sub-centers, technical assistance, and a major new effort in cropping systems;
- the Musikot Horticultural Farm in Rukum District, for support of contract (private) vegetable seed production, seed distribution, and some fruit seedling production for Rapti Zone and elsewhere;
- the Department of Agriculture's Training Center at Nepalgunj, for support to dormitory construction and some materials and equipment;
- the Agriculture Development Bank of Nepal, for support to general credit, to expanding credit outlets to all districts in Rapti Zone, and to establishment of 23 Small Farmer Development Groups programs, the first five of which are now self-sustaining;
- the Agriculture Inputs Corporation, for construction of new warehouse facilities in Rapti Zone; and
- the Department of Livestock Development and Animal Health, for establishment of new sub-centres and other program support.

This analysis covers only the crop and horticultural portions of the proposed Phase II program. A separate analysis, undertaken by a team from PADCO during January-April, 1986, provides information and recommendations on livestock.

The program did not achieve all of its stated objectives, although there is general consensus that the basic infrastructure is now in place to accelerate efforts. A brief review of the agriculture situation in Rapti Zone today follows.

Table I shows agricultural baseline data for the Rapti Zone for the year 1984/85 and gives the status of agricultural production to date. Total area under paddy is 67,136 hectares and average yields are 2.8 MT per hectare. Likewise the area under wheat and maize is 122,247 hectares and 126,666 hectares respectively. The average yields for wheat and maize are 1.9 MT and 2.95 MT respectively. The oil seed acreage is 25,899 hectare with an average yield of 0.52 MT per hectare.

Agriculture inputs used in 1984/85 includes 525 MT nitrogen, 339 MT phosphorous and 12 MT of potash. Improved seeds supplied by AIC included 5.6 MT of paddy, 49.9 MT of wheat and 4.38 MT of maize. Total credit disbursed for agriculture and related activities amounted to NRs. 15,156,000.

The table reveals that a total of 3254 person days of extension training was provided for agriculture JT/JTA and farmers. Likewise 70 person days of training was provided for livestock JT/JTA and training was provided for livestock training was provided for livestock farmers.

## 1.2 Production Potential

The Final Evaluation report further emphasizes that adaptive technologies evolved from the Cropping System Program (CSP) hold great promise for increased agricultural productivity in the zone. The CSP has identified adaptable technologies, particularly for irrigated rice and wheat, where potential for yield increases is great, but also for maize and mustard. In Phase I of the Project, PPVT (verifying recommended cropping patterns through farmer's field trials) were conducted in 25 panchayats covering all five districts of the Zone. A total of 400 PPVTs were conducted involving 215 farmers and 730 hectares of land. Four major crops--paddy, wheat, maize, and mustard--were involved.

The trials yielded marginal cost-benefit ratios ranging from negative to 20. The trials realized yield increases up to 100 percent in Dang, 150 percent in Salyan, 50-100 percent in Rukum and moderate increases in Pyuthan. These results are very encouraging as the PPVT has demonstrated that yield increases are possible especially on irrigated low lands with the provision of adequate inputs. A recent report of the World Bank noted the following:

"The above examples indicate that several locally tested and economically viable technologies for improving yields are known. These technologies have yet to be delivered economically on a large scale, and, equally important, renewed biologically. These issues should receive high priority. In fact, insufficient and unreliable input supplies have already constrained even the testing and the pilot production activities of the CSP. To ensure successful delivery of the improved technologies, the institutions which handle agricultural inputs in Nepal need to be strengthened thoroughly and immediately."

Section 2 of this paper addresses the constraints noted in the Bank report.

Following an established progression for the CSP, successful PPVT's led to Block Production Programs in selected areas.

Block Production Programs were initiated in 15 panchayats involving 817 farmers and 1195 hectares of rice, wheat and maize. Yield results in the block program were found to be promising.

Based on the yield results of Block Production Program, it is theoretically possible in Rapti Zone to increase rice production by 24% percent, wheat by 51 percent and maize by 9 percent.<sup>1/</sup> Table 2 shows the present and potential area and production for rice, wheat and maize over the eight year period of Rapti Phase II.

TABLE II: Present and Potential Area and Production for Rice, Wheat & Maize

CROPS	PRESENT PRODUCTION AND AREA			POTENTIAL BASED BLOCK PRODUCTION ON TRIALS			% Potential PDN Increase End 8th Yr.
	Area	Yield	Total	Area	Yield	Total	
	HA	Per HA MT	PDN MT	HA	Per HA MT	PDN MT	
RICE	67,138	2.77	186,671	(34,311) 67,138	4.15	233,320	24
WHEAT	122,247	1.97	163,350	(82,995) 122,247	3.32	352,869	51
MAIZE	126,666	3.00	224,808	(75,128) 126,666	3.36	407,044	9

<sup>1/</sup> Computation is based on land types identified by LRM Project. According to it: 51% of total rice land was suitable for application of block results; 68% of total wheat land was suitable for application of block results; 59% of total maize land was suitable for application of block results. Figure in parenthesis indicates the area to be brought under Block Production Program during the 8 year period.

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The achievement of these production levels assume the use of 10,242 MT of nitrogen, 4,261 of phosphorus and 2,253 MT of improved seeds per annum at full production i.e., three years after project implementation. The cost of the fertilizer amounts to approximately Rs.47,351,700 in current prices, giving an idea of annual credit requirements. This would amount to roughly ten times the current levels for fertilizer in the Zone. As overall credit use increased by a factor of almost five during the last six years, this does not appear impossible. More difficult will be the timely provision of the physical inputs. This problem is addressed at Section 3 to follow.

These production potentials, while encouraging, cannot be assumed to be production targets for the project period. Little is known about farmer adoption rates, and calculations regarding adoption of only the partial package of inputs (i.e. less-than-recommended fertilizer, improved seeds only, etc.) are tenuous at best. The figures must also be taken with extreme caution in that they represent data from a small number of trials, and most of those have been conducted on quite favorable land and favourable condition. Thus, these are production potentials under almost optimum conditions. USAID/Nepal is encouraged to work with ADO's in Rapti and technical assistance personnel to develop more detailed production targets during Project Paper development.

## 2. KEY CONSTRAINTS TO INCREASED PRODUCTION IN THE RAPTI PROJECT

### 2.1 The Agricultural Setting

2.1.1 Land Resource Base: Uneconomical farm size, the scattered nature of the holdings and settlement pattern which has placed a constraint on production. Seventy per cent of Rapti's population live in the hill areas of Salyan, Rukum, Rolpa, and Pyuthan where the farm size rangers from 0.25 hectare to 0.4 hectare. The remaining thirty per cent of the population live in the Dang and Deukhuri Valleys where the average farm size is about one hectare and where there are a large number of tenant farmers. Share cropping arrangements have inherent disincentives to production because the tenant is not encouraged to investment in high cost production inputs (fertilizers etc.) when the landlord gets a fixed share without any extra effort. The land resource has forced the farmer to place increasing emphasis livestock and forestry. It is estimated that about twenty per cent of Rapti's population are landless and some of these migrate to the Terai and India thus creating a labor shortage during peak agriculture season particularly in the hill district. As a result production responsibilities have been placed on women within the household system.

The possibility of increasing agriculture production through bringing new land under cultivation does not exist as a viable option. Soil studies done by the LRM Project indicate that only 31% of the land in Rapti Zone is suitable for cultivation and of this amount 24% is already under cultivation. In general it is reasonable to assume that production increases should come from more intensive production of existing areas under cultivation rather than to bringing marginal land into cultivation.

2.1.2 Limited Irrigation: Absence of perennial irrigation in 85% of the presently cultivated area poses a serious constraint to production in that it is difficult to get more than one crop a year and impossible to get three crops a year. At the present time 8% of the total cultivated area has perennial irrigation and 7% is partially irrigated making a total of 15%. The remaining 85% as indicated above is rained. Unfortunately production increases on an intensive basis assumes the introduction of short duration high yielding varieties (HYV) and consequently more consumptive use of water which does not exist under rainfed conditions all year round. However, in some cases it is possible to get a second crop the rained areas as a result of residual moisture as for example short duration mustard crop. The Deukhuri Valley has ground water potential because of a high water table and shallow tubewells with mobile pumps can be used with good results.

2.1.3 Difficult and Costly Transport: Rugged topography and absence of access roads impede transportation of both outputs and inputs in the hill districts. An all weather gravel road connects the main Zonal centers of Ghorahi and Tulsipur in Dang District to the East-West Highway and thus gives a definite advantage to the Dang/Deukhuri Valley relative to the hill district. However seasonal jeepable roads run from Tulsipur to Salyan Khalanga and from Ghorahi to Pyuthan Khalanga and partly into Rolpa. While mule tracks serve as important transportation links in other hill areas. The motorable roads are subject to landslides and washouts in the raining season which sometimes take months to be repaired. Most goods in the hill district are carried by porters and animals at a high cost in terms of money and time particularly in the monsoon season.

2.1.4 Available Technology: High yielding cereal technology is available for the Terai and low hills but this is input and water intensive. Only partial technology is available for horticulture and cereal crops in mid and high hills.

Numerous agro climatic variations make the development of suitable technology very difficult. For the purpose of agro climatic distinction, the Dang District is divided into upland and lowland and each of these is in turn further subdivided into low, medium and high production potential areas making a total of six (6). The hill areas can be seen in terms of low hills, mid hills and high hills and these are in turn subdivided into upland and lowland.

## 2.2 Agriculture Service Provision

### 2.2.1 Inadequate Quantity and Quality Extension Staff:

JT's, JTA's, AA's are inadequately trained, illequipped and poorly paid and this leads to a lack of commitment, lack of motivation and high staff turnover. The level of training of JT's is limited to two years of technical training and this is not enough considering that many JT's are just out of school and have no solid farming experience. To compound matters many JT/JTA's do not have a suitable technological package to deliver. The farmers have years of practical experience. Thus creates a credibility gap and a difficult environment for Extension activity. At the present time there are 101 JT/JTA on staff serving 230 Panchayats and many farmers never see the extension officer and many Panchayats are not served. It is difficult for the JT/JTA to visit these families as he has to travel long distances on foot, particularly during the monsoon when movement in the hills is very restricted. The indications are that direct contact with many farmers in the hill districts will never be possible, and strategies to maximize this limited manpower through use of groups as contact points is indicated. It also appears that many of the authorized extension positions remain vacant. While many vacancies exist at the JT/JTA level certain key positions like Subject Matter Specialist (SMS) are not authorized anywhere in HMG budget for Rapti Zone.

2.2.2 Inadequate Support for Extension: There is a lack of equipment and this is affecting the work of the extension staff. The vehicle of the ADO Dang has been unusable for over one year now and the JT's/JTA have to travel on foot to remote areas and use buses to get elsewhere.

Only 23 Sub Centers out of a the long-term plan of 45 have so far been established. This makes for difficult supervision of Extension staff and severely restricts Extension activity.

2.2.3 Inadequate In-service Training: To date training for extension staff and farmers has been geared to the achievement of targets rather than the actual needs and problems of the area. It is the consensus of opinion that in-service training has been generally very ineffective.

2.2.4 Weak Research and Extension Links: Formal links between the National Research Program and the ADO offices have been weak. The main link has been through the minikit distribution and farmers field trail programs. The two agricultural advisors on the Rapti Project do serve as a link with the Commodity Research Stations mainly through attendance at the summer and winter crops seminar each year. Weak research extension links and the absence of a free two way flow of information tend to slow down the diffusion of new technology. In addition a basic draw back in the Research Program is the absence of hill agriculture research in a meaningful way. Only limited attention is given to research in non-chemical fertilizers despite their importance to traditional agriculture in the Rapti Zone.

2.2.5 Agricultural Planning Targets under Decentralization: Agricultural planning at the district level under the decentralized systems appears to be weak because of a poor data base, lack of village profiles and ineffective statistical reporting system. The number of programs in the agriculture development plan for Rapti has too many programs when matched against manpower and other resources available. It does appear that the district level agriculture targets were based on target guidelines received from the center and therefore more target oriented. These guidelines may not have taken the locally available resources fully into account. The plan should target site-specific activities and be more detailed. Unrealistic targets create serious problems in implementation of programs.

2.2.6 Late Budget Releases: Untimely release of funds has also affected program implementation in the agriculture program of Rapti Zone. At the present time for example payments are over five (5) months overdue because of uncleared advances. The accounting system is based on the reimbursement principle, accountability and justification. The problem may be eased if qualified accountants are placed in district offices. In many cases salaries of extension staff are not paid on time seedlings not purchased and the productive machinery ground to a halt because financial flows are inadequate.

### 2.3 Agriculture Inputs and Markets

2.3.1 Weak Impact of Services Delivery: Un timeliness and inadequacies of inputs are major deterrents to agricultural production. The new technologies require fertilizer and improved seeds to reach their full agronomic potential but at the same time large quantities of imported fertilizer place a foreign exchange burden on HMG and involve a heavy fiscal subsidy every year. This is an issue which has to be considered at the policy level. At the field level the input supply situation also affects both the PPVT and the Block Production Program, in addition to other farm production. The total amount of fertilizers and seeds delivered by AIC appears to be too small relative to the total demand. There is also a chronic inadequacy of chemicals and tools. There are 33 distributor outlets in Rapti Zone of which 23 are SAJHAS and 10 private dealers. The cooperative structure is too weak and other private groups as yet unformed for input delivery. Private dealerships may not be economical, given low fixed commission rates and variations in transportation.

2.3.2 Price Policy and Marketing: Price policy by the NFC has not provided effective incentives to farmers and in fact might have had disincentive effects. To meet immediate cash needs farmers sell after harvest at distress prices lower than the announced NFC support prices even though they have to buy grain again later at higher prices from traders. This situation occurs because of the fragmented nature of the market, long distances, between markets difficulties in transportation and the limited intervention of NFC which buys on a quota system thus making the support price ineffective. Apart from the fact that markets are too few and too distant there is a lack of market information, inadequate storage and the lack of a standardized system of grading.

### 3. STRATEGIES TO INCREASE PRODUCTION FOR PHASE II RAPTI

#### 3.1 A Geographically Focussed Strategy

The strategy is to continue to work within the framework of the policies, programs and objectives of HMG as regards the Rapti Zone and the policy emphasis of AID/Washington on the productive sectors. Within this framework, the analysis of production potentials and experience to date indicate that more geographic focus will increase effectiveness and efficiencies of project supported efforts. The overall focus should be roughly as follows:

1. Continued and increased work in cereals production in Dang, the low hills and river valleys of the hill districts where production potential exists. This will consist of continued use of PPVT's and extension work based on the block approach. These efforts should be tied to complementary efforts of the ADB/N and District Panchayat in improving small scale irrigation.
2. Expanded crop production work through use of farming systems-based extension in selected areas of high production potential in the middle hills. Given the described constraints in terms of staffing, resources and coordination of inputs, these efforts should only be undertaken in conjunction with SFDP or other viable user groups, e.g. irrigation associations. Efforts will be based on PPVT's and a "new" extension approach for the hills. Expansion of this work may have to await development of appropriate varieties and technology for the hills being developed under the AID-financed ARP.
3. Efforts in the higher hills will focus more on horticulture, livestock--the predominant productive resource--and/or production of goods that can be marketed given transport and other constraints. It is accepted that the high hills will never become food grain sufficient, so marketable products are indicated. Continued emphasis on vegetable seed production and an increased emphasis on fodder and fruit saplings is indicated, both through the private sector at the ward and village level.

The strategy takes advantage of the project infrastructure already in place and consolidates gains already made. The constraints indicated will be addressed through the simultaneous application of complementary programs in research, extension and training. An important element of the program would be establishment of close links with the ARP Project and the Farming Systems Network of the Farming Systems Division of the Department of Agriculture in support of new HMG strategies. Given the absence of an effective broad-based extension methodology in the hills, early efforts under the project will focus on identifying improved methodologies per land use area. Use will be made of appropriate technology already developed under the previous ATU component of the project. The essential expansion of irrigation must continue under funding from the ADB/N (rower pumps in Deokhuri, group loans under SFDP) and/or the District Panchayat grant-in-aid program.

The overall approach must be seen as three pronged:

1. Accelerated efforts in group formation at the ward and village level to enhance the efficiency and effectiveness of extension efforts. Groups have formed and are effectively disseminating technology through "Leader Farmers" under the PPVT/Block Production programs. SFDP groups are repaying loans and increasing production. Women's groups are beginning to work in various forms of agriculture. The strategy assumes that expanded and improved work with these "users groups" will greatly complement extension efforts in place.
2. Expansion as indicated by demonstrated demand of extension services through sub-centres, located in areas of high production potential and feeding into group efforts.
3. A crop development program directed from the district office which emphasizes the rapid diffusion of new tested varieties, improved plant protection measures and improved use of nurseries, seed production, on farm storage, farm trials and provision of agricultural tools. (Over the course of the project, subsidies on these latter items should be progressively lifted.)

### 3.2 Improved Agriculture Service Provision

Emphasis will be placed on more efficient coordination of agriculture support services at the sub center and district level. As noted above, User's Groups at the Panchayat level will be trained and/or formed to undertake planning, monitoring and implementation of agriculture activities. These groups would include, but not be limited to, PPVT/Block Production Groups headed by "Leader Farmers", SFDP production groups, women's groups formed by the WDO working in agriculture, and Irrigation Water User Groups associated with the ADB/N and/or the panchayat system. Individuals from these groups would serve as contact points for extension personnel, thus enhancing possible spread of technology transfer.

In terms of ADO staff, technical and in-service training will be improved qualitatively through use of Training Consultants and Coordinators to undertake needs assessments and to evaluate on a more regular basis the impact of training. Where possible, in-country facilities such as the new Agriculture Training Center in Nepalgunj and the Institute of Agriculture and Animal Sciences at Rampur will take precedence over foreign training. Strategic emphasis above all will be on improving quality rather than quantity of services provided.

### 3.3 Improved Provision of Agricultural Inputs

The overall production potential analysis assumes that the input supply situation is regularized and adequate and timely inputs including fertilizer seeds, chemicals and agricultural tools are made available to farmers. This is unfortunately not the case in Rapti Zone. Although the Phase I project achieved all its targets regarding expanded input storage and input supplies, they rarely arrived in the Zone on time.

AID/W has requested that the team address the potential for privatization of input distribution. Nepal has no stated policy against fertilizer imports by private individuals, and indeed the Seventh Five year Plan includes encouraging rhetoric about the private sector. His Majesty's Government does, however, maintain a policy that inputs should cost the same in each of the 75 districts in the country, be they Kathmandu or the base of Everest. The actual price of the fertilizer and supplies are subsidised, and HMG pays a major transport subsidy each year to move the fertilizer out. Given that this is national policy, and that the Rapti Zone shares a long and very open border with India (where subsidised Nepali fertilizer is in great demand), the team suggests that the overall provision of inputs cannot be addressed on this area-specific basis.

Once fertilizer has reached the Zonal headquarters, however, private dealers and more effective means of distribution of inputs can be encouraged by the project. The Institutional Analysis includes one pilot suggestion wherein the internal-zonal transport subsidy would be provided in a lump sum annually to the District Panchayat, which would have to contract for transport to the District headquarters and then line up dealers (or Tukis) for distribution to outlying areas. Another possibility is for the project to experiment with paying higher rates to existing AIC dealers. A third is to use the model developed at the Kabre SFDP group, where a wealthier progressive non-small farmer (in fact, the Pradhan Pancha) serves as dealer for the group with the SFDP Group Organizer helping him with the transaction costs of credit chits and payment. In sum, the strategy is to maximize efficiency where the project has control, at the Zonal and District and sub-district and village levels, and to emphasize the use of private outlets to complement the AIC efforts.

AID/Washington has also stated that support to credit not be included in the Phase II program. The Phase I Rapti effort provided a lump sum of almost \$ 1 million to the ADB/N for use in Rapti Zone, which is now revolving in the area. As noted under the section on "Production Potentials", to reach the optimal levels theoretically possible credit for fertilizer would have to increase tenfold over the project period. As USAID/Nepal develops the more detail production targets for the Project Paper, it should carefully assess with the ADB/N the probability of those credit amounts being available from the national accounts. The new Asian Development Bank loan of \$ 15 million for three years should make this possible; USAID/Nepal must carefully work with the ADB/N to ensure that Rapti zone gets its fair share.

Finally, AID/Washington has proscribed direct support to irrigation under Phase II. The analysis above notes that access to irrigation is a major constraint to many of the zone's farmers, and that water is a key input towards optimizing production potential. Through the emphasis on improving User's Groups, the project can serve as a facilitator for groups to get ADB/N credit for irrigation activities (either individual rower pumps or group-constructed systems). Also, through the small "setaside for productive activities" under the District Panchayat, some groups may be able to get District support for expanded systems. The PP design team will need to take this limitation into account when developing production targets for the Phase II period.

#### 4. RECOMMENDED PROGRAMS

##### 4.1 Cereal Production in the Low Hills

The standard PPVT's and Block Production approach should continue but with greater emphasis on the diffusion of the technology. Based on likely availability of staff, the program can be expanded from 25 up to 75 panchayats to take into account the numerous variations in agro climatic environments as they relate to cereal crops. The CSP will focus and expand cereal production in the low hills both on irrigated and non-irrigated areas where there is access to inputs, markets and roads. Selected locations in the middle hills will also be used.

A cardinal principal in site selection should be locating near sub-centers, or vice versa, to avoid diluting the services of the already few JT/JTA's. Attention will be focused on minor hill crops like finger millet, barley, buck wheat, amaranthus, pulses, cash crops and other oil seed crops when technologies are available.

##### 4.2 Mixed Farming Systems in Middle Hills

This program will work closely with the recently established Farming Systems Research Division of the Department of Agriculture. This research network is based on the nine research sites under the ARP Project and the work being done at Lumle and Pakharibas.

The approach and organization to the FSP is basically the same as the CSP. FSP describes the entire farming system including the animal component but then focuses its development work on the plant or crop components. The interactions with animals are noted and in fact the cropping system is designed to maximize the interaction between crops and animals which exist on the farm, either as draft animals or production animals.

It is suggested that at least two accessible and visible pilot sites be identified and that PPVT's begin with forages, fodder and agro-forestry. Coordinated and interdepartmental efforts are suggested at the proposed East Deukhuri Agro-Forestry site in Dang District and near the Musikot Horticultural farm in Rukum.

##### 4.3 Horticulture in the Mid and High Hills

The program begun under Rapti Phase I will also be continued. Fruit and fodder nurseries will be established by the private farmers with the assistance of the ADO and credit from ADB/N. It is estimated that over the eight year period horticultural production can be expanded by 2000 hectares at the rate of about 250 hectares per year. Emphasis will be on tropical and sub-tropical fruits up to 1000 meters elevation, sub-tropical

fruits between 1000-2000 meters, and temperate fruits above 2000 meters. Private farmers involved in this program will be trained and assisted to get loans from ADB/N.

Seeds will initially be provided by private nurseries in similar ecosystems. It is also recommended that the project through the ADO establish small fruit orchards, one in each of the ecological zones, for demonstration purposes. For the high hills an apple and walnut orchard would be most suitable, for the middle hills a citrus orchard and for Dang a tropical fruit orchard including mango, leechie, banana, and pineapple. It is recommended that a short-term local consultant be recruited to assist with the planning and execution of this program.

Rapti Phase II will continue to support the farm. The vegetable seed farm will work in close collaboration with the ADO who will oversee vegetable seed multiplication by selected private contact farmers. The ADO will collect, treat, store and redistribute the seed. Farmers involved in this program will be paid and provided necessary equipment on a partially subsidised basis.

In many cases seed germination is a problem and this will be approached through the establishment of vegetable seedling nurseries in selected areas of higher population densities where seedling viability would not be problem due to distance. Farmers involved in this program will be trained and given equipment. It is estimated that vegetable seed packets will be distributed to about 50 percent of the households in Rapti Zone during the project life.

In general the Horticultural Farm would play a more significant role in research and extension outreach programs directed at household vegetable production. Adaptive research and extension would be carried out to support private nurseries and growers.

#### 4.4 Emphasis on User's Group Formation and Function.

4.4.1 Small Farmer Development Program: SFDP would be strengthened and expanded as an efficient and effective vehicle for continued access to credit and agricultural development in the Rapti Zone. As an agricultural lending program SFDP has been very successful in the Rapti Zone where there are 23 functioning units. The success of the program derives from the fact that small farmers are assured of credit because of group liability and peer pressure. Experience to date in Rapti Zone under Phase I indicates that the average length of time it takes for a new unit, composed of many groups, to create enough interest reflow to cover administrative costs is approximately four years. Although AID/W has noted that SFDP not be included in Phase II, given its remarkable success to date in increasing production and generating rural savings, and given the fact that hard data indicates that the interest reflows cover administrative costs over time, the team strongly recommends that USAID/N consider retaining support for expansion of the program

in Rapti under Phase II. It is recommended that AID fund the administrative costs for Group Organizer training and support for up to four years for each of up to forty new groups over the life of the project. In that the costs are estimated at less than \$ 5,000 per year per group and rural savings generated can equal that amount, and in that all programs to date have shown substantial production increases marked by creditable repayment rates, the team believes it is a high impact investment for AID.

4.4.2 Other User's Groups: Where socio-cultural and settlement conditions are favourable, farmers will be organized into users groups for production technology transfer. The transfer will be facilitated by Leader Farmers who are familiar with local conditions, interested in the long-term development of their areas and hold positions of respect in the community. Leader Farmers will be chosen by the groups, and will receive training at the district and sub-district level. They will provide assistance to fellow farmers as well as provide a contact point for outside extension or credit agents. These groups can be involved in a number of activities as for example seed multiplication, input provision, irrigation, group credit and group small scale marketing.

Group formation activities will initially be undertaken by JT's or JTA's in cooperation with Panchayat Leaders who have been trained in the process, i.e., WDO's for women's groups, District Training Officers where they exist, or other. If the accelerated training recommended in the Institutional Analysis is begun, it is hoped that some JTA's could eventually carry out the process on their own.

4.4.3 Women's Groups. The three new Women's Development Officers in Rapti Zone and their Peace Corps counterparts have demonstrated success in organizing women's and mixed sex groups for credit and for other self-help activities. Programs for the coming year emphasize group activities in agriculture (seed multiplication, vegetable gardening) and livestock (goat and sheep fattening). As these programs become more established, the WDO's must more strongly encourage support from the relevant extension staff. Funding for support to the WDO is provided through her supervisor, the LDO. No additional credit funds beyond what the ADB/N and RBB already provide are required for these small scale activities.

#### 4.5 Improved Extension to Feed Into Group Efforts.

4.5.1 On-going Extension Efforts. Extension staff at the district level is at the present time too thinly spread to be truly effective. Although the new geographic focus on productive areas will help focus their efforts, and the emphasis on groups as vehicles for technology transfer will help, there may be need for additional JT/JTAs over the eight year project period. The project should encourage the concept of quality extension, however, much more than simple quantitative increases. If candidates can be recruited, an objective of at least 10 percent women should be maintained. Two Subject Matter Specialists (SMS)--in Plant Protection and Agroonomy--should be recruited for the ADO's office in Dang District.

4.5.2 Pilot Extension Project: An important element of the extension strategy for Phase II Rapti Project will be the initiation of new extension methodologies. Justification for this approach derives from the failure of the pure T&V system in the Gandaki Zone and the several difficulties with the orthodox HMG system. There appears to be the need particularly in the hill areas for a more focussed and intensive extension system.

In this regard a short term consultant will be recruited to study the various extension methodologies being used in Nepal at the present time with particular reference to the applicability of SATA's Tukey system used under the Integrated Hill Development Program to the Rapti Zone. This system appears to hold the most promise based on experience over the last decade. The system has many elements but essentially involves the use of Leader Farmers who are intensively trained for a month at a time and who provide extension and agricultural inputs for which they receive a 20% commission. The trained Leader Farmers are in turn required to pass on their training. It is strongly believed that this system can be modified and applied to the Rapti Zone with beneficial results, although careful planning of the pilot phase is required.

#### 4.6 Research Extension Link

More active and more direct interactions between the Commodity Research Stations and District ADO's is imperative. To this end short one-to-two week consultancies will be periodically provided by researchers from the national maize, wheat and rice stations. The researchers will be requested during "down time" at the stations and will visit the Rapti Zone to hold seminars with extension staff and farmers. ADO's and other extension staff will in turn visit research stations on structured visits at least twice a year. This together with the proposed SMS's in Dang (see below) will have the effect of increasing the two way flow of information and strengthening the extension research links.

#### 4.7 Training

At the present time over 1000 foreign aided projects are being implemented in Nepal of which 300 alone fall within the Ministry of Agriculture. The absorptive capacity in terms of availability of management and technical skills is very strained.

In this regard local extension training will be intensified with heavy emphasis on quality rather than quantity. In other words training will be problem or need oriented rather than target oriented. Selected overseas training will be carried out in fields in which Nepal is weak, such as plant protection. It should be mandatory that candidates selected for external training must have served in the Rapti Project for a minimum stipulated period and must be contractually obligated to return to the project for a minimum

period after the training is completed. Extension and project staff will also get courses in agriculture planning. The proposed expatriate long-term trainer under the Institutional Analysis will greatly facilitate the planning and execution of this improved training system.

4.8 Agriculture Inputs, Credit & Markets. No direct funding for AIC is proposed. The judicious use of short-term consultants for production campaign planning and logistics may be required on an annual basis. The program ideas presented under the strategy section should be detailed as pilot projects by other consultants.

Outside of funding for start-up for up to 40 new SFDP programs, no direct funding to the ADB/N is proposed. USAID/Nepal should monitor credit supply and demand in Rapti Zone, and should work with the ADB/N to ensure that Rapti Branch Offices get their share of the new Asian Development Bank credit.

AID/Washington has also proscribed direct support for irrigation, particularly medium irrigation. Through the accelerated support for groups described herein and in the Institutional Analysis, User's Groups and SFDP groups can access rower pumps (in Deokhuri) and funds for group-constructed small-scale irrigation through the regular ADB/N program. Some groups, with assistance of the local panchayat leaders, may be eligible for small-scale grants for irrigation improvement through the District Panchayat setaside program. No other support for irrigation is contemplated.

Following the recommendations of the IDS report, no direct support to or intervention in markets is proposed. Through the DP setaside program, small bridges can be constructed and trails/mule tracks improved to allow for better market access, the key IDS recommendation. Should groups want to engage in cooperative marketing, they should be encourage to request assistance from the ADO office.

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NATURAL RESOURCES/FORESTRY

TECHNICAL ANALYSIS

RAPTI DEVELOPMENT PROJECT

1987 - 1995

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## NATURAL RESOURCES/FORESTRY TECHNICAL ANALYSIS

### 1. REVIEW OF EXPERIENCE AND DATA

The National Resources/Forestry Sector of the Rapti Phase I Project encompasses a variety of programs under the Department of Forest (DOF), the Department of Soil Conservation and Watershed Management (DSCWM), and the Department of Roads (DOR). Rebounding from an understandably slow start, the program has made significant accomplishments during the last two years. Probably the most significant was under the new program of Community Forestry, where slightly more than 800 hectares of previously barren land was planted with trees (Table 1).

To support this endeavor, 34 panchayat nurseries produced approximately 2 million seedlings. Survival rates for these seedlings averaged slightly less than 70 percent, which was greater than expected given the degraded conditions of the planting sites. When some of these plantations were examined in April 1986, growth of these trees was excellent in most places and specimens over 2 meters tall were found.

The DOF in the Rapti Zone has also produced and distributed approximately 1 million seedlings to individuals for planting on private land, established 640 hectares of community and plantations and placed 165 hectares of forested land under community protection.

Probably more important than these figures is the change in attitude regarding natural resources. Although difficult to measure, there appears to be a growing awareness, especially among panchayat leaders, of the importance of conserving and managing renewable natural resources.

The DSCWM and the DOR have also established successful natural resources programs. When both programs are combined, a total of 490 hectares of degraded or disturbed land has been planted with trees and approximately 600,000 seedlings produced and planted. Survival rates appear to average approximately 80 percent and the growth rate for many species is rapid. Other accomplishments of this program can be found in Table 1.

Additional information and data concerning Rapti Phase I can be found in numerous documents on file at the USAID office in Kathmandu. Some of these documents are listed in the Bibliography to these reports.

Although a massive deforestation problem still exists in the Rapti Zone, the participating staff and population can look with pride on their accomplishments of reducing the rate of degradation and at returning degraded lands to productive uses.

TABLE 1  
Natural Resources Forestry Outputs for the Rapti Integrated Rural Development Project, 1980-1985

Activities	Districts											
	Dang		Pyuthan		Rolpa		Rukum		Salyan		Total	
	Area Ha.	No. or Sds.										
Plantation-Forest Dept.												
1. Panchyt. Forest Plntn.	235	1456000	164.7	1264000	23.0	36800	40	65000	177	1283200	639.7	1103000
Survival Rate %		72%		65%		70%		53%		70%		
2. Panchyt. Ptd. F.Plntn.	39	62400	55	88000	14.0	22400	1.5	2400	164.5	1263200	164.5	263200
Survival Rate %		69%		69%		70%		68%		68%		
3. Departmental Plantation	35.5	56800	15	24000	0	0	9	14400	14	22400	73.5	117600
Survival Rate %		68%		65%				63%		70%		
Total Plantations												
Nurseries Establishment												
4. Panchayat Nurseries No.		12		7		5		5		5		34
5. Divisional Nurseries No.		2		1		0		1		2		6
6. Private Nurseries No.		0		0		0		0		0		
7. Seedling Distrib. No.												
To Individuals		1300000		1175000		65000		50000		1385000		975000
8. Pcht. Forest Democat. Km		46		23.5		22.5		16.0		51.5		149.5
9. Forest Bndry. Democat. Km		0		50		0		80		30		160
Soil & Water Con. Dept.												
11. Plantations	155	1387500	10	25000	0	0	0	0	10	25000	175	437500
12. Nursery Establishment		2		1		1		0		1		
13. Gully Control No.		3		1				1				5
14. Roadside Stab. w/fencing	15	12500	10	25000	0	0	0	0	0	0	25	37550
15. Water Source Protection	170		15								185	
16. Irrigation Canal Rehab.		1							1			2
17. Trail Improvement		0		0		0		0		0		0
Roads Dept.												
11. Roadside Stab. Imp't.	9	11900	47	51861	49	52029					105	115790

(1) Information extracted from M. A. Conley and B. P. Upadhaya, 1985.  
Report on Forestry Sector, Soil Conservation sector, and department of Roads  
Biological stabilization sector.

The efforts under Rapti Phase I are just a few of many natural resources/forestry projects now under way throughout Nepal, undertaken by a variety of organizations and donor groups. As of July 1985, 44 different natural resources related projects were on-going in Nepal. Of these projects, 16 percent had community forestry as a primary area of interest, 2 percent had fodder production as a primary interest, 5 percent were primarily concerned with forest management, and 36 percent were product oriented (timber, pulp, fuel, turpentine, etc.). Other programs were concerned with silviculture, environmental protection, training, watershed management, livestock, and related areas. Although to date the Ministry of Forests and Soil Conservation appears to be able to keep up with the demands of these many projects, care needs to be taken that it does not become overburdened.

## 2. CONSTRAINTS TO INCREASED FOREST PRODUCTION

Following are some of the more obvious and serious constraints affecting the natural resources/forestry sector in the Rapti Zone. The list is not intended to be comprehensive and space limitation precludes elaboration.

### 2.1 Magnitude of Deforestation

The Rapti Zone is one of the least developed and most degraded areas in Nepal. A population of 0.95 million people and 1.3 million livestock depend on the forest for all of their timber, fuel and most of the fodder needs. The manner in which these products are obtained is not consistent with environmental protection of sustained yield, and degradation is occurring at an alarming rate. Mature forests (or those capable of supplying products on a sustained yield basis if managed) occupy only 21 percent of the forested land (Table 2). Degraded forests and shrub lands occupy 18 percent of the land area, and these areas are expanding at a rapid rate as the population of both people and livestock increases. While the efforts under Phase I in Forestry and Soil Conservation converted 1368 hectares of degraded forests and shrub lands back to project use, this represented only 1.2 percent of the total shrub and degraded land in need of such treatment.

Table 2

Type of Forest Area Coverage in the Rapti Zone  
(Area in hectares)

<u>District</u>	<u>Shrubs</u>	<u>Degraded Forest</u>	<u>Mature</u>	<u>Immature</u>	<u>Regeneration</u>	<u>Total Area</u>
Dang	17,158	11,224	34,665	139,862	5,587	208,496
%	8.2%	5.4%	16.6%	67.1%	2.7%	
Salyan	5,989	9,183	5,904	65,070	2,633	88,779
%	6.7%	10.3%	6.6%	73.3%	3.0%	
Pyuthan	6,410	10,712	9,605	50,448	6,230	83,405
%	7.7%	12.8%	11.5%	60.5%	7.5%	
Rolpa	9,620	15,437	34,020	47,047	3,408	109,532
%	8.8%	14.1%	31.1%	43.0%	3.1%	
Rukum	8,042	20,244	52,259	75,995	156	156,696
%	25.1%	12.9%	33.3%	48.5%	0.1%	
Total =	<u>47,219</u>	<u>66,800</u>	<u>136,453</u>	<u>378,422</u>	<u>18,014</u>	<u>646,908</u>
%	7.3%	10.3%	21.1%	58.5%	2.8%	100%

Source: Resources Mapping project, Kathmandu, Nepal, Land Capability Report. Kenting Earth Sciences United, 1983, UNDP

Table 3

## D.D.F. Project Targets for Rapti II

	Dang	Salyan	Pyuthan	Rukum	Rolpa	Totals	% of Total Cost
Panchayat Nursery No.	40	42	41	31	32	186	12%
District Nursery No.	2	1	1	1	1	6	1%
P.F. Ha.	2,500	2,100	2,100	1,700	1,700	10,100	16%
PPF, Ha. Total	10,000	3,000	3,000	2,000	2,000	20,000	
PPF, Ha. Planted	1,000	300	300	200	200	2,000	
Demarcation Km.	1,150	550	550	400	400	3,050	4%
Departmental Plantation, Ha.	400	200	200	150	150	1,100	
Building Construction No.	8	3	4	4	4	23	8%
M.P. Agro-Forest	4,000	0	0	0	0	4,000	43%
Natural Forest Management	180,114	73,607	66,283	128,410	84,475	532,889	5%
Lease Forest Ha.	100	75	75	50	50	350	
Private Plantations Ha.	100	75	75	50	50	350	
Preparing & Imp. Forest Mgt. Plans No.	80	84	82	62	64	372	8%
School Nursery & Plantation	25	20	25	20	20	110	
Estimated Cost (i) Rs.	59,700,000	12,500,000	12,500,000	9,600,000	9,600,000	103,900,000	

(US \$4,947,619)

(1) Annual Adjustments for Inflation will be needed.

## 2.2 Differing Attitudes of HMG and Local People

The prevailing attitude of the population appears to be that the forest will continue to supply fuel, fodder, and timber irrespective of treatment. This attitude is a serious constraint and threatens to destroy the basis of production, particularly the soil which supplies and cycles nutrients, retains water, supports microbial activity, etc. Even those persons who are aware of the problem are often not interested in changing their behavior. Their attitude is often that forest products can always be found some place and, from a man's point of view, such issues are not concern because it is the women's job to find fuel and fodder. In addition, the forests belong to the government, so many citizens assume that the government should take care of them. Villagers are often of the opinion that there is nothing to lose by over utilizing the forests, and if you do not utilize it, your neighbor will certainly do so. This "help yourself and let the future take care of itself" attitude only results in abuse and degradation.

Compounding these problems is the general citizen attitude that the DOF is only concerned about protecting forests and, in essence, removing them from village use. The fact that the DOF has authority to arrest those engaged in unlawful removal of forest products helps reinforce the negative image. In contrast, the DOF often views citizens as unable to understand forest management and sustained yield. However, with promotion of community forestry programs, these antagonistic attitudes are quickly changing.

## 2.3 Lack of Short-Term Benefits to the Population

Compounding these differing attitudes described above are the problems of the low economic status of much of the population. When people live at or near the subsistence level, short-term solutions to problems are often needed. The idea of planting and protecting a resource for later use may be contrary to their immediate needs and attitudes. In addition, the current HMG reforestation programs often do not specify who will benefit from the program, other than in very general terms. If an individual suspects that another panchayat, individual, or the government will benefit from his or her efforts, she/he has little motivation to improve existing conditions.

## 2.4 Lack of Women's Involvement

While women are largely responsible for the collection and use of fuel and fodder, their traditional place in the social structure prevents them from taking an active role in many government-sponsored reforestation programs. The women may, in fact participate in planting seedlings, but is it the men who participate in training and orientation meetings, who

form the Forest Committees and who serve as naikes and guards. Part of the problem is that 100 percent of the DOF field staff in Rapti Zone is male, a fact which does not present role models on elicit strong women's attendance at meetings.

#### 2.5 Unrestricted Grazing

The current common system of unrestricted grazing of animals can only lead to continued resource degradation. This problem is compounded by the fact that due to spcial reasons, unproductive cattle cannot be culled from the herd. Discussions with villagers indicate that approximately 70 percent of their cattle provide no other function that to provide manure that can be used for fertilizer. However, manure is being increasingly used as fuel so even this minor contribution to the resource situation from the unproductive cows is being lost. Cattle are considered a form of wealth, so villagers strive to increase the size of their herds without realizing the tremendous burden that is being placed on the quickly disappearing fodder resources. Goats are also a severe problem due to their ability to climb and to eat almost any type of plant.

#### 2.6 Restricted Private Ownership of Land and Forest

Private ownership of forest land is limited and those lands in private ownership is generally confined to small parcels. When the community or government owns the forest and thus the products produced in the forest, the distribution of benefits to the individual is often not clear, and there may be little incentive for an individual to become involved with the existing natural resources/forestry programs. As government involvement increases, individual participation tends to decrease and the abuse of natural resources continues.

#### 2.7 Lack of Operating Funds for Government Programs

Operating funds for natural resources/forestry programs (and all other HMG programs) are often received by the district offices 6 to 9 months late, and in some years the last trimester release of funds never occurs, thus arbitrarily reducing budgets by 33 percent. This forces operations to either cease or to operate at a low level and on credit. When funds are finally released, they must be spent before the end of the fiscal year, thus resulting in a crash program that may lack coordination and quality.

## 2.8 Lack of Coordination and Cooperation Among Line Agencies

The various agencies involved in the natural resources/forestry sector often fail to communicate with each other at both district and national levels. Coordination of activities for the benefit of the overall program is thus limited. Rivalry, status, a lack of consideration and empathy, etc. does nothing to enhance to the program and often results in incompleting projects, duplication of efforts, or failures.

Donor groups involved in natural resources/forestry programs also fail to communicate with one another on a regular basis. Without this sharing of information, mistakes are likely to be repeated and a coordinated strategy or program does not occur.

## 2.9 Lack of Manpower and Training

Approximately 40 percent of the authorized positions in the DOF and the DSCWM in the Rapti Zone are unfilled at the present time due to a lack of qualified and willing people. For the most part, technical people do not like living in hill districts due to the lack of facilities, the lack of prestige, remote location, etc. Additionally, while basic technical training is usually adequate, extension training and the techniques of motivating people are often lacking and this important component of the program suffers.

## 2.10 Environmental

While Nepal has a favorable climate and adequate soil resources for rapid production of fuel and fodder, current forest practices threaten to destroy these basic resources, and once these resources are destroyed or severely altered, recovery will be extremely slow. Current reforestation efforts often concentrate on the most degraded areas where the soil resource is essentially lost, where natural seed sources no longer exist, and where surface temperatures, water infiltration, crusting, and other factors produce extremely harsh conditions. Reforestation efforts for such sites requires large inputs of time and materials, and success is tenuous at best.

## 3. STRATEGIES TO OVERCOME CONSTRAINTS

Following are strategies that could be used to overcome the constraints mentioned in the previous section. These strategies are not presented in detail, but the recommended programs (section 4.0) that follow give detail for the strategies that are recommended for incorporation into the Rapti II program.

### 3.1 Reforestation

The massive problem of forest degradation in the Rapti Zone cannot be solved by huge infusions of foreign aid. Reversing the practice of degrading the land to obtain fuel, fodder, and timber and balancing the supply of these products with the demand will require decades of concerted effort by all concerned. Simple, panchayat based natural resources/forestry programs can have a significant impact on reducing degradation and restoring degraded lands to productivity. Production oriented programs must emphasize the basic concept that planting plus protection plus management will result in sustained benefits not obtainable under the present system which degrades the resource. In addition, more efficient use of fuel and fodder and alternate sources of these commodities must be investigated.

### 3.2 Resource Oriented Attitudes

Extension and demonstration programs probably represent the most effective methods for changing attitudes that are contrary to good resource management. Extension efforts should emphasize that abuse of natural systems will destroy the ability of that system to produce products and regenerate, and this cause and effect relationship must be thoroughly understood. Introducing resource conservation into the schools will also be beneficial, especially if the study of resource conservation is reinforced by demonstration (such as school plantations or nurseries). Changing attitudes is a slow process that is difficult to monitor, but attitude change is essential if the resource conservation is to take place.

DOF personnel should receive more training in extension so that they can become a positive influence concerning forest management rather than the negative influence which was conveyed to most citizens in the past.

### 3.3 Providing Short-Term Benefits

Reforestation efforts should be redirected to provide short-term benefits. In some situations, this simply entails planting fodder and multi-purpose trees rather than pines. There appears to be large number of such of fodder and multipurpose species that are well suited for reforestation. In other areas, increased utilization of high yielding fodder grasses will produce the desired short-term results.

### 3.4 Increasing the Role of Women

The integration of women into the reforestation programs will likely be slow. But efforts must be deliberate. Requiring women to be part of the panchayat Forestry Committee may be one socially acceptable step to involve women. Preferential treatment of women when filling naike and forest watcher positions is also suggested. Locating nurseries, preferably private nurseries, near homes will also facilitate womens involvement.

### 3.5 Control of Livestock

To control the practice of unrestricted grazing in the Rapti Zone, a system of confined livestock feeding will likely be required in most areas. In some areas where sufficient fodder resources still exist, a rotational grazing may be appropriate. This dramatic departure from the traditional livestock system must be approached within the present system slowly, such as through prohibiting grazing in Panchayat Forests (PF) and Panchayat Protected Forests (PPF), but allowing the cutting of fodder. Lands thus protected must be substantially increased in Rapti II. Improving the quality of livestock may provide incentive to decrease herd size, but given the social attitude that livestock is form of wealth, this reduction may not occur and cannot be viewed as a solution to the problem.

### 3.6 Privatization

The Decentralization Act provides an excellent vehicle for privatization in the natural resources/forestry sector, by reinforcing the Community Forestry mandates and promoting local participation and "bottom-up" planning and decision-making by essentially private groups and individuals. The leased forest concept now being reconsidered by HMG will likely be an excellent method of guaranteeing benefits to those who expend the money and effort to revegetate degraded land. Privatization of nurseries is recommended as a means of increasing quality and decreasing cost. Tax concessions to individuals that reforest barren lands can be viewed as another form of privatization. Other likely areas for private sector involvement includes seed collection, preparation of management plans, fencing, and demarcation.

### 3.7 Operating Funds for Government Program

HMG budgetary policies must be reviewed if the Rapti II natural resources/forestry sector is to achieve its objectives. Members of the Natural Resource Analysis team strongly support the recommendation for an outside financial management team to review the USAID/HMG financial systems.

### 3.8 Coordination and Cooperation Among Line Agencies

The reforestation problem is far too serious to be hampered by a lack of cooperation and coordination among agencies, particular the DOF and the DSCWM. One way to overcome this is to hold annual meetings that discuss programs, technical issues, and jointly plan the program for the following year. While the DOF is production oriented and the DSCWM is protection oriented, both Departments face similar problems and utilize similar solution, and cooperation between both Departments will benefit both programs.

A second agency with which the DOF and DSCWM must cooperate is the Department of Livestock Development and Animal Health, particularly in restricted grazing programs and in development of fodder and forage supplies and enrichment programs. All three, plus the Department of Agriculture, are working on the latter, and while some redundancies exist more often work seems to "fall between the cracks". With the new reemphasis on coordination of programs at the district level, it is hoped that more cooperation through periodic meetings can be achieved in these important areas.

As previously mentioned, there are 44 different forestry projects now being funded in Nepal. While there may be sporadic meetings with some of the Donor organization, an organized effort to share information, successes, and failures is needed to provide more coherence at the national level to support district level efforts.

### 3.9 Manpower and Training

A well-defined program of incentives for HMG personnel which includes a rotation policy between hill and terai districts, living allowances for hill districts, training, etc. will be necessary to maintain motivation and to attract foresters to serve in the hill districts. Promotion of forestry curriculum in hill district schools may lead to more hill professionals in the forestry program, and such individuals may be more inclined to enjoy the hill districts than those from metropolitan areas or the terai. Inservice training, foreign tours and short courses, annual workshops, etc. are needed to keep the DOF and the DSCWM personnel up to date with technical and extension information.

### 3.10 Environmental

Site selection for reforestation efforts should concentrate on degraded sites that still retain a high potential for rapid recovery. This is especially important for the Panchayat Forest program if villagers are to be convinced of the merits of the program's short-term benefits. This strategy emphasizes the prevention of sites from becoming highly degraded rather than trying to correct the problem once it occurs. Only

if surplus funding becomes available should it be focused on the highly degraded sites with a low capacity for recovery.

#### 4. RECOMMENDED PROGRAM

Following is a brief description of the natural resources/forestry programs recommended for the 8-year Rapti II project. These recommendations are based on a 12 day field trip to the Rapti Zone, discussions with numerous HMG officials, discussions with consultants and directors of donor programs, and various documents obtained from USAID and other sources.

##### 4.1 Objective of the Natural Resources/Forestry in the Rapti Zone

The long-term objective of the natural resources/forestry program is to balance the demand for fuel, fodder, and timber with the ability of the ecosystem to supply these products on a sustained basis. Given the constraints, it appears that the best means of accomplishing this is through a system of confined feeding of livestock in some areas, a rotational grazing system in other areas, and a panchayat based program of planting, protecting, and managing private, community, and national lands for the sustained production of fodder, fuel wood, and timber in all areas of the Rapti Zone.

Although attainment of this objective is beyond the scope of Rapti II, significant accomplishments can be made within the time and financial limits of the Project. If project aims discussed in the following sections are met, 17.1 percent of the degraded forests and shrub lands in Rapti Zone will be stabilized, protected and placed back into production for fodder, fuel and timber. The recommended programs that follow have the objective of continuing the process started during Rapti I of bringing supply and demand into balance through a series of simple production-oriented programs. However, it will likely require several decades to balance the demand for natural resources with the sustainable supply of natural resources.

##### 4.2 Village Panchayat and Ward Programs

###### 4.2.1 Community Forestry (DOF)

4.2.1.1 Panchayat Forests and Panchayat Protected Forests. An integral part of Rapti II is the establishing of new Panchayat Forest (PF) and Panchayat Protected Forests (PPF) and expanding those that exist whenever possible.

The expansion and strengthening of this program appears highly dependent on utilization of user groups (or forest committees) at the ward and village level. These groups must be made to feel important and to feel responsible for the production-oriented forestry program. The Panchayat Forest Management Plan as designed under the current program should be simplified from its present form. Much more emphasis needs to be placed on the collection of products and the distribution of benefits, particularly those in the short-term.

The area Ranger is extremely important in promoting community forestry and in describing the management process, but direct involvement in the planning aspects should be minimized to allow the ideas and plans to evolve from the user group. A member of the Forestry Committee should prepare the management plan and not the DOF.

Because initial success of the Community Forestry Program is essential to its acceptance and realization of benefits, selection of land for the Panchayat Forest should be altered from the present system which focuses on highly degraded land to a system which selects the areas that are rapidly degrading but that have a high potential for quick recovery and production. Such lands are far more valuable for fodder, fuel, and timber than severely degraded land that will require a major input of time and money and where chances of success and producing short-term benefits are remote. This same selection criterion should also apply to Panchayat Protected Forests.

By the end of Rapti II, approximately 10,000 hectares of barren land will have been planted as Panchayat Forests. Approximately 20,000 hectares of forests will be administratively transferred to panchayat control (as Panchayat Protected Forest) and of this approximately 10 percent will be planted as enriched forest.

4.2.1.2 Nurseries. For existing panchayat nurseries, seedling production at the designed rate of 25,000 seedlings per year should be met as soon as possible. It is also recommended that these nurseries be transferred to a private basis by renting (via payment in kind) the nursery to an individual (presumably the naike). The DOF would then either agree to purchase the seedlings at a set rate, or, as experience dictates, citizens could be encouraged to purchase the seedlings for a small sum.

This method will likely increase the quantity and quality of seedling production by increasing the naike's stake in the outcome. It is likely to be more efficient than the existing operation where the naike is in theory an employee of the Forest Committee but in fact is supervised and paid directly by the DOF. It is recommended that this privatization program be initiated on a trial basis at selected sites with capable and willing naikes in all the districts, and if the first evaluation finds that this program is successful, privatization should be promoted throughout the Zone.

New nurseries should be established as necessary to support the Panchayat Forests. Privatization of these nurseries is also recommended either under the Forest Committee as a private assisted group or under individuals on a "franchise basis" with the Forest Committee. There may be some reluctance to initially privatize the new nurseries as the naike will presumably have had no training. However, privatization should proceed as soon as feasible.

Nurseries should be responsive to local needs and in most cases this means increasing the supply of fodder and multi purpose trees<sup>1/</sup>. Emphasis should also be placed on the propagation of native species. The current emphasis on propagation of pine seedlings at some panchayat nurseries should be discouraged because the benefits from planting pine can be only realized in the long-term and consequently do not satisfy short-term needs which are an essential part of the Community Forestry program. Forest Committee control of mature pine tree resin tapping contracts or sub-contracts, however, could be encouraged on a pilot basis to provide the committee with funds to support further multi-purpose forest development.

Although nursery location is dependent on water availability, land availability, access, etc., whenever possible the panchayat nursery should be located in a highly visible area, such as near a school, to serve as a reminder the reforestation is important and that efforts are underway to mitigate the current problems.

#### 4.2.2 Leased Forests (DOF)

It appears probable that the concept and revised rules pursuant to leased forests will be approved in the near future. The Rapti II project should formulate a program that can quickly implement these rules in the Rapti Zone. It is recommended that the Agricultural Development Bank be encouraged to support private forestry undertaken by individuals or groups of individuals for the purpose of planting and protecting the plantations established under the lease. Repayment schedules should be flexible and preferably delayed until products are derived from the leased forest.

The District Forest Controller and his staff should be prepared to vigorously promote leased forests as soon as the rules are approved. This includes explaining the program to village panchayats, groups and individuals, assisting in the submission of applications, helping with loan arrangements when necessary, helping prepare simple management plans, supplying the quantity and desired species of seeds and seedlings (under a credit arrangement), and technical assistance (gratis) as needed.

<sup>1/</sup> A fodder tree provides only fodder while a multi purpose tree may provide fodder, fuel, fruit, thatch, seeds for oil, timber, etc.

Leased lands may be well suited for the production of fodder and multi purpose species. Such species will provide a quick return to the farmer. In addition, this may make the Agricultural Development Bank more willing to issue loans because the return on the loan will be much higher than if slow growing species, such as sal or pine, are planted.

#### 4.2.3 Private Forests (DOF)

A district level program should be initiated to assist present owners of private forests to manage their holdings for sustained yields and to replant poorly stocked areas. The existing HMG program of giving tax concessions to individuals that convert privately held barren land into forest has not been widely used, perhaps due to a lack of knowledge about the program and a lack of encouragement. This concession must be enlarged to cover agri-tree growing lands and also to encourage farmers to have agri-crops and tree crops together. The DFO and the DSCO and their respective staffs should vigorously promote this program.

#### 4.2.4 Management and Utilization

4.2.4.1 Management Plans (DOF). It is recommended that a district forest management plan be prepared for each district in the Rapti zone. The purpose of these documents would be to evaluate the existing resources and to allocate these resources to maximize production of fuel, fodder, and timber. Efforts should be concentrated on evaluating the current and potential resource production from National Protected Forests, National Production Forests, Panchayat forests (existing and potential), Panchayat Protected Forests (existing and potential), leased forests (potential), and existing private forests.

During Rapti II, detailed planning is not viewed as necessary and efforts should concentrate on the direction and organization of forestry efforts for appropriate utilization of existing and potential resources. Some land classification information is available and should be fully utilized.

Preparation of detailed management plans for selected tracks of National Protected Forests and especially National Production Forests should be prepared for those areas that can in fact be managed under existing manpower and social constraints. Whenever possible, management plans should be jointly prepared by the area Ranger and the panchayat Forestry Committee, with the technical assistance and the guidance of the DFC. Forestry consultants could also assist in the preparation of management plans.

4.2.4.2 Demarcation (DOF). Demarcation of PF and PPF appears unnecessary in most situations because of village panchayat awareness of local boundaries, obvious geographic boundaries, and the presence of seedlings in PF. However, in any areas where the boundary is not clear, demarcation should take place.

In contrast, demarcation is needed in those areas where cultivation is encroaching on the National Forest. Once encroachment takes place, it is virtually impossible to return the now barren land to the National Forest. Therefore, Rapti II should provide for demarcation of National Forest lands that are threatened by encroachment or that will likely be threatened in the near future. Rangers and assistant rangers would carry out field demarcation under direction of the DFC.

4.2.4.3 Improved Utilization (DOF). Improved utilization of forest products will obviously decrease the demands placed on the existing forests and improved utilization should be a part of Rapti II. The best program to date is the improved chulos approach which has the potential of significantly decreasing fuel consumption. The existing program is gaining wider acceptance and the program should be continued. Extension efforts (by the DFC and his staff) that point out the increased utilization realized when trees are cut by a saw rather than by axes will be of benefit, although the number of villagers that can afford to buy a saw may be low.

#### 4.2.5 Involvement of Women in the Natural Resources/Forestry Sector (DOF and DSCWM)

Because women are responsible for the collection and use of fuel and fodder, they are likely to have more interest and motivation in reforestation projects than men and their involvement may be essential if the projects are to be successful. To involve women in Community Forestry, it is recommended that at least 25 percent of the members of the Panchayat Forestry Committee be women. This will give women a voice and role in the initial, and critical, stages of community forestry. Women should be encouraged to apply for naike and forest watchers positions, and any women applicants should be given preferential treatment. Privatization of nurseries could allow more women's involvement because private land near the home could be used to produce seedlings. Women should also be involved in the professional aspects of forestry and soil conservation, but such involvement will likely be slow.

### 4.3 District Level Programs

#### 4.3.1 Divisional Nurseries (DOF)

It is recommended that the Rapti II program establish Divisional nurseries in Pyuthan, Rolpa, and Rukum Districts. And that additional divisional nurseries be established in Dang and Salyan districts. Initial size of the nursery should correspond to anticipated demand and all nursery operations would be carried out under the direction of the DFC. To the extent that panchayat nurseries cannot meet local demands, the Divisional nursery should ensure that adequate supplies of fodder and multi-purpose trees are available for private planting. Because of land ownership and possibly other constraints, privatization of Divisional nurseries may be difficult, but if opportunities arise for privatization, they should be pursued.

#### 4.3.2 Divisional Plantations

The Rapti II program should continue the existing program of establishing new Divisional plantations and expanding existing plantations. Whenever possible, fringe plantations should be established. These plantations are located at the base of a forested slope and such plantations would likely be long and narrow. By protecting the plantation, the entire forested slope is also protected. When establishing plantations, the local panchayat Forestry Committee should be involved and the management plan should be a joint effort involving the Forestry Committee and the area ranger.

#### 4.3.3 Seed Collection and Storage (DOF)

Seed collection and storage for panchayat and divisional nurseries should be centralized on a district basis and incorporated into the operations of the divisional nurseries. At the present time, this means that centralized seed collection and storage should take place in Dang and Salyan Districts where divisional nurseries now exist. As Divisional nurseries are established in the remaining districts, a seed collection and storage program should be established. It is of great importance that high quality seeds are collected properly, so that their viability is guaranteed. Naikes, forest guards, and private individuals can collect and store seeds under the direction of the DFC.

#### 4.3.4 Dang-Deokhuri Multi-purpose Agro Forestry Plantation (DOF)

It is recommended that the Rapti II program support a large scale production-oriented agro-forestry project within natural forest lands in the Dang-Deokhuri area north of the East-West Highway and including both sides of the Chure Hills.

Although this area is highly degraded and threatened by encroaching cultivation, it still retains a high recovery potential and a large area of land could be placed under protection and management at a relatively low cost. The flat and fertile land at the base of the hills would be fenced and the boundary of the National Forest clearly marked. Such fencing would not only protect the flat land but would also protect the degraded forest found on the unoccupied hills to the north and south. A block of the flat land would be designated for agro-forestry, and local villagers would be allowed to plant crops provided that they also planted fuel, fodder and timber trees at a specified spacing intervals. Within about 3 years, the trees would shade the understory agriculture crop and yields would decrease. New blocks would be selected and the agro-forestry block converted to only forest, and the process repeated. Ideally, a rotation system could be developed whereby once the last block is ready for transfer to forest, the first block is ready for timber harvest and the cycle repeated.

The villagers would serve as tenant farmers not owning the land, but having exclusive rights to the crops produced. Any removal of fodder, fuel, and timber would be under the direction of the DFC and in accordance with the management plan. The forest on the hillside would be allowed to recover and a management plan prepared and implemented. Finally, this area is highly visible and would serve as an excellent education and extension tool. While this project would be under the direction of the Dang District DFC, coordination and services of several JT's and JTA's would be beneficial for increasing production of agricultural crops, selecting appropriate crops and cropping methods, improved seeds, fertilizer programs, etc.

This agro-forestry concept is based on existing agro-forestry plantations in Tamagarhi, Bara District and the Sagarnath Forestry Development Project in the Sarlahi District. Both of these projects were started in the late 1970's and have been quite successful. These projects demonstrate that agro-forestry has many advantages over either system alone. Intercropping has a positive benefit on tree growth and a 100 percent increase in height, and a 5-fold increase in biomass production is often obtainable when compared to a forest plantation without intercropping. Other advantages include elimination of the fire danger and the threat of grazing during the intercropping period.

The scope of this paper allows for only limited detail concerning the proposed agro-forestry system. Relatively wide spacing, such as 2 by 4 meters will be necessary for the trees. Each farmer would be assigned up to 1 hectare of land per year and he or she would be required to plant 1250 trees on that hectare. Seedlings would be provided free of charge from a project nursery and would be planted free of charge. Trees species likely to be considered for planting include Sissoo, Eucalyptus, Khair, Teak, Bakaino and possibly others as listed in the Appendix. The crops can be economically produced for about three years at which time the shade from the trees is of sufficient intensity to decrease yields. During the wet season, maize or groundnuts are commonly grown in an intercropping system, while mustard oil seed is grown during the dry season. Approximately 500 hectares could be placed under the agro-forestry system per year and because of the location of the villages along the highway, the distance from a farmer's home to his or her field is close and convenient for farming. Estimated total annual production for this project is 750 tons of maize and 150 tons oilseed for an estimated annual gross income of Rs.2,250,000. In addition, approximately 500 families will have access to farm land and employment opportunities will be created (such as naikes).

#### 4.3.5 Stabilization

4.3.5.1. Biological Stabilization Programs (DSCWM). Rapti II should continue the existing program of biological stabilization of roadsides, but this program and nursery operations should be transferred from the DOR to the DSCWM and conducted under the direction of the DSCO and his staff of overseers, rangers, and naikes. The DOR should prioritize stabilization sites and provide

the DSCWM with any other details to ensure an effective and coordinated program. The current trail stabilization program should also be continued. Both programs should work with the local panchayat Forestry Committee in preparing management plans for these areas. Both programs should also place more emphasis on the use of grasses for surface stabilization. It appears that a number of native grasses are capable of providing a rapid and effective surface stabilization and are better suited for biological stabilization than trees.

The existing canal rehabilitation program and the terrace improvement program should be continued with emphasis placed on integrating stabilization with fodder, fuel and agricultural production. Junior Technicians, who are concerned with Agriculture issues within the DSCWM, should be utilized to promote and implement this program through the use of fodder and multi purpose trees. These programs have the potential of making a significant contribution to the agro-forestry concept and the existing level of effort should be expanded in Rapti II. The recently started water source protection program should be continued, although this program is aimed at protection rather than production.

4.3.5.2 Critical Area Stabilization (DSCWM). Continuation of this program under Rapti II is recommended, but some changes appear necessary for a more effective program. Site selection should be changed from selecting the highly degraded areas to selecting the areas in danger of severe degradation but still retaining a high capacity for rapid recovery. Stabilization efforts should emphasize the use of grasses as they are usually one order of magnitude more effective in surface stabilization than shrubs and trees. However, grasses should not be planted to the exclusion of fuel and fodder trees. All stabilization efforts should be coordinated through the local panchayat and the affected wards, and a management plan, which clearly describes the protection program and the distribution of benefits, should be jointly prepared by the DSCO and the staff, the village panchayat, and the ward. Mechanical (or physical) stabilization should be limited as most of the previous efforts appear to be of questionable benefits. However, in some areas of rapid down cutting, gabions may be necessary.

#### 4.4 Multi-District Programs And Support

##### 4.4.1 Extension (DOF and DSCWM)

Both the DOF and the DSCWM should intensify their extension activities to increase citizen understanding of resource management for sustained yields. This can be partially accomplished by better utilization of existing extension materials which include posters, pamphlets, reforestation symbols, calendars, films, shirts for the forestry staff, demonstration etc. Rangers, assistant rangers, naikes, guards, watchers, overseers, junior technicians, and assistant junior technicians, should include extension techniques. Vigorous extension efforts should be directed at various groups including women, school children, ward leaders, etc.

The existing in-country Pradhan Pancha forestry tour has been very successful and should be continued and expanded to include (as space is available) ward leaders, Forestry Committee members, and representatives from women's organization, youth organization, and other organizations as well. While this program is now organized by the PCO, as the program matures it could be handled by individual districts.

Schools have been largely ignored in the extension provided thus far and it is recommended that the concept of planting, protecting, and managing lands for the production of fodder, fuel, and timber be thoroughly integrated into the education process at all grade levels during Rapti II. One approach is to establish a small (less than 5 hectare) plantation adjacent to as many schools as possible. A "forestry committee" would consist of the older students, teachers and the area ranger. Once a comprehensive management plan is written, the students would plant fodder and multi purpose trees and the plantation protected. Products would be harvested according to the management plan and sold to the community; the funds thus generated would be used by the students or school in some manner. The plantation could be established in phases (perhaps at three 5 year intervals) to allow frequent planting, and the 15 year old trees harvested for timber and new trees planted. This would give student an opportunity to participate in the full range of forest activities and to benefit from the products. The DSCO and his staff should also be involved to promote the stabilization aspects of reforestation. Another approach is a school nursery where the students, with help from a naike, would raise and sell seedlings.

#### 4.4.2 Facilities and Maintenance (DOF and DSCWM)

Each district should have the basic facilities from which to operate an effective natural resources/forestry program. DFC facilities, DSCWM facilities, and ranger accommodations are important to the success of the project and provision of the needed facilities should be considered for inclusion under Rapti II. Equipment, vehicles, and especially maintenance must also be a part of Rapti II as these items are required for efficient and timely operations. Funding by AID of any recurrent costs should be provided on a descending percentage basis over the life of the project to ensure that the various departments become accustomed to including them in their plans and budgets.

#### 4.4.3 Revised Financial Disbursement Program (HMG)

The timely release of approved funds for natural resources/forestry programs is essential if these programs are to be successful and meet their objectives. The Rapti Phase II project should encourage revision of the current budgetary system.

#### 4.4.4 Incentive Program (HMG)

District Forestry Officers, District Soil Conservation Officers, and other personnel often suffer from a lack of motivation due to poorly defined incentives for those who do a good job. A national program that clearly states policies regarding promotions, transfers, and rotation policy between the hill districts and terai districts, field allowances for hill posts, training, etc. needs to be developed to provide a highly motivated staff that will carry out the essential task of restoring productivity to the public lands in Nepal. Rapti II should provide any requested technical assistance to help formulate a better incentive program.

#### 4.4.5 Integration with Livestock Programs (SFDP and WDO)

The deforestation problem in the Rapti Zone is essentially a livestock problem and cannot be solved without an integrated program. One integration method is through the livestock loan program that is now conducted through SFDP and the WDO. When a user group or individual applies for a livestock loan, loan approval should be contingent on the requirement that sufficient fodder be planted, protected, and managed to feed the purchased livestock. The need for fodder should be obvious to the user group, and if this requirement is approached in a positive manner by those administering the loan, it should not complicate or delay loan approval. Fodder plants would be provided by the panchayat nursery and a management plan could be prepared through the community forestry program. Some type of simple enforcement mechanism would be required to insure that the fodder species are being protected and managed according to plan.

Encouraging the planting of a fodder crop, preferably some type of legume, during the interval between wet season and dry season crops could greatly decrease the fodder demand now placed on the forests. Some fodder species such as legumes can be very productive with minimal irrigation, and the legumes will decrease fertilizer requirements of subsequent crops. Unfortunately, this system is limited to irrigated land and the fodder crop will require some type of protection from the livestock that roam freely during crop intervals.

As mentioned throughout the recommended program section, considerably more attention must be placed on the propagation and utilization of fodder and multipurpose species by the DOF, the DSCWM, DLD. Organized and coordinated extension efforts, integration with privatization programs, involvement of women, and adequate supplies of suitable species are necessary if the supply of quality fodder is to be increased.

#### 4.4.6 Training (DOF and DSCWM)

Training should remain an integral part of the natural resources/forestry program throughout Rapti II. It is recommended that an annual Zone-wide seminar-workshop be held for DFC's, Rangers, and the DSCO. The purpose of this meeting is to exchange technical

information, review extension efforts, and to organize and coordinate activities for the up coming year. In addition, each district would have trimestrial reviews under the Forest and Industry Committee of the District Panchayat, and DOF and DSCWM personnel would work together during these meetings. Annual plans for both programs are also prepared with this committee, so training/coordination can be facilitated at the district level as well.

Zone and/or district level workshops are also recommended for naikes for the purpose of exchanging technical information concerning propagation techniques, seed collection, field trials, supply-demand problems, and other subjects relating to the production and distribution of seedlings. This exchange of information will help achieve more efficient operations and will help prevent mistakes from reoccurring. It is recommended that such workshops be organized every other year starting in 1987.

It is recommended that district workshops be organized on an annual basis to review programs, discuss problems, and to plan for the next year. The DFC, rangers, assistant rangers, naikes, forest guards, and forest watchers should be included. The workshops should be preceded by meetings with Panchayat Forest Committees.

Existing programs of offering short-term (6 months or less) training in foreign countries has been successful both in terms of training and motivation. These programs should be continued in Rapti II. As previously mentioned, the Pradhan Pancha forestry tours should be continued. Initial training for naikes, forest watchers, and forest guards is essential and should obviously continue throughout Rapti II.

#### 4.4.7 Monitoring and Evaluation

Probably the best method of monitoring achievements and evaluating programs is through annual reports prepared by the DFC and the DSCO. These annual reports should be based on the basis of the program for the up coming year, and targets and programs should be flexible to ensure that programs relate to changing conditions and opportunities. They should be supplemented by use of the nationally established monitoring system under the Community Forestry Project.

Insufficient monitoring currently exists in Rapti Zone to evaluate the success and failures of the seedling distribution program. Some type of simple monitoring program is needed that collect survival and growth information on a species basis and on a plantation type (panchayat, private, divisional, etc.) basis. This monitoring could be under the direction of the Regional Forestry Directory to ensure consistency of methods and sampling and to provide data that is accurate and free of bias. Results should be thoroughly discussed at the previously mentioned workshops. Other monitoring programs are needed for community forestry, success of private plantings, agro-forestry programs, stabilization efforts, citizen involvement and attitude change, etc.

Such monitoring efforts have been described in detail in the Smith 1986 report entitled "A Preliminary Monitoring and Impact Assessment Plan and Sample Monitoring Report for the Rapti Development Project."

#### 4.5 Summary of Inputs, Outputs And Benefits Recommended Inputs and Probable outputs

4.5.1 Inputs. Personnel requirements for implementation of the above projects can be largely met by increasing the DFO staff and the DSCWM staff to the level authorized by HMG. Currently, only about 60 percent of these positions are filled. The remaining unfilled positions should be filled as soon as possible if this project is to achieve the anticipated outputs. These unfilled positions include rangers, assistant rangers, overseers, junior technicians, etc. The existing forestry consultant employed by USAID, the training and extension coordinator (contract), and the five forestry Peace Corps volunteers (one per district) should be retained throughout the Rapti II program, subject to reevaluation of need and to budget availability. Additional personnel requirements are associated with the proposed Dang-Deukhuri Multi-Purpose Agro-Forestry Plantation. This effort is expected to require two Gazetted Class 3 Forestry Officers, 5 Rangers, 12 Assistant Rangers, and 1 Forestry Peace Corps Volunteer. The Community Forestry program will require naikes, forest guards, and forest watchers that should be hired on an as needed basis. It is hoped that HMG will begin to help Forest Committees better manage generation and collection of short-term benefits so that the Committees can begin to assume the costs of these personnel.

4.5.2 Outputs. Presented in Table 3 are the projected targets and estimated costs for the DOF portion of Rapti II. Approximately 60 percent of the DOF budget is allocated for the forestry programs in the Dang District. Of the 5 districts in the Zone, this district has both the greatest reforestation needs and the greatest ability to produce forest products due to fertile soils, adequate precipitation, and accessibility. Salyan and Pyuthan Districts are both budgeted to receive approximately 12 percent of the allocated funds while the two remaining and more remote districts will each receive approximately 10 percent. This distribution of funds is consistent with the needs and especially the development potential in these Districts.

With respect to particular projects, the Dang-Deukhuri Multi-Purpose Agro-Forestry Plantation will require approximately 43 percent of the DOF budget. Although this project will be costly, the benefits of increased (and integrated) forest and agriculture crops production, protection of a valuable resource that may be soon lost, local capacity building, creating many jobs for the local people, providing agriculture land to landless farmers and farmers with small holdings, and of providing a highly visible example of multi-purpose forestry more than justify the cost.

The second largest item is Community Forestry (panchayat nurseries, PF, and PPF) which will require approximately 31 percent of the budget. Extension and other programs, such as incentives, livestock, women's participation, and private forests also need financial support when detailed budgets are prepared.

Table 4 presents the projected targets and estimated costs for the DSCWM portion of the natural resources/forestry program. Because these programs are protection oriented rather than production oriented, total expenditures are substantially less than for the DOF program. For the most part, the funds are relatively evenly split among the various stabilization projects; all appear of equal importance and value. The need for stabilization is of approximate equal magnitude in all the Districts, and the disparity between funds allocated to the Dang Districts as compared to the other Districts is not as great here as it was in the DOF budget. District budgets reflect accessibility and what the program can realistically accomplish given the constraints.

Unit costs are presented in Table 5 and represent the figures used to obtain many of the costs in Tables 3 and 4. A 15 percent contingency was added to each District's budget to cover unforeseen expenses. Plantation maintenance, fire protection, extension, natural forest management planning, gully control, terrace improvement, watershed protection, and school plantation or nurseries were estimated on a lump sum basis and not on a unit cost basis. Vehicles costs are also included in the budget. Vehicles and equipment will be required for the DFC and the DSCO and include trucks, motorcycles, bicycles, and horses depending on the need and traveling conditions within the district. In addition, the agro-forestry project will need vehicles and equipment to facilitate transportation between the different production blocks.

The targets presented in Tables 3 and 4 were based on anticipated program accomplishments obtain through discussions with the DFC and the DSCO, absorptive and production capabilities of each district, and from information provided by the Chief of the Community Forestry and Afforestation Division. Targets for community forestry may appear low in view of the importance of this program, but after careful consideration of all issues involved, of this program, the targets presented in Table 4 are realistic.

It must be reemphasized that while projected targets presented in Table 3 and 4 represent realistic estimates at this point in time, the project must not be tied to these targets. Annual readjustments should be made during the District planning cycle. The project must be flexible in terms of targeted outputs to take advantage of opportunities and to adjust for unexpected difficulties. Additionally, costs are based on gross unit costs to date and will understandably vary with specific situations over time.

Costs for participant training and technical assistance are found in a separate report accompanying the Sheladia analyses.

Table 6 presents a summary of inputs and outputs for the Natural Resources/Forestry programs. Such information will be of use in preparing detailed budgets.

#### 4.5.3 Benefits

The most important benefits of the natural resources/forestry program in Rapti II will likely be the education and attitude changes that should take place. Assuming 10 members per forest committee, at least 2000 farmers will be directly involved in forest management and sustained yield of forest products. Additional thousands will be involved in tree planting and harvesting fuel and fodder according to a management plan. It is anticipated that these programs will foster an appreciation for natural resources and the conviction that planting plus protection plus management will yield benefits that are not obtained under traditional systems that results in resource degradation.

The agro-forestry project will demonstrate that trees and crops can be compatible and that a sustained rotational system developed that meets the basic needs of food, fuel, fodder, and timber. This highly visible project will also serve as an excellent extension and demonstration tool as it will be the first one of its kind in western Nepal, and will foster cooperation between the DOF and the DOA.

Quantative benefits not presented in Tables 3, 4, and 6 are estimated as follows

<u>Category</u>	<u>Product:</u>	<u>Yield/hectare/year</u>
Managed forest (1)	fuel/timber	4.5 tons (dry weight) (2)
	fodder	8.8 tons (wet weight) (3)
Agro-Forestry	fuel/timber	6 tons (dry weight) (2)
	fodder	14 tons (wet weight) (3)
	crops (maize or groundnut)	1.5 tons
	oil seed	0.3 tons

In addition, the DOF Programs will produce and plant approximately 26,700,000 seedlings, the agro-forestry project will produce and plant approximately 5,000,000 seedlings, and the DSCWM will produce and plant approximately 5,500,000 seedlings. Approximately 17.1 percent (or 19,500 hectares) of degraded forest and shrub land in the Rapti Zone will be stabilized, protected and managed for sustained yield of forest products. Other benefits including soil protection, increased water yields, reduced erosion, higher wildlife populations, watershed protection, local capacity building, a more productive life for the citizens, employment opportunities and a highly motivated and trained natural resources/forestry staff that can continue and expand these programs following termination of Rapti II.

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1) includes panchayat forests, panchayat protected forest, leased forest, private forest, and divisional plantation

2) production is dependent on species, and growth rate is not consistent; the production figures represent the average growth over a 6-year period

3) growth rate is not consistent and this figures represent an average; yield assumes that 25% of the plantated trees are fodder species.

Table 4

DSCNM Project Targets for Rapli II

District	Nursery No.	Trail, Canal, Roadside Stabilization, Ha.		Gully Control (Vegetative & Physical)	Terrace Improvement	Watershed Protection & Improvement	Building Construction	Estimated Cost Rs. (1)
		Fenced	Unfenced					
Dang	13	150	300	6	Undefined	Undefined	3	5,400,000
Salyan	12	125	250	5	"	"	3	4,500,000
Pyuthan	11	125	250	5	"	"	2	4,500,000
Rukum	9	100	200	4	"	"	2	3,600,000
Rolpa	9	100	200	4	"	"	2	3,600,000
Totals	54	600	1,000	24	-----	-----	12	21,600,000 (US \$1,028,571)

Percentage  
of Total  
Cost

11%

22%

22%

25%

12%

(1) Annual Adjustments for Inflation will be necessary.

## APPENDIX

### Common Tree Speies

#### Multi-Purpose Tree Species

1. Chiuri	-	Bassia Butyracea
2. Lapsi	-	Choerospondias Axilliris
3. Koiralo	-	Bauhinia Veriegata
4. Timilo	-	Fiens Aurculata
5. Bamboos	-	Dandrocalamus Spps.
6. Sissoo	-	Dalbergia Sisso
7. Ritha	-	Sapindus Mukorossi
8. Okhar(Walnut)	-	Juglans Regia
9. Kimbu(Malburry)	-	Morus Alba

#### Fodder-Firewood Tree Species

1. Bhimal	-	Grewia Oppositifloia
2. Kutmiro	-	Litsea Polyantha
3. Khanyo	-	Ficus Semicordata
4. Baisa	-	Salix Spps.
5. Khari	-	Celtis Australis
6. Ipil Ipil	-	Leucaena Leacocephala
7. Lakuri	-	Fraxinus Floribunda
8. Bakino	-	Melia Azedarach
9. Siris	-	Albizzia Spps.
10. Kabro	-	Ficus Infectoria
11. Utis	-	Alnus Nepalensis
12. Dudilo	-	Ficus Nemoralis
13. Badar	-	Artocarpus Lakoocha
14. Jingan	-	Lanea Grandis

#### Timber and Industrial Tree Species

1. Khair	-	Acacia Catechue
2. Teak	-	Tectona Grandis
3. Masla	-	Eucalyptus Spp.

TABLE 5  
UNIT COSTS

<u>Item</u>	<u>Unit</u>	<u>Cost Rs.</u>
Panchayat Nursery	EA	14,000
District Nursery	EA	50,000
Panchayat Forest	HA	1,600
Panchayat Protected Forest (Plantation Portion)	HA	1,600
Panchayat Protected Forest (Non Plantation)	HA	0
Demarcation	KM	1,200
Departmental Plantation	HA	5,000
Seedling Cost	per seedling	0.50
 Buildings		
Seedhouse and Training Center	EA	250,000
Ranger Office	EA	250,000
DFC/DSCO Office	EA	400,000
DFC/DSCO Residence	EA	350,000
Agro-Forestry	HA	5,000
Private Plantations	HA	0

(20)

TABLE 6

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 INPUTS AND OUTPUTS FOR THE NATURAL RESOURCES/FORESTRY SECTOR  
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Component	Inputs	Responsible Party	Outputs
<b>Ward &amp; Village Panchayat Level</b>			
<b>1. Community Forestry</b>			
	Extension		
	MGT. Plan Assistance	Area Ranger /PCV	10,100 Ha P.F.
	Demarcation	Area Ranger /DFC	40 Nurseries
	Local Participation	Private Citizens/VP	2,000 Ha. PPF (Plantation)
	Local Paid Labor	Private Citizens/VP	20,000 Ha. PPF (Administrative Transfer)
	Technical Assistance	TA Contract	500 Km. Demarcation
	Training	District/Multi-District	25,000 Seedlings/Nursery
	Seed & Materials	District/DFC	Fuel Fodder, Timber
	Seedlings	Panchayat Nursery/Contractor	Employment opportunities
<b>2. Leased Forests</b>			
	Extension		
	Promotion	DFC/Area Ranger /PCV	350 Ha. Leased Forest
	MGT. Plan Assistance	Area Ranger /DFC	Plantation
	Seedlings	Panchayat Nursery	Fuel, Fodder, Timber
	Planting	Lesser	
	Projection	Lesser	
<b>3. Private Forests</b>			
	Extension		
	Promotion	DFC/Area Ranger /PCV	350 Ha. of Private
	MGT. Plan Assistance	Area Ranger /DFC	Plantation
	Seedling	Panchayat Nursery	Fuel, Fodder, Timber
	Planting	Owner	
	Protection	Owner	
<b>4. Management &amp; Utilization</b>			
	MGT. Plans	DFC/Contractor	350 Ha. of Private
	Demarcation	Area Ranger /Contractor	Plantation
	Utilization	Area Ranger /PCV	Decreased Fuel Consumption
<b>5. Involvement of Women</b>			
	Extension	Area Ranger /PCV	25% increase of Women in Forestry Committee
	Preferential Treatment	Area Ranger /DFC	Increase in Women Naikes and Watchers

TABLE 6

Continued

Component	Inputs	Responsible Party	Outputs
<b>District Level Programs</b>			
1. Divisional Nurseries	Seeds and Materials Paid Local Labor Training	District Private Citizens District/Multi-District	100,000 Seedlings/Nursery Training and Estension Employment opportunities
2. Divisional Plantations	Seedlings Fencing Local Paid Labor	Divisional Nursery Area Ranger/Contractor Private Citizens	Employment opportunities 1,100 Ha. of Plantation Fuel, Fodder, Timber
3. Seed Collection	Training Local Labor	District/Multi-District Private Citizens/Contractor	Employment opportunities Quality Seeds for Nurseries
4. Agro. Forestry	Extension Crop Systems Forest MGT. Seedlings Ag. Seeds Fencing Equipment Seeds & Materials Local Participation Training	Ag. Extension Agent Area Ranger/DFC Project Nursery AII/Private Citizens DFC/Contractor DFC District Private Citizens District	4,000 Ha. Agro-Forestry Plantation Chure Hills National Forest Crops Fodder, Fuel, Timber Employment opportunities
5. Stabilization	Seeds & Materials Seedlings Fencing Local Paid Labor Extension Training	District/Contractor DSCO DSCO/Contract Private Citizens DSCO Staff District	54 Nurseries 600 Fenced Plantation 1000 Ha. Unfenced Piantation 24 Bully Control Projects Employment opportunities

TABLE 6

Continued

Component	Inputs	Responsible Party	Outputs
----- Multi-District Programs -----			
1. Extension	Tours Training Materials School Plantations/Nurseries Seeds & Materials Seedlings Training	DCO District/Multi-District District/Division Area Ranger/DFC DFC DFC Area Ranger/Schools	Motivation Education
2. Facilities & Maintenance	Materials Local labor	Contractor Private Citizens	Employment opportunities 5 Seed Houses/Training Centres (DOF) 18 office & Residential Buildings (DOF) 12 Office & Residential- Buildings (DSCWM)
3. Revised Financial Disbursement Tech. Asst. Training		USAID & Ministry of Finance	Timely Release of Funds
4. Incentives	Programs	HMG	Improved Program
5. Integration with Livestock	Extension Livestock Fodder Livestock Loan Requirements Fodder Seedlings	LDO DFC, AG. Extension SFDP and WDO District Nurseries	Increased Fodder Production
6. Training	Materials Teachers Facilities	District/Multi-District /Zonal/Divisional	Education, Motivation, increased Productivity
7. Monitoring and Evaluation	Personnel	USAID	Program Evaluation Data on tree survival and Growth Guidelines for Species Selection