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RESOURCE CONSERVATION AND UTILIZATION

PROJECT

PROJECT NUMBER 367-0132

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Prepared by: APROSC

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RESOURCE CONSERVATION UTILIZATION PROJECT

HORTICULTURE COMPONENT

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RCU PROJECT

HORTICULTURE COMPONENT

Introduction:

The environmental problems of Nepal, to which the RCUP is addressed, have been discussed exhaustively in other sections of this report. A brief summary will suffice to provide the context for the activities of the horticulture component of the RCUP.

The hills of Nepal, geologically young and very steep, and subject to the intense rainfall and periodic droughts of a monsoon climate are naturally prone to erosion. Intensive use of the land's surface right up to the brick of perennial snows has exacerbated this problem. The natural regenerator capacity of the soils, grazing lands and forests is so overburdened that it cannot keep pace with the demands placed on it by a rapidly expanding population. The people who are making these demands, meanwhile, are basically able to provide themselves with the basic necessities of life: drinking water, staple foods, fuelwood, and feed for their livestock. As they burn up the forests for fuel or to increase the growth of grasses and establish farms on increasingly marginal land, soil erosion is vastly accelerated, further limiting the basis of their livelihood and that of people hundreds of miles away throughout the huge watershed of the Himalayas.

The solution to this complex problem is conceptually quite simple: the hill residents of Nepal must be provided with the means of attaining a better-than-subsistence level quality of life, by -

(a) increasing production of staple crops in lands best suited to agronomy, so as to reduce the pressure on marginal lands while increasing crop production.

(b) management and plantation of forests and grazing lands, so as to increase and sustain the availability of forest products to the villagers while reducing erosion.

(c) improving the quality of livestock, so as to increase production levels while making each animal a valuable asset so that stall-feeding and managed grazing will be encouraged, thereby further reducing pressure on marginal lands and providing protection for forest plantations and other sensitive areas.

(d) introducing horticulture, so as to improve the nutrition of hill residents and to make better use of certain marginal lands, as well as to develop the basis for employment alternatives to subsistence agriculture, as the infrastructure is developed to market horticultural products.

(e) expanding opportunities for off-farm employment, including locally-based industries such as fruit and vegetable processing plants, sawmills and cottage industries.

This is the core of the RCUP activities. The additional training institutional development evaluation and monitoring aspects of the RCUP are, in effect, support activities so that these village level projects are sustained and expanded until they eventually become habitual practices in all the hill villages of Nepal.

II. Current Status of Horticulture in RCU Project Areas:

At present, the districts covered by the RCUP are similar to most of the rest of Nepal in terms of this horticultural activities: fruit and vegetable production is not even equal to demand. Generally speaking, the only vegetables which are produced for local sale or trade are onions, potatoes and soybeans, and even those are in short supply. Most households raise cucurbits, radishes and mustard greens for their own consumption, and a few produce peas, string beans, tomatoes and cauliflower on a very limited basis. No attempt was

made to quantify these minimal levels of vegetable production for the purposes of this report.

Fruit types and production levels vary from region to region, dependent on climate, proximity to markets, and intensity of pervious horticultural extension activities. In the Kulekhani catchment there are about 99 hectares of trees bearing temperate fruits (apple, pear, peach, plum, walnut, etc.) from which the mature trees currently produce about 555 metric tons. Mature semi-tropical fruit species (lime, orange, lemon, banana, and others) cover roughly 7 1/2 hectares and produce around 61 metric tons. The Daraundi catchment has about 27 hectares of temperate fruit trees producing 318 metric tons, 141 hectares of semi-tropical fruits yielding 1,219 metric tons, and 68 hectares of tropical fruits producing 552 metric tons. The Myagdi portion of the Kaligandaki catchment produces around 99 metric tons of temperate fruits from 16 hectares, 591 metric tons of semi-tropical fruits from 34 hectares and 8 metric tons of tropical fruits from 0.5 hectare. Finally, the Mustang portion of the Kaligandaki catchment yields 241 metric tons of temperate fruits from 168 hectares. It is too high for semi-tropical or tropical species.

It is important to note that even in areas where fruit production is comparatively high there are people who never taste it. Gorkha, for instance, exports substantial quantities of fruit to Pokhara and Kathmandu.

III. RCUP Horticulture Activities

A. Home Fruit Gardens

Among the RCUP project goals are those of introducing efficient and appropriate land uses with the additional opportunity of generating off-farm income, and improving the nutritional level of citizens of the project area. A first step in this direction is to introduce fruit raising for home consumption, with the opportunity of expanding the individual involvement in fruit raising as each farmer gains skill in this field and marketing facilities become available.

The fruits introduced in this project will vary by climatic region (which is governed in the hills by altitude). The following fruits are recommended for various ranges in elevation:

Elevation	Types of fruit	
a. Below 800 m	Tropical	Mango, Litchi, Jackfruit, Banana, Guava, Lemon, Papaya, Pineapple
b. 800 m - 1500 m	Sub-tropical	Oranges, Limes, Lemons, Pomegranate
c. 1500 m - 1800 m	Warm temperate	Peach, Pear, Japanese Plum, Apricot, Almond, Persimmon
d. 1800 m - 3300 m	Cool temperate	Apple, Walnut, European Plum

Each household in the project areas will be provided with roughly equal number of fruit saplings appropriate to the area. The number will vary according to the types of fruit provided and what the household already has. A much greater number of saplings will be provided to each household in Mustang, due to a government policy to stress fruit production in that region. The plan for sapling distribution is as follows:

Project area	No. of saplings per household
a. Kulekhani	10
b. Gorkha	15
c. Myagdi	17
d. Mustang	56

Proposed number of fruit plants to be distributed during the project period (Total for all catchment area)

TABLE 1

::	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	T O T A L
Temperate	108,613	183,061	164,756	456,432
Sub-tropical	74,310	152,990	141,466	368,767
Tropical	25,875	67,748	59,011	152,635
Total	208,800	403,800	365,235	977,835

Anticipated area to be brought under fruit cultivation with RCUP (in hectares)

TABLE 2

::	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	T O T A L
Temperate	465,575	771,979	598,759	1,936,313
Sub-tropical	194,701	377,274	338,320	910,295
Tropical	87,828	238,441	210,436	536,705
Total	748,104	1,387,694	1,247,515	3,383,313

Number of households to be provided with fruit saplings during the whole project period.

TABLE 3

::	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	T O T A L
	22,359.0	47,985.0	42,250.0	112,594.0

The distribution of the saplings will be accomplished through the Department of Agriculture which will disburse RCUP funds for this activity to the District Agricultural Development Office (DADO). The DADO will be responsible for acquiring the saplings from various sources (Government or private nurseries) and for arranging for their transport to central points of collection for pickup by the farmers. The JTA (there should be no fewer than one for each panchayat) will then be responsible for assisting the farmers with the care of the trees.

The project will be subsidized so that farmers pay no more than 25% of the cost of the saplings. The cost of supplying the saplings will be the only cost borne by the RCUP, and will amount to 1199.4 thousand rupees. Other production costs will be carried by the farmers as their trees begin to bear. Approximate annual costs of production for various fruits in the different regions are presented in detail in Attachment 13. Production estimates for temperate, subtropical and tropical fruits on the RCUP are given in this table below:

Production of fruits
(in metric tons)

TABLE 4

	Temperate fruits	Sub-tropical	Tropical	Total
Kulekhani	8,721.0	2,300.8	-	11,021.8
Gorkha	7,161.0	24,385.0	19,244.0	50,790.0
Myagdi	10,078.0	12,702.0	-	22,780.0
Mustang	23,609.5	-	-	23,609.5
Total	49,569.5	39,387.8	19,244.0	108,201.3

Benefits of the homestead fruit gardens project are not entirely quantifiable; benefits of improved nutrition and of increased ground cover, for instance, are difficult to measure, yet are significant contributions of the project. On the basis of simple net market value of the fruit anticipated to be produced from RCUP trees over fifteen years, the net benefits could be estimated as 62.7 million rupees.

B. Kitchen Gardens

The rational for RCUP involvement in encouraging the widespread establishment of individual kitchen gardens, is similar to that for home fruit gardens. At present in the project areas, vegetables are produced in very limited quantities of very few varieties. The kitchen

garden project aims at providing every household with the means to obtain the vegetables sufficient to supply the family members with an adequate and balanced diet. In addition, it is anticipated that surplus vegetables will be produced for local markets; and, as with the home fruit garden scheme, it is hoped that as transportation and storage facilities become available in some districts, vegetable gardening will be expanded to supply more distant markets, making a more productive use of the land and bringing economic benefits to the hill regions.

The RCUP kitchen garden project provides for every family in the project areas to receive a "Vegetable Minikit" once during the project period. The kit contains about 773 grams of the following vegetable seeds:

Winter Vegetable

1.	Cole crops	10%
2.	Root	30%
3.	Onion	30%
4.	Peas	20%
5.	Solanaceous	10%

Summer Vegetable

1.	Beans	50%
2.	Okra	30%
3.	Cucurbits	20%

The kits will be identical for all project areas except for Mustang; where the climate does not permit a summer vegetable crop. In addition to the vegetable seeds, the minikit contains about 10.4 kilograms of chemical fertilizers:

Urea	16%
Muriate of potash	31%
Triple super phosphate	18%
Complex	35%

This quantity of seed and fertilizer is sufficient to produce about 540 kilograms of vegetables from a 200 m^2 garden plot: more than enough for a family of five.

About 56 thousand minikits will be distributed in the project areas over the 15-year project period. RCUP funds will be disbursed by the Department of Agriculture to the DADOs in the project areas. The DADO will use the funds to purchase seeds, fertilizers and chemicals from the Agricultural Inputs Corporation (AIC), arrange for their transport to a central location, have them packed into the minikits, and arrange for transport of the minikits to distribution points in each panchayat covered by the RCUP. The JTAs will assist in overseeing the distribution operation and will provide advice to the farmers, particularly in the area of rates and techniques of application of the chemical fertilizers.

The cost of the minikit is about 42 rupees. Subsidies bring the cost to the farmer down to Rs. 12.35. The costs of providing the minikits to all households in the project area are anticipated to run about Rs. 2,299,000 over 15 years, neglecting costs of transport (some of which is expected to be contributed labor). Production estimates are given below:

Vegetable production from kitchen garden project

(metric tons)

TABLE 5

Catchment / Yr:	1	2	3	4	5	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	Total
Kulekhani	189.0	238.1	333.7	333.7	333.7	1428.2	1668.6	1668.3	4765.4
Gorkha	360.7	451.0	631.4	631.4	631.4	2705.9	7664.3	7664.3	18034.5
Myagdi	217.7	272.7	380.7	380.7	380.7	1632.5	1904.4	1904.4	5441.3
Mustang	48.1	60.4	84.5	84.5	84.5	362.0	422.8	422.8	1207.6
Total	815.5	1022.2	1430.3	1430.3	1430.3	6128.6	11660.1	11660.1	29448.8

As with the fruit garden project, some of the most important benefits of kitchen gardening are very difficult to quantify: improved nutrition, improved land use, development of skills in the area of horticulture which may be applied to large-scale horticulture in the hills at a later date. A crude estimate of benefits from this project has been made on the basis of the market value of vegetables produced. That figure is roughly 30.78 million rupees.

IV. Support activities

In order to meet the demand for fruit plants and vegetable seeds that will be generated by this project and by others, as well as popular demand, it is necessary to expand and establish horticulture nursery facilities in the project areas. In addition to simple supply functions, these nurseries will engage in experimentation on all aspects of horticulture under various conditions in the hills of Nepal. The information generated will be used in training JTAs who will in turn transmit the information to farmers. It will be useful in improving the techniques employed by RCUP personnel, and in planning future horticultural activities.

A. Nursery establishment

Eight new nurseries will be established throughout the project areas: Two central nurseries, one in Gorkha and one in Myagdi; and six satellite nurseries, one in Kulekhani, three in Gorkha, one in Myagdi, and one in Mustang. The proposed sites, sizes and times for construction of the nurseries are given in the following table:

TABLE 6

Project Area	Year of Establishment	Panchayat	Site	Climatic Region	Area (ha)
A. Kulekhani					
(a) Satellite nursery	3rd Yr.	Sisneri	Sisnerikhola	Sub-Tropical	0.50

B.	Gorkha				
(a)	Central N	1st Yr.	Chhoprak	Chorkate	Tropical	1.00
(b)	Satellite N	2nd Yr.	Gorakhakali	Pokharithok	Sub-Tropical	0.75
(c)	Satellite N	3rd Yr.	Deorali	Deorali	Tropical	0.75
(d)	Satellite N	4th Yr.	Sirandada	Sirandada	Temperate	0.50
C.	Myagdi					
(a)	Central N	1st Yr.	Doba	Tatopani	Sub-Tropical	1.00
(b)	Satellite N	2nd Yr.	Shikha	Shikha	Temperate	0.75
D.	Mustang					
(a)	Satellite N	4th Yr.	Ghami	Ghami	Temperate	0.50

The objectives of the central nurseries will be: (1) production of high-quality fruit saplings and vegetable seeds (ii) experimentation on adaptivity of improved and exotic varieties of fruits and vegetables, and on improvement of local species (iii) experimentation to determine ideal management practices for soil, water, planting calendars, etc. (iv) providing technical information to satellite nurseries and extension workers (v) conducting demonstrations of improved horticultural practices (vi) collection, preservation, and propogation of local species of economic importance.

The satellite nurseries are expected to:

(1) produce high quality fruit saplings and vegetable seeds

(2) conduct demonstrations and otherwise provide information to farmers on improved horticultural techniques.

As indicated in the table, the proposed sites for the nurseries will fall in three different climatic zones. Ideally, the nursery should be located on deep, clay soil with adequate and regular water supplies and good drainage arrangements.

Establishment of the nurseries will require cooperation from several government agencies. HMG funds will be disbursed by the Fruit and Vegetable Development Division of the Department of Agriculture for

the purchase of land. The Department of Agriculture will appoint nursery managers and other specialists, who will oversee the project from the land acquisition phase through the nursery's becoming fully functional. With RCU funds disbursed by the Fruit and Vegetable Development Division, the Department of Agriculture personnel will hire local assistants, and carry out land preparation, building, irrigation facilities and other construction, fencing and other preliminary arrangements. RCUP funds will also be used to procure fertilizers, chemicals and foods from the AIC, and seeds and saplings from sources arranged by the Fruit and Vegetable Development Division. The latter will provide overall supervision, and training for the nursery staff will be the responsibility of the Regional Development Office. The nursery is expected to be fully functional in the fourth year after breaking ground.

In addition to the standard facilities, the Central Nursery at Gorkha and Myagdi will be provided with a greenhouse to enhance their research and production capabilities. The greenhouse costs 150,000 rupees for construction.

The manager of a central nursery will be a JT specialist in horticulture, while a JTA trained in horticulture will manage each satellite nursery. In Gorkha and Myagdi, the nursery managers will be supervised by the assistant horticulturist attached to the DADO. In Kulekhani, supervision will come from the farm manager of the Daman Horticulture Farm, and in Mustang, from the Marpha Horticulture Farm Manager. The rest of the nursery staff will include a field assistant to the manager, an office clerk, and gardens.

Periodic training sessions are planned for all members of the nursery staff. In the second year after breaking ground at each nursery, the whole staff up to the level of field assistant should receive about two weeks of training in layout of the nursery planting, care of plants, etc. In the second year and periodically thereafter, the JTs and JTAs will receive additional training in propaga-

tion techniques, nursery management and other follow-up topics. Training will probably be conducted at the Pokhara Horticulture Farm, for Kulekhani nursery staff, at the Daman Horticulture Farm, and at Khairenitar Training Center, for staff from Gorkha nurseries, at Pokhara and at the Marpha Agricultural Station, for Myagdi nursery staff; and at Marpha, for nursery staff from Mustang.

Total capital and operating costs of the eight new nurseries over fifteen years are estimated to be 2,404,300 rupees. 7,908,700 rupees of that cost is for land, priced at 4,000 rupees per ropani (500 m^2) and borne by HMG. In addition, training costs will run about 92,000 rupees over a 15 year project period.

A summary of projected production is presented in the following table: (in numbers)

TABLE 7

Fruit type	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	Total
Temperate	3,137	34,488	59,578	97,203
Sub-tropical	11,375	90,575	116,635	218,585
Tropical	5,068	27,387	43,077	75,532
Total	19,550	152,450	219,290	391,290

Benefits of this project include the immeasurables of the information that will be gained by experimentation, and the increased levels of skill in horticulture resulting from the training, demonstration and extension components. It is expected that most of the production of fruit saplings and vegetable seed produced by the nurseries will be used in RCU projects during the RCU period, so the economic value of the products of the nurseries will not be repeated here.

B. Improving facilities at Government Farms

The Government horticulture farms at Daman in Kulekhani and Marpha in Mustang will be instrumental in implementation of the RCUP horticulture component, providing seeds and saplings, advice, guid-

ance and training. Their activities extend beyond the boundaries of the RCUP, both in space and over time. They have had more than ten years of experience in species trials and distribution of horticultural products. Therefore it is deemed to be useful to strengthen these farms by providing them with some additional facilities. The cold room project has been discussed above. In addition, it is recommended that both Daman and Marpha be provided with a mist/shade house, and Marpha with a greenhouse: the former for plant propagation, and storage between removal from nursery beds and sale to farmers, the greenhouse for research and other purposes. The mist/shade house for Daman and Marpha will be constructed at a cost of 125,000 rupees each, with RCUP funds disbursed to the Farm Managers from the Fruit and Vegetable Development Division. The same process will apply to construction of the greenhouse at Marpha, at a cost of 150,000 rupees. The total cost of this project would come to 400,000 rupees over the course of the fifteen project years.

To further support the procurement, production and distribution activities at Daman Horticulture Farm and of the DADO Office in Gorkha, the RCUP will provide each with a pick-up truck at a cost of 200,000 rupees. This brings the total cost of the support activities for government farms to 800,000 rupees.

C. Natural Cold Rooms

One of the problems with development of horticulture in the hill regions is that, with limited local markets and transportation facilities, fruit and vegetables will spoil before they can be marketed. Besides, the market is flooded with fruits at harvest time so that they fetch a relatively low price, whereas in off-seasons the fruit is not available at all.

To combat these problems, a natural cold room was constructed at Marpha on an experimental basis, and it has proved useful in storing apples for up to six months. The RCUP will provide for twelve of these natural cold rooms to be built in the project area at the RCUP nurseries or existing Government Farms on the following schedule.

TABLE 8

	Year 3	Year 4	Year 5	2nd 5 Yrs.	Total
Kulekhani	1	0	0	1	2
Gorkha	0	1	0	2	3
Myagdi	0	1	1	2	4
Mustang	1	0	1	1	3

The Department of Agriculture's Fruit and Vegetable Development Division and Food Research Laboratory Division will provide RCUP funds and technical assistance to the farm or nursery manager for construction of the cold room. Each room has a capacity of four to six metric tons; the value of produce preserved in these rooms varies from 15,000 to 20,000 rupees, depending on the value of the product, with potatoes at the low end of the scale and apples the most valuable. At a cost of construction of about 50,000 rupees for each room, this project will cost roughly 600,000 rupees.

D. Establishing Fruit and Vegetable Processing Plants

Building cold-storage facilities is one way to preserve produce to lengthen the period during which it can be marketed. Another method is to turn it immediately into products which (i) condense the bulk of the produce, making it simpler to transport; (ii) increase the market value of the produce, making it economically more viable to go to the trouble and expense of transport to markets, and bringing benefits of additional income to the farmers - thereby providing the basis for further expansion of horticulture in the hills (iii) utilize all of the fruit and vegetables produced, including lower - quality and damaged produce which would not otherwise be marketable. Furthermore, dried, tinned and bottled fruit and vegetable products can be transported to much more distant markets, extending the nutritional benefits of the produce to distant populations; and there will be local employment benefits, as well, where the processing plants are established.

The RCUP will establish three fruit and vegetable processing plants in the project area in the third five year phase of the project after the fruit and vegetable production schemes have become well established, yielding surplus produce. One semi-commercial plant, with an output of three to five thousand bottles a day, will be built in Gorkha, probably in Tara Nagar Panchayat, and one in Marpha Panchayat in Mustang. A smaller plant, producing around a hundred bottles a day, is scheduled for construction at Tatopani in Doba Panchayat, Myagdi District. Establishment of the plants will be carried out through the Fruit and Vegetable Division and the Food Research Laboratory Division of the Division of Agriculture. These two divisions will collaborate on disbursing HMG funds for purchase of the land and RCUP funds for hiring the staff, constructing and equipping the plants.

The question remains open as to whether the plants will be run as cooperatives, with the farmers sharing in the profits and contributing the same percentage to the operating costs as they contributed in raw materials; or whether it will be a straight government operation, with the farmers being paid outright for their produce.

The larger semi-commercial plants as planned have a capacity to process 92 metric tons of fruit and 66 metric tons of vegetables per year whereas the mini-processing plants require only 11.3 metric tons of fruit and 10.9 tons of vegetables per year. The value of the processed goods each plant could produce annually is estimated at 1.7 million rupees for a semi-commercial plant and 185 thousand rupees for the smaller plant. Construction and other capital costs for the project are estimated at 2,660,900, with annual operating costs around 598,600.

V. Conclusion

The horticulture development program outlined above constitutes a balanced approach to phasing in fruit and vegetable growing in the project areas. It begins with a concern for improving nutritional

levels of hill residents and developing their skills in horticulture; it addresses the need for support with local nurseries, training, and experimentation; and it provides for more widespread horticultural development by establishing processing and storage facilities. At the same time, it should be borne in mind that these horticulture projects are only one aspect of the Resource Conservation and Utilization Project. Their ultimate purpose is to contribute to reducing pressures on the land in the hills, so as to improve the capacity of the environment to support generation after generation of Nepalese citizens.

The rest of this report details the RUP Horticulture Projects by catchment area.

KULEKHANI CATCHMENT AREA

A. Existing situation:

The Kulekhani catchment area lies immediately southwest of Kathmandu valley in Makwanpur district. This area comprises seven panchayats having a total area of 211 Km^2, most of which is contained in the catchment of Kulekhani Khola. The total cultivated area is 81.9 Km^2 (8190 ha.), out of which 41% (3,350 ha.) is situated at elevations between 1,800 m. and 2400 m. and has a temperate climate. About 57% (4695 ha.) of the total cultivated land lies at elevations between 1200 m. and 1800 m., where the climate ranges from warm temperate to sub-tropical. The remaining 2% (138 ha.) lies below 1200 m., with a mostly sub-tropical climate.

This area falls in a high rainfall region with an average annual precipitation of 1500 to 2500 mm., 80% of which falls during the main monsoon period (June-September). The remaining falls in the pre-monsoon (April-May) and post-monsoon (October-November) periods. The relative humidity reaches a low of about 60% in winter - spring and a high of 90% during the monsoons. The average monthly temperatures vary from 5.6°C in January to 17°C in June. Summer mean maxima reach 23.5°C, whereas winter mean minima drop to 1.5°C. This suggests that the climate would be suitable for growing temperate fruits.

Most of the area is in proximity to the Tribhuvan Rajpath. Other areas are connected by a gravelled road which runs south-east to the Kulekhani Dam project. Other access is made primarily by trails.

Varieties of temperate and sub-tropical fruits are found growing in different parts of this project area. Among the temperate fruits the most important are apple, peach, pear, plum and walnut. Among the sub-tropical types, the most commonly grown are orange

(C. reticulata), lime, hill lemon (nibuwa) and banana. Temperate fruits are found growing above 1600 m., whereas sub-tropical types are found between 1000 and 1600 m. elevation.

Both local and improved varieties are grown. The improved varieties of temperate fruits were introduced in this area approximately 15 years ago. The actual data are not available, but according to the farmers, quite a large number of saplings were distributed. Most of the existing ones have come into bearing. The common varieties are:

Apple	-	Red Delicious, Royal Delicious, Rome Beauty, Richard Red, Summer pippins
Pear	-	Bartlet and Farping
Peach	-	Perie green
Plum	-	Santa Rosa
Walnut	-	Thin shelled

The varieties of other fruits are mostly local. Due to mismanagement and insufficient care, most of the fruit trees are in bad shape

Fruit cultivation in this area is generally confined to back yard gardens. However, there are some small growers in Palung, Daman and Tistung panchayats. The RCUP design team estimated the present total area under fruit cultivation to be 100.4 ha., which is about 1.3% of the total cultivated land. Of that area, 99 ha. (93%) are in temperate fruits, whereas 6.03 ha. (6%) and 1.4 ha. (1%) are in sub-tropical and other fruits respectively. Pears are the most widely grown, covering about 32 ha., peach (29 ha.) and apple (27 ha.) come second and third. The total number of existing plants is estimated to be 27,397 out of which 15,161 (55%) are bearing trees. (Appendix Jb, Attachment - 1) The remainder are about to come into bearing or were just planted. The average number of plants per household comes to about four.

Annual production of fruit in this catchment area has been estimated to be about 617 metric tons (MT). (Appendix Jb, Attachment - 1). Out of this, 555 MT are temperate and the rest subtropical fruits. The average yield per hectare of each fruit has been calculated in Attachment - 18. In this project area, the present consumption of fruit has been roughly estimated to be 17 Kg. per person per year, which means per year about 617 MT fruits are consumed locally (Appendix Jb, Attachment 10). The remaining amount is sold outside of the area of cultivation.

Fruits are mostly consumed or sold fresh, though lemon and limes are also preserved in pickles by a local method: juice from the hill lemon (nibuwa) is boiled down to a concentrate which can be preserved and later used in perparation of various pickles.

Government efforts:

1. Daman Horticulture Station:

This station is located in Sikharkot village panchayat at an altitude of 2,298 to 2,400 meters. It was established in the year 1962, to determine the varieties of different kinds of fruits most suitable for cultivation in this region of the country and to popularize and encourage growing of such varieties of fruits and vegetables in the temperate and warm temperate zones of Nepal. Briefly, the work being carried out is as follows:

a. Introduction and trial of different varieties of apples, pears, peaches, plums, walnuts, etc.
b. Trial of different root stocks for apples, pears, peaches and plums.
c. Experiments to learn appropriate soil management practices.

d. Trials of different varieties of vegetable crops.

e. Seed production of different varieties of vegetable crops.

f. Production and distribution of fruit saplings of varieties suited to the local climate.

g. Experiments to combat pests and diseases of fruits and vegetables.

h. Help to establish private nurseries in the area.

i. Provide technical guidance and supervision in the horticulture activities of the area.

Area: The total area in the farm is about 68.85 hectares, which is used as follows:

1.	Orchard	46.50 ha.
2.	Fruit Nursery	2.80 ha.
3.	Vegetable crops	6.00 ha.
4.	Vegetable Nursery	0.05 ha.
5.	Forest land	9.10 ha.
5.	Others	4.40 ha.

The existing number of fruit trees, varieties and sapling production are in the following tables.

TARGET AND ACHIEVEMENTS OF THE DAMAN HORTICULTURE FARM STATION IN DIFFERENT ACTIVITIES

(1975/76-1979/80)

TABLE 9

S.N.	YEAR/ACTIVITIES	UNIT	1975/76		1976/77		1977/78		1978/79		1979/80		TOTAL	
			TARGET	ACHIEVEMENT	TARGET	ACHIEVEMENT	TARGET	ACHIEVEMENT	TARGET	ACHIEVEMENT	TARGET	ACHIEVEMENT	TARGET	ACHIEVEMENT
1.	Sapling production	No.	50000	26982	30000	55886	31000	41476	38000	38000	50000	NA	199000	NA
2.	Vegetable Seed production	Kg.	600	150	400	572	450	265	500	272	500	NA	2450	NA
3.	Sapling Distribution	No.	50000	27647	30000	22539	31000	36486	38000	39268	50000	NA	199000	NA
4.	Vegetable Seed distribution	Kg.	600	150	400	NA	450	240	500	260	500	NA	2450	NA
5.	Study and Experimentation	No.	6	5	6	5	3	3	3	8	8	5	31	26
6.	Private Nursery establishment	No.	-	-	-	-	1	1	-	-	-	-	1	1
7.	Inservice Training of JTs & JTAs	No.	-	-	-	-	21	18	4	4	5	5	30	27

NA = Data Not Available

- = No Target, No Achievement

Source: Daman Horticulture Station

EXISTING NO. AND VARIETIES OF PLANTS (1979)

IN THE STATION

TABLE 10

TYPE OF FRUITS	VARIETIES	NO. OF PLANTS
Apple	1. Delicious	
	a) Golden	
	b) Red	
	c) Royal	
	2. Richa-Red	
	3. Rome Beauty	
	4. Jonathan	
	5. Green Pippin	
	6. MacIntosh	4,173
Pear	1. Pharping	
	2. Bartlett	
	3. Nijusaci	
	4. Chujuro	35
Peach	1. Peregrien	
	2. J.H. Hale	
	3. Kura-kate-wase	
	4. Triumph	46
Plum	1. Sant Rosa	
	2. Metheley	9
Walnut	1. Thin shelled	1,695
Apricot	NA	1
Cherry	NA	6
Almond	NA	2
Total		5,987

Source: 1) Horticulture Station, Daman

2) Studies on Fruit Activities of Horticulture and Agriculture Stations in Nepal (1952 Fruit Development Division,HMG/Nepal 1978

2. In order to meet the increasing demand for fruit saplings, farmers are encouraged to start private nurseries. One such nursery, the Kali Devi nursery, was established in Daman panchayat at Kitini Village in 1975, to raise temperate fruits. It is under the supervision of Daman Horticulture Station. It is in good shape. Its area is about 0.5 ha., and it is situated at an elevation of 1800 m. The total production of last year was 16,000 saplings, of which 9,260 were apple, 4,500 pear, 1,700 peach, 500 plum and 40 lime. When it is fully developed, it will have a capacity of producing more than 20,000 saplings per year.

3. The Agriculture Development Bank has provided long-term credits for fruit cultivation for the past few years in this district. In the last year, the ADB supplied 23,262 loans to the fruit growers of this area. They have a target of Rs. 95,000 for this year. More emphasis is given to fruits like mango, apple, orange and banana, due to their economical importance.

4. Attempts are being made through the District Agriculture Office to popularize fruit cultivation among farmers. Saplings of improved varieties of fruits are being distributed at a subsidized rate to the farmers.

5. Inputs like fertilizers, plant protection chemicals, vegetable seeds and agricultural tools are supplied by Agricultural Inputs Corporation (AIC). Its branch office at Hetaura takes care of this area.

Constraints:

Development of fruit farming in this project area is limited by the following constraints:

(a) Climate:

The main limiting factor for the development of fruit cultivation in this project area is the adverse climate with its frequent hailstorms and high humidity. Hailstorms are a major hazard in most of this area, causing considerable damage and loss of fruits. The hailstorm season extends from May to June, with four to eight events per year. It was reported that the size of the hailstones average 0.5 cm. in diameter. Hailstones of that size cause large wounds on the stems and can even break branches. They strip off the young shoots and leaves that grow during May, so that growth is checked. The extent of damage varies for the different fruits. It was reported that plum trees are more resistant than peach and apple.

This area receives very high rainfall, mostly occuring during the monsoon. The result is that several diseases of apple are difficult to control. This causes considerable losses in the quantity and quality of apple fruit.

(b) Incidence of diseases and pests:

Cultivation of peaches has been restricted for the past few years due to a very heavy infestation of peach leaf curl disease. Almost every plant is infested by this disease, due to which hardly any fruit is harvested. Control measures have been developed at Daman Horticultural Farm, so that this problem can be addressed by the RCUP. Apple plants were observed to be affected by wooly aphids, shoot cankers, collar rot, sooty blotch and scab diseases. Mature orange trees had symptoms of citrus die-back disease, but it was not too severe.

Other problems were: mis-management and insufficient care of plants, lack of technical supervision, and weak extension services.

Proposed Activities:

a. Distribution of fruit saplings:

Thirteen different types of fruit have been selected for this area to distribute to the farmers. Orange, hill lemon (nibuwa), lime, banana and lemon (Eureka) are sub-tropical fruits suitable to plant at altitudes ranging from 900 m. to 1600 m. Warm temperate fruits like peach, pear, plum (Prenus salicina), persimmon and lemon (Eureka) should be distributed among the farmers living between 1600 m. and 1800 m. altitude. Fruits like apple, pear (some varieties), walnut and European plum (P. domestica) which require a cool temperate climate should be provided for plantation above 1800 m. elevation.

In the first five years a total area of about 65 ha. will be brought under fruit cultivation, of which 55 ha. (85%) will be temperate and 10 ha. (15%) sub-tropical fruits. In the second five years, 167 ha. of new area is proposed to be brought under fruit cultivation. Temperate fruits will cover 147 ha. (88%) and the remaining 12 ha. (12%) will be planted to sub-tropical fruits. Roughly 133 ha. of additional area will be brought under fruits, including 114 ha. (86%) temperate and 19 ha. (14%) sub-tropical fruits in the third five years.

At the end of the project period of 15 years, a total area of 365 ha. will be brought under fruit plantation, of which 317 ha. (82%) area will be temperate and 48 ha. (13%) sub-tropical. Peach will cover the largest area, about 21% of the total proposed area under fruit. Pears will comprise

15% and apples 13% of the saplings distributed. Among sub-tropical fruits, oranges will cover the most area. (Appendix Jb, Attachment 31).

Distribution Program:

In the first five years a total of 16,250 saplings including 12,692 temperate and 3558 sub-tropical fruits are proposed to be distributed among 3,125 farm households. In the second five years, 8,100 farm families will receive a total of 42,150 saplings of temperate 34,149 and sub-tropical 8,001 fruits at the rate of five plants per household. About 33,435 saplings of temperate 25,794 and sub-tropical 7,641 fruits will be provided to 6,425 farm houses at the same rate as above in the third five years. At the end of the 15 year period of the RCUP, roughly 92,000 saplings including 72,636 temperate and 19,199 sub-tropical fruits will have been distributed among farm families at the rate of 10 plants per household.

Sources of saplings:

Farms and nurseries where fruit saplings can be obtained are listed in Appendix Jb, Attachment 9.1. Daman Horticulture Farm is the main source of plants for temperate fruits. Persimmons can be obtained from the Horticulture Farm in Godawari. Another source for temperate plants is Kalidevi Nursery in Daman. For sub-tropical fruit plants, Brahmala Nursery and Ghale Nursery in Dhading district are the tentative sources. Eureka lemon will be obtained from Parwanipur Agriculture Station in Bara district. After five years, the satellite project nursery at Sisneri will start producing some plants of lemon, orange and banana. Total saplings of sub-tropical fruits required for the second and third five years will be supplied by the project nursery at Sisneri.

Production/Consumption:

Expected yearwise production of fruit has been worked out in Appendix Jb, Attachment 14.1. Production of the RCUP provided fruit trees will begin in the second five year period and continue to increase as more plants come into bearing. In the 15th year, about 2,789 MT more fruit will be available in this area than are currently produced. The expected production of fruits from the already existing fruit plants has been worked out in the Attachment - 10.1. After about 10 years the without RCUP production will decline, due to replacement of old trees and local varieties with immature improved trees. The present per capita consumption of fruit in this area has been estimated to 17 Kg. Expected per-year increments of per capita fruit consumption is also presented in the same table. It is assumed that at the end of 15 years, per capita consumption will go up to 27 Kg. The surplus amount of fruit to be marketed also has been worked out.

Production Costs:

Yearwise estimated costs of production are presented in Appendix Jb, Attachment 14.1. In the first year total costs come to 16.6 thousand rupees which gradually increases to about 666 thousand by the 15th year. Year-wise costs of production for various fruits in this catchment area are given in Appendix Jb, Attachment 13. These calculations are based on information obtained from the farmers and the Government Farm.

Benefits:

Based upon the overall cropping pattern, the gross value of production is presented in Appendix Jb, Attachment 14.1

and the unit price of each fruit from which the calculation was made is given in Appendix Jb, Attachment 21. Incremental net values of production are negative from the first year to the 6th year of the project. Only from the 7th year does it become positive. The expected incremental net value of production then increases from 35 thousand rupees in the 7th year to 3.6 million rupees.

b. Kitchen-garden vegetable production:

It is planned that in the first year of RCUP about 350 farm houses will get a vegetable minikit. 441 minikits will be distributed in the second year and 618 in each of the third, fourth and fifth years. 3,09 minikits will be distributed among the households in the project area in both the second five-year and third five-year project phases. Altogether 8,825 farm houses will get a kit during the project period of 15 years. Yearly seed requirements for different vegetables have been worked out in the Appendix Jb, Attachment 3.1. The total amount of seed needed for the first, second and third five-year phases is calculated to be 2045 Kg., 2,388 Kg., and 2,388 Kg. respectively (Appendix Jb, Attachment 6). Estimated area and production of vegetables are presented in Attachment - 5.

c. Fruit Nursery Establishment:

It is proposed that a satellite nursery be established in this project area in 1983 for the production of high quality saplings of sub-tropical fruits. Of the areas surveyed by the RCUP design team, Sisneri Panchayat Ward No. 9 seems the most suitable place for setting up this nursery. However, the exact spot should be determined in the year of establishment. When fully functioning, the nursery should

have the capacity to produce a minimum of 6,000 saplings every year.

The following fruits are recommended for this nursery to produce as mother plant saplings:

1. Oranges - Mandarin
2. Lime - Local
3. Lemon - Eureka & Hill Lemon
4. Banana - Dwarf varieties
5. Guava - Improved varieties
6. Pomegranate

The nursery will require the following staff:

1. Junior Technical Assistant (JTA) (Non-Gazetted Second Class) trained in Horticulture - one permanent
2. Field Assistant - (Non-Gazetted Third Class) - one permanent
3. Storekeeper cum office assistant - (Non Gazetted Third Class) - one permanent
4. Gardeners (peon level) - three permanent

A two-story building to accomodate an office, a store and a residence for the JTA is proposed at a cost of 88,000 rupees. A working shade will be supplied at a cost of 1500 rupees.

Costs: Yearwise detailed costs are presented in Appendix Jb, Attachment - 11.1. Capital costs total 181,900 and operating costs come to 532,777. Land costs are taken to be Rs. 4,000 per Ropani. Other costs have been estimated based on current prevailing prices. Contingency costs are not included here.

Tentative Production Targets for Sisneri Nursery

Table 11

Item	5th Yr.	2nd 5 Yrs.	3rd 5 Yrs.	Total
1. Lime (Cuttings)	-	2,150	2,150	4,300
2. Lemon (Eureka)(Cuttings)	-	1,800	1,800	3,600
3. Nibuwa (Cuttings)	100	450	450	1,000
4. Orange (Budded & Seedlings)	100	1,450	1,450	3,000
5. Banana (Suckers)	100	1,300	1,300	2,700
6. Others	50	850	850	1,750
Total	350	8,000	8,000	16,350
7. Vegetable seed production (Kg)	50	300	350	700

Additional facilities for Daman Horticulture Farm:

It is proposed to provide the Daman Farm with a pick-up truck to be used to deliver plants and other materials to farmers within the project area. A lump sum of Rs. 200 thousand is allocated for this expenditure. It should be provided in the first year. A mist house cum shade house is proposed for construction in the fourth year, at a cost of 125,000 rupees. Rs. 100 thousand is allocated to build two natural cold rooms, one in the third project year and one in the second five-year phase.

Daraundi Catchment Area - Gorkha

A. Existing Situation

This catchment area lies in the central part of Nepal in Gorkha District. This river originates in the Himal Chuli Range in the North and flows through a narrow valley towards the South. This catchment comprises 29 panchayats having a total area of 794.8 km^2. The cultivated land area is about 308 km^2 (30,800 ha.), which is about 39 percent of the total area. Of this land, 7,334 ha. (24%) is situated at elevations below 610 m. with tropical climate; 18,000 ha (58%) lies between 610-1220 m. with tropical to sub-tropical climates; 4,750 ha. (16%) lies between 1220-1830 m. with a sub-tropical to warm temperate climate, and 684 ha. (2%) is situated at elevations between 1830-2440 m., and has a temperate climate.

Except on the riverbank, most of the land has steep slopes, increasing with altitude. Soil erosion is very severe in this region.

There is no weather station in this region which can truly represent the weather conditions of the whole area, because of micro-climatological differences. But data obtained from the district headquarters shows the annual precipitation to be about 1600 mm., more than 75% of which falls in the monsoon period. (For detailed meterological data, vegetation, etc., please refer to the Watershed Management report of the RCUP.)

Three panchayats will be connected soon with an all-weather motorable road, the Narayanghat-Gorkha highway, which is now under construction. Other access is primarily by trails.

Due to the wide range of climatic conditions, almost every type of fruit is found here. Tropical fruits are found below 1000 m., whereas sub-tropical fruits are found between 1000 m. to 1500 m. and temperate fruits from 1500 m. to 3000 m. altitudes. Among the tropical fruits, the most common ones are mango, guava, banana, pineapple, jackfruits, litchi and hill lemon. The sub-tropical types are orange

(Citrus reticulata), papaya, pomegranate, hill lemon (nibuwa) and lime. Among the temperate fruits are pear, peach, plum and a few apple trees (Appendix Jb, Attachment 12).

Almost 99% of the fruits are of local varieties and, except for oranges, are of inferior quality with little or no market value. Only very recently, a few fruits of improved varieties have been introduced. The orange, which has been grown here for centuries, has significant economic importance in this region. However, even in the sub-tropical zone, only a few pockets are found which are suitable for orange cultivation, the important panchayats being Manakamana, Bhogatini, Taple, Taku and Swarpani. Even in their existing condition, the design team estimated the yield of oranges at about 200 Kg. per tree, that is about 55 MT/Ha, which is comparatively a very high yield. It is estimated that oranges account for about 15% of the total area under fruit. A large quantity of oranges are exported to Kathmandu and Pokhara. Another economically important fruit is the banana, which occupies about 14.6 percent of fruit area. Most of the varieties are local, yet are fully marketable.

Fruit cultivation in this region is mostly confined to backyard gardens. There are a few old community orchards, mostly of mango, but they have very little economical importance.

The RCUP survey team estimated the present area under fruits to be 236 ha., that is about 0.76 percent of the total cultivated land. Of this 67 ha. (28%) falls under tropical fruits, whereas 141 ha. (60%) and 28 ha. (12%) come under sub-tropical and temperate fruits respectively. The total number of existing fruit trees in this catchment is estimated to be about 155,261, out of which 95,671 (62%) are bearing trees (Appendix Jb, Attachment 1.2). The remaining are immature. The average number of plants per farm house is six.

The annual production of fruits is estimated to be about 2,089 tons. Out of this 552 tons are tropical, 1,219 sub-tropical, and 318

temperate fruits. The average yields per hectare of various fruits are presented in Appendix Jb, Attachment 18. The present consumption of fruit per capita is estimated to be 16.5 kg. per annum (Appendix Jb, Attachment 10.2). The total consumption of fruit is 615 MT.

Fruits are mostly consumed or sold fresh, though a few fruits like lemon and lime are preserved by a local method. The juice of hill lemons is boiled to a concentrate for preservation, which is later used in preparation of various pickles.

Saplings of some improved varieties that have been distributed in the area are either dead or in very bad condition. This is mainly due to insufficient care. These plants rarely are manured, irrigated or protected. Most of the plants are diseased and heavily infested with insects. Quite a number of farmers are interested in fruit farming, but due to their lack of technical know-how, unavailability of plants and the low profit given fruit raising by government agencies, their current activities are limited.

Vegetables are grown in this project area on a very limited scale. Summer vegetables are more common than winter ones. The most common are cucurbits, colocasia, lady's finger, ginger, cowpea, cluster bean and broad bean. They are mostly grown on the edge of the upland terraces or mixed with the field crops. The winter vegetables like chillies, brinjal, radish, broad leaf mustard, onion, garlic, potato, and tomato are cultivated on a very small scale. Among them, the broad-leaf mustard (locally known as Rayo Sag) is most commonly grown. Potato is grown as a staple food crop at the higher elevations(above 2200 m.) and as a vegetable in the lower elevations. Cauliflower, cabbage, carrot, turnip, bottle gourd and dwarf beans have been introduced recently in some areas.

Varieties are mostly local and very little care is taken in management. As a result, the quality and yield is very low. Data on the area and production of these vegetables is not available.

Government Efforts:

There is no Government farm in this area; one private nursery has been established at Gorakhakali with encouragement from the ADO office. This mostly produces orange saplings.

A few years ago the ADB started to provide long-term credit for fruit farming in this district. Last year the ADB provided Rs. 197,000 loans to fruit growers.

Attempts are being made through the ADO office to popularize fruit cultivation. Fruit plants of improved varieties are being distributed every year.

Chemicals, vegetable seed, fertilizers and agricultural tools are being supplied by the Agricultural Inputs Corporation (AIC).

Constraints:

The major constraints are:

1. Lack of transportation facilities
2. Lack of irrigation facilities
3. Lack of market for fruits and vegetables
4. Insufficient and weak extension program
5. In most areas, frequent hailstorms
6. Lack of technical know-how in fruit and vegetable production
7. Unavailability of fruit saplings and vegetable seeds
8. Farmers lack of orientation toward fruit growing
9. Incidence of diseases and pests, e.g. citrus die-back, peach leaf curl, etc.

Proposed Activities:

A. Distribution of fruit saplings

Fifteen different types of fruit have been selected for this catchment for distribution to the farmers. Sub-tropical fruits like orange, lime, hill melon, banana, and pomegranate should be planted in altitudes ranging from 950 m. to 1600 m. Warm temperate fruits like peach, pear and plum (Prunus salicina) should be established at farms situated at elevations between 1600 m. and 1800 m. The fruits

like apple, pear (cold varieties), and European plum (P. domestica) which require a cool temperate climate should be provided for plantation above 1800 m. elevation.

At the end of the project period of 15 years, the total area of about 1,427 ha. will be under 237 ha. (17%) of temperate fruits, 653 ha. (46%) of sub-tropical fruits and 537 ha. (37%) of tropical fruits. The largest area (250 ha., about 17.5%) will come under mango, followed by orange and guava. (Appendix Jb, Attachment 3.2)

Distribution Programme:

It is proposed that about 86,000 saplings of different fruits, including 9,562 temperate, 50,813 sub-tropical, and 25,875 tropical fruits, be distributed among 11,732 farm houses at the rate of 7 plants per household in the first five years. In the second five years 217,300 plants will go to 29,560 farm houses, including 29,272 temperate, 120,280 sub-tropical, and 67,748 tropical. The remaining 187,450 plants, including 19,322 temperate, 109,116 sub-tropical, and 59,012 tropical fruits will be provided to 25,500 households.

At the end of 15 years, a total of 491,000 saplings will have been provided to the farmers of this catchment area. (Appendix Jb, Attachment 3.2). The distribution programme will be started only after the second project year.

Sources of Saplings:

Possible sources for these saplings are listed in Appendix Jb, Attachment 9:2. For tropical fruits, Yagyapuri Horticulture Farm in Chitwan District is the main source, whereas for sub-tropical fruits the Pokhara Horticulture Farm, Dhunbeshi Horticulture Farm in Dhading district, and a private nursery--Ganesh Bahadur Nursery in Gorkha district will be the best sources. The Kirtipur Horticulture Station will be the only close-by source for temperate fruits. The nurseries built by the RCUP will only begin producing after the fifth year. About 14% of the needed fruit plants will be available from the project nurseries in the first five years, 44% in the second five

years, and 79% in the third five years. Of the total fruit saplings required in this area, 52% will be available from the project nurseries (see page , Table 5 and 6).

Production/consumption:

Production of fruit will start only after the third project year. The detailed yearwise production of different fruits has been worked out in Appendix Jb, Attachment 14.2. The production goes on increasing as more trees come into bearing. In the 15th project year, about 14,000 metric tons of fruit will be produced. After about 11 years, the production from the existing (without project) plants will decrease due to the replacement of old trees and local varieties with improved ones. The present per-capita consumption of fruits in this area is estimated to be 16.5 kg. per annum. It is assumed that at the end of 15 years, per capita consumption will rise 28 kg. (Appendix Jb, Attachment 10.2). The surplus quantity will be processed or sold outside of the producing areas.

Production Cost:

Yearwise estimated total costs of production are given in Attachment 14.2. In the first year of plantation, the total comes to 42,000 rupees, which gradually increases to 2,459,000 rupees in 15 years. The estimated costs of production for individual fruit has been worked out in Attachment 13. These estimates are based on data obtained by the survey team from fruit growers in the area.

Benefits:

The gross value of production is calculated in Attachment 13 based on the unit price given in Attachment 21. The incremental net value of production has been worked out in the same table. This value is negative from the first year to the 6th year. It forms positive beginning in the 7th year. The expected incremental net value of production increases from 86,000 rupees in the 7th year to 16.7 million rupees in the 15th project year.

B. Kitchen Garden Vegetable Production:

The proposed number of vegetable production minikits to be distributed annually to farmers has been presented in Attachment 2.2. Altogether, 33,396 minikits will be distributed in this catchment. The annual requirement of seed of each vegetable is calculated in Attachment 8:2. The total area and expected production is given in Attachment 5.

C. Fruit Nursery Establishment:

This catchment area being the largest of all the project areas, the requirement of fruit plants and vegetable seeds is also quite high. To meet the project requirements for fruit saplings and vegetable seeds from internal sources, establishment of four different horticultur' nurseries located in different climatic zones has been proposed. These nurseries will be phased in over the project period. About 52% of the total required saplings would be available from these nurseries.

In addition to their activities in production and distribution of fruit saplings and vegetable seeds, the nurseries will also engage in research on species adaptability and management practices. Specific research activities will be determined by the Fruit and Vegetable Development Division.

List of the Proposed Nurseries

TABLE 12

Location	Type	Region	Year of Establish-ment	Capacity per Year	Area
a. Chhoprak panchayat at Chorkate	Central Nursery	Tropical	1st year	15,000	1 ha.
b. Deorali panchayat at Deorali	Satellite	Tropical	4th year	10,000	0.75 ha.
c. Gorakhakali panchayat at Pokharithok	Satellite	Sub-Tropical	2nd year	10,000	0.75 ha.
d. Simjung panchayat at Sirandada	Satellite	Temperate	3rd year	6,000	0.5 ha.

Recommended Fruits and Varieties

TABLE 13

Fruit	Recommended Varieties for Mother Plant	Root Stock	Method of Propagation
Mango	Malda, Dusehri, Chausa, Bombay Green, Langra	Local varieties	Approach grafting
Litchi	Muzafarpore, Mcleen, Early Large Red, Late Large Red, Seedless Late, Dehardun	-	Air layering
Guava	Safeda, Lucknow--49, Chittidar	-	Air layering
Jack fruit	Local	-	By seed
Banana	Harichhal, Basrai Dwarf, Mal Bhog	-	Suckers
Pineapple	Gaintkew, Queen, Mauritius	-	Suckers
Papaya	Washington, Coorg-Honey Dew, Ranchi	-	By seed
Pomegranate	Bedana, Paper Shell	-	Cuttings
Apple	Rome Beauty, Winter Banana	Malling crab apple	Bench grafting, shield budding
Peach	Alberta, Peregrine	Peach	Budding, Bench grafting
Pear	Kharping, Le Conte, Kaiffer, Bartlett	Wild pear	Budding, Bench grafting
Plum	Santa Rosa	Wild apricot, plum	Bench grafting

These nurseries would require the following staff:

TABLE 14

Staffs	Central N.	Deorali N.	Gorakhakali N.	Simjung
a. Junior Technician	1	-	-	-
b. Junior Tech. Asst.	1	1	1	1
c. Field Asst.	1	1	1	1
d. Storekeeper cum office asst.	1	1	1	1
e. Gardeners	8	5	5	3
Total	12	8	8	6

A two story building to accomodate an office, a store, and a residence will be constructed in each nursery. One shed for each nursery will be provided.

Costs:

Total costs for all four nurseries come to Rs. 4.8 million, out of which Rs. 1.4 million is capital and Rs. 3.76 million is operating costs. Land costs are taken to be Rs. 4,000/Ropani (Attachment 11.2). Other costs have been estimated based on current prevailing prices. Contingency costs are not included here.

Tentative production targets for each nursery are given separately in the tables below:

PROJECT NURSERIES

TABLE 15

Fruit/year	3rd yr	4th yr	5th yr	2nd 5 yr	3rd 5 yr	Total
A. Central Nursery						
1. Mango (Grafts)	-	-	300	3,000	4,000	
2. Litchi (Layers)	-	-	300	1,000	1,500	
3. Guava (Layers)	-	-	500	2,000	3,000	
4. Banana (Suckers)	100	500	1,000	10,000	15,000	
5. Pineapple (Suckers)	-	500	2,000	10,000	15,000	
6. Jack fruit (Seedlings)	300	600	600	3,000	3,000	
7. Papaya (Seedlings)	300	900	900	3,000	4,000	
8. Others	-	200	500	4,000	5,000	
9. Pomegranate (Cuttings)	-	100	300	1,500	1,100	
	700	2,800	6,400	37,500	52,100	99,500
10. Vegetable seed prod.	80(kg.)	90	100	500	600	1,320

TABLE 16

B. S.N. Dorali						
1. Mango (Grafts)	-	-	-	1,600	4,000	
2. Litchi (Layers)	-	-	-	1,500	1,500	
3. Guava (Layers)	-	-	-	1,500	2,000	
4. Banana (Suckers)	-	-	-	4,000	14,000	
5. Pineapple (Suckers)	-	-	-	2,000	8,000	
6. Jackfruit (Seedlings)	-	-	-	2,000	2,000	
7. Papaya (Seedlings)	-	-	-	3,600	4,000	
8. Others	-	-	-	1,500	2,000	
9. Pomogranate (Cuttings)	-	-	-	8,000	1,000	
	-	-	-	17,900	38,500	55,600
10. Vegetable seed prod. (kg.)		-	-	450	500	950

TABLE 17

Fruit/year	3rd yr	4th yr	5th yr	2nd 5 yr	3rd 5 yr	Total
C. S.N. Gorakhakali						
1. Orange (Budded seedlings)	-	-		10,000	15,000	
2. Lime (Cuttings & seedlings)	-	-	500	5,000	6,000	
3. Nibuwa (Layers & cuttings)	-	-	300	5,000	6,000	
4. Pomogranate (Cuttings)	-	-	300	2,000	2,000	
5. Banana (Suckers)	-	-	500	5,000	5,000	
6. Others	-	-	500	2,000	2.000	
	-	-	2,100	29,000	36,000	67,100
7. Vegetable seed prod.(kg.)	-	70	80	450	500	1,100

TABLE 18

D. S.N. Simjung						
1. Apple (Grafts)	-	-	-	500	1,000	
2. Pear (Grafts)	-	-	-	4,000	7,000	
3. Peach (Grafts)	-	-	-	4,000	7,000	
4. Plum (Grafts & budded)	-	-	-	3,000	5,000	
5. Others	-	-	-	500	2,000	
				12,000	22,000	34,000
6. Vegetable seed prod. (kg.)		-	30	300	400	730

D. Establishment of a Semi-Commercial Fruit and Vegetable Processing Plant

It is expected that after about 10 years time, this area will have quite a quantity of surplus fruit.

It will not be possible to send all of the surplus to markets. Therefore, a fruit and vegetable processing plant is proposed for this catchment area. This area has great potential for commercial fruit and vegetable production. This processing plant would certainly encourage the farmers of this area to engage in fruit farming.

Taranagar village panchayat seems to be an ideal place for setting up the factory. However, the exact site should be chosen after the program has been approved.

Raw Materials:

The main fruits to be used for preparation of different products:

	Product	Fruits and vegetables to be used
a.	Squash	Orange, Lemon, Mango, Papaya, Plum
b.	Jam/Jelly	Guava, Orange, Mango, Apple, Peach, Plum, Apricot, Pear, Papaya
c.	Fruit Juice	Mango, Pineapple, Orange, Lemon, Lime
d.	Canned Fruits	Pineapple, Mango, Apple, Pear, Peach, Grape
e.	Dried Fruits	Apple, Walnut, Apricot, Peach, Pear, Mango, Banana, Grape, Jackfruit, Papaya, Plum
f.	Tomato Ketchup	Tomato
g.	Canned Vegetables	Peas, Asparagus, Cauliflower, Carrot, Turnip, Beans

Tentative annual requirement of fruits and vegetables has been estimated to be about 92 metric tons of fruits and 66 metric tons of vegetables. About 53 metric tons of tomato would be needed to produce about 15,000 bottles of ketchup. An overall discussion of this project is given on page . Estimated production and value is given in Attachment 16.

Market for the product:

This area is linked by the Prithivi Rajmarg with the two largest cities: Kathmandu in the east and Pokhara in the west. Another link will be to the southern terai via the Narayanghat--Gorka highway now under construction. Therefore, there will be no problem sending produce to these big markets where the demand for processed fruit and vegetables is very high. It can therefore be safely assumed that the products of this factory will reach markets.

E. Greenhouse Construction:

The proposed central nursery for this catchment will carry out some experiments and trials on horticultural crops. A greenhouse will be needed for this purpose. Therefore, a lump sum of Rs. 150,000 is allocated to build it in the second five-year phase. Requirements of materials and dimensions will be worked out later on.

F. Natural Cold Room Construction:

Three such storage rooms will be constructed in this catchment area, one in the 4th project year and two in the second five year phase. Barpak, Simjung and Swarpani panchayats are recommended locations.

LOWER KALIGANDAKI CATCHMENT AREA

MYAGDI DISTRICT

A. Existing Situation:

This region lies in the west-central part of Nepal in the inner Himalayan zone. It borders the lower part of the Kaligandaki River immediately south of the Mustang region. It extends to Tatopani in the north and Beni in the south. The climates of this region are quite different from the Mustang region. There is great variation in altitude, which ranges from 835 m. to over 6,000 m. Everywhere relief is great. Most slopes exceed 35°.

This catchment area includes 14 panchayats with a total area of 943.96 km^2 (APROSC--1979). Cultivated land accounts for only 143.44 km^2 (15%). The cultivated area at different elevations is shown in the table below.

TABLE 19

Area/Altitude	less than 1200 m.	1220-1830 m.	1830-2440 m.	2440-3050 m.	Total
Total Area (ha.)	1604	9510	19,677	18,604	94,396
Cultivated Area (ha.)	823 * (51)	5719 (60)	7,545 (38)	257 (1)	14,344 (15)
% of the total cultivated land	6	40	53	1	

*(Figures in parentheses indicate the percentage of land cultivated.)

It is clear from the above table that most of the cultivated land

falls in the sub-tropical and temperate regions.

The annual precipitation varies from 700 to 1400 mm., 58% to 85% of which falls in the monsoon period. There is more annual precipitation in the south than in the north. Winter precipitation varies from 5--20%, falling more in the north than in the south. For more information about meteorological data please refer to the Watershed Management Report of the RCUP.

Primarily, access to this region is by foot trails. The main marketplaces are Beni, Tatopani and Dana, which are located on the bank of the Kaligandaki River along the trail to Mustang from Pokhara. The next nearest market is Baglung (a day's walk from Beni), which is going to be connected by a motorable road from Pokhara in the near future. It will then be the nearest outlet for trading from this district.

Mostly temperate and sub-tropical fruits are found growing in different parts of this region. Among the temperate fruits, the most important are peach, pear, apple, plum, walnut, grape and apricot. Among the sub-tropical types, the most commonly grown are tangerine (Citrus reticulata), hill lemon (nibuwa), lime, orange (C. sinesis) and pomegranate. In some parts of the river valley near Beni, a few trees of mango, guava and banana were also noticed. Temperate fruits are found growing above 1500 m., whereas sub-tropical ones are found mostly between 800 and 1500 m. elevation.

Most of the varieties are local and of inferior quality with hardly any market value. Mostly such fruits are locally consumed. Tangerine is economically the most important fruit of this region. It has been grown for many years. The RCUP design team estimated the present area under tangerine cultivation to be 24.5 ha. which is about 48 percent of the area under fruits. About 490 metric tons of tangerines are produced every year. Their cultivation is mainly confined along the bank of the river Kaligandaki. The most important places are Dana and Tatopani where many old and new orchards exist. Among the other citrus

fruits the important ones are hill lemon, lime and orange. The oranges are doing very well.

Fruit growing in this region is mostly confined to backyard gardens. It is estimated that the present total area under fruit cultivation is only 51 ha. That is about 0.34% of the total cultivated land. Of that area 16 ha. (32%) is in temperate fruits, whereas 33.6 ha. (66.8%) and 0.5 ha. (1%) are in sub-tropical and tropical fruits respectively. The total number of existing fruit trees is estimated to be 19,686, out of which 9,249 (50%) are bearing trees (Attachment 1:3). The remaining are about to come into bearing or were just planted. The average number of plants per household comes to about three.

The annual production of fruit in this catchment area has been estimated to be about 649 tons. The present per capita consumption of fruit has been roughly estimated to be 15 kg. per annum. About 590 tons of fruits are consumed locally. The remaining quantity is sold outside of the area of cultivation.

Vegetable production in this area is very scanty. Only some local varieties like broad leaf mustard (Rayo), radish, mustard, potato and cucurbits are found in some farm houses. The improved varieties of tomato, egg plant, cauliflower, cabbage, onion, peas, gourds and beans have been recently introduced in some areas.

Government Efforts:

There is no government farm in this catchment area. Only one private nursery, the Karmacharya Nursery, has been established in Doba Panchayat at Tatopani Village to raise citrus fruit saplings (mostly tangerine). But it is not a good nursery. The total production of last year was 1500 orange seedlings.

The Agricultural Development Bank has been providing long term credits for fruit cultivation for the past few years in this district. Last year (1978/79), the ADB supplied Rs. 304,000 in loans to the fruit growers of this area.

Attempts are being made through the District Agriculture Office to popularize fruit growing among farmers. Every year, saplings of improved varieties of fruit are being distributed at a subsidized rate to the farmers. Up to last year, about 17,000 saplings of fruits were distributed to the farmers.

As in other areas, inputs such as fertilizers, plant protection chemicals, vegetable seeds and agricultural tools are supplied by the Agricultual Inputs Corporation (AIC). Its branch office at Beni takes care of this region.

Constraints:

Development of commercial fruit farming in this project area is limited by the following constraints:

a. Lack of transportation facilities. This area is not connected with any motorable road. Access is only by foot trails. From this area the nearest outlet would be Baglung (Dhaulagiri zonal headquarters), which is a day's walk from Beni. This market is going to be connected with a motorable road from Pokjara in the near future.

b. Lack of markets.

c. Lack of irrigation facilities.

d. Lack of technical know-how for fruit cultivation.

e. Lack of awareness of the farmers of techniques and potentials of commercial fruit farming.

f. Hailstorms: Many parts of the project area have frequent incidence of hailstorms which have caused considerable damage and loss of crops.

g. Diseases and pests: The most important disease of this area is citrus die back, due to which tangerine production has been severely curtailed. Farmers report that almost 15% of their mature trees have died and most of the remaining trees are also infested. This is of course a problem in all the tangerine growing areas of the country. Research to overcome this problem

is on the way and it is hoped that some solution will be found soon. Other diseases observed were peach leaf curl, citrus canker and gummosis. The common pests are leaf miners, lemon butterflies and trunk borers.

Proposed Activities:

a. Distribution of Fruit Saplings:

Ten major fruits have been selected for distribution in this area. The sub-tropical fruits, i.e. orange, lemon and lime, should be planted at altitudes ranging from 900 m. to 1600 m. Warm temperature fruits like peach, Japanese plum (Prunus salicina), apricot, almond and lemon (Eureka) should be distributed among the farmers living between 1600 m. and 1800 m. altitude. Fruits which require a cool temperate climate like apple, pears (some varieties only), walnut and European plum (P. domestica) should be provided for plantation above 1800 m. elevation.

In the first five years of the RCUP a total area of about 188.5 ha. will be brought under fruit cultivation, of which 128.5 (68%) would be temperate and 60 ha. (32%) sub-tropical fruits. In the second five years 253 ha. of new area is proposed to be brought under fruit cultivation. Temperate fruit will cover 179 ha. (71%) and the remaining 74 (29%) would be covered by sub-tropical fruits. Approximately 253 ha. of additional area will be brought under fruits, including 179 ha. (71%) temperate and 74 ha. (29%) sub-tropical fruits in the third five year period.

At the end of the project period of 15 years, a total area of about 695 ha. would be brought under fruit plantation. Walnut will cover the largest area, about 21% of the total proposed area under fruit. Tangerine will comprise 19% and apples 15% of the saplings distributed. (Attachment 3.3)

Distribution Program:

In the first five years, a total of 44,800 saplings of different fruits, including 24,860 (55.5%) and 19,940 (44.5%)

sub-tropical fruits, are proposed to be distributed among 5,314 farm households. In the second five years 7,420 farm families will receive a total of 62,600 saplings of temperate (37,891) and sub-tropical (24,709) fruits. In the third five years about the same number will be distributed. By the end of the 15 year period of the RCUP, roughly 170,000 saplings, including 100,635 (59%) temperate and 69,365 (41%) sub-tropical fruits, will have been distributed among farm families at the rate of 17 plants per household. (Attachment 3.3)

Sources of Saplings:

The nearest government farms and private nurseries where fruit saplings can be obtained are listed in Attachment 9.3. The Marpha Agriculture Station and the Lumle Agricultural Station are the primary sources for temperate fruit saplings, whereas for sub-tropical plants the nearest possible sources would be the Harilal Private Nursery in Baglung district and the Karmacharya Private Nursery at Tatopani. By the 5th project year some plants of sub-tropical and temperate fruits will be available from the proposed project nurseries at Tatopani and Shikha.

Production/Consumption:

Production of fruit from project trees will begin in the 4th project year and continue to increase as more plants come into production. At the end of the third five year period about 6,106 tons more fruit would be available in this area than is currently produced. Detailed yearwise estimated production of fruit has been worked out in Appendix Jb, Attachment 14.3. The expected yield from the already existing fruit trees (without project) also has been calculated (see Attachment 1:3). This table shows tha after about 10 years the total production tends to decline. This is due to the replacement of old trees and inferior varieties with improved ones that are not yet of bearing age.

The present per capita comsumption of fruit in this area has been estimated to be 15 kg. per annum. It is assumed that at the end of 15 years per capita comsumption will go up to 29 kg. The surplus amount of fruit to be marketed also has been worked out in the same table. It is assumed that about 5,144 tons (with project and without) after local consumption would be available for the market.

Market:

Non-perishable fruits like orange, apple, pear, lemon, lime and walnut will be sent to Pokhara as the road opens from Baglung. The local trading places like Beni, Dena and Tatopani where there is a lot of tourist traffic can also be a good marketplace for the fruit. The proposed fruit-processing plant will utilize some quantity.

Production Costs:

Yearwise estimated cost of production of all fruits is presented in Attachment 14.3. Yearwise costs of production for each fruit in this catchment area is given in Attachment 13. These calculations are based on information obtained from the best fruit growers of this area.

Benefits:

Based on the overall cropping pattern including field crops and inter-crops, the gross value of production of 695 hectares is presented in Attachment 14.3. This has been calculated based on on the unit price given in Attachment 21. This value minus costs of production gives the net benefit. From this value the incremental net benefit has been calculated. The incremental net value of benefits is negative from the first to the 7th year of the project. Only from the 8th year does it become positive. This benefit then increases from 49,000 rupees in the 8th year to 14 million rupees in the 15th year.

b. Kitchen Garden Vegetable Production:

It is planned that in the first year of RCUP about 403 farm houses will get a vegetable minikit. This number will increase yearly so that altogether 10,077 farm houses will get a kit during the project period of 15 years. (Attachment 2.3) Yearly seed requirements for different vegetables have been worked out in Attachment 8.3. The total amount of seeds needed for the first, second and third five year phases is calculated to be 2337 kg., 2726 kg. and 2726 kg. respectively.

Under this scheme about 1632.5 tons of vegetables will be produced in about 60 ha. of area during the first five years, and 1904.4 tons in 70.5 ha. in each of the second and third five year phases (Attachment 5). Rs. 5,700,160 worth of vegetables will be produced in this catchment during the 15 year period.

c Fruit Nursery Establishment:

There is no government farm in this district. The requirement of saplings of this scheme as given elsewhere is estimated to be about 170,000. The nearest possible sources will not be in a position to supply so much to this area only. Therefore, two project fruit nurseries are proposed for this catchment. One central nursery in Doba Panchayat at Tatopani for sub-tropical fruits, and another satellite nursery in Shikha Adarsha Panchayat at Shikha Village for the temperate fruits.

A central nursery should have an area not less than 1.0 hectare and the satellite not less than 0.75 ha. When fully functioning, the central nursery should have the capacity for produce a minimum of 12,000 plants and the satellite nursery 10,000 saplings every year.

The following varieties of fruit are recommended for these nurseries:

TABLE 20

Fruit	Varieties	Fruit	Varieties
1. Orange	Tangerine and sweet orange	1. Apple	Jonathan, Royal Delicious, Rome Beauty, Golden Delicious
2. Lime	Selected best local varieties	2. Pear	Pharping, Bartlett
3. Lemon	Eureka, Hill lemon	3. Peach	Alberta, Triumph
4. Other citrus	Bhogate, Kathe Chaski, etc.	4. Plum	Santa Rosa, Methely
		5. Walnut	
		6. Apricot	
		7. Almond	
		8. Others (Hazel nut, pecan, strawberry, etc.)	

These nurseries will require the following staff:

TABLE 21

Staff	Tatopani Nursery	Sikha Nursery
a. Junior Technical	1	0
b. Junior Technical Asst.	1	1
c. Field Assistant	1	1
d. Storekeeper cum Office Assistant	1	1
e. Gardeners	7	5

A two story building to accomodate an office, a store and a residence is proposed at a cost of Rs. 171,000 for a central nursery and Rs. 131,000 for the satellite nursery. A workshed would be constructed at a cost of Rs. 3,000 at each nursery.

Yearwise detailed costs are presented in Attachment 11.3. The total capital costs and operating costs for both nurseries come to 73,000 rupees and 2.2 million rupees respectively. Land costs are taken to be Rs. 4,000/ropani (500 m^2). Other costs have been estimated based on current prevailing prices. Contingency costs are not included here.

Tentative Production Targets for both nurseries:

(a) Tatopani Central Project Nurseries:

TABLE 22

Fruit/Year	4th yr	5th yr	1st 5 yr	2nd 5 yr	3rd 5 yr	Total
1. Orange (seedlings & bredded)	-	2,000	2,000	13,250	1,325	28,500
2. Lime (cuttings & saplings)	500	1,000	1,500	6,500	6,500	14,500
3. Lemon (Eureka) (layers & cuttings)	-	500	500	3,000	3,000	6,500
4. Others	100	500	600	3,000	3,000	6,600
Total	600	4,000	4,600	25,750	25,750	65,100
5. Vegetable seed production (kg.)	80	90	170	450	450	1,170

(b) Shikha Satellite Nursery:

TABLE 23

Fruit/Year	5th year	1st 5 yr	2nd 5 yr	3rd 5 yr	Total
1. Apple (grafts)	500	500	8,000	10,000	18,500
2. Pear (grafts)	500	500	2,000	4,000	6,500
3. Peach (grafts)	500	500	2,000	4,000	6,500
4. Plum (grafts)	300	300	1,000	2,500	3,800
5. Walnut (seedlings)	500	500	2,000	4,000	6,500
6. Apricot (grafts)	300	300	1,000	2,500	3,800
7. Almond (grafts)	100	100	1,000	2,000	3,100
8. Others	200	200	1,000	1,000	2,200
Total	2,900	2,900	18,000	30,000	50,900
9. Vegetable seed production (kg.)	40	40	350	400	790

The Central Nursery will start producing some saplings from the fourth year. This nursery would produce about 56,100 plants during the project period, which is about 81% of the total required number of sub-tropical plants during the whole project period.

It is hoped that about 50,900 saplings of temperate fruits would be made available from the Shikha satellite nursery, which is about 51% of the total requirement.

1. Establishing a Fruit and Vegetable Mini-Processing Plant:

A small fruit and vegetable processing plant is proposed for this catchment area, so that perishable fruits and some vegetables can be preserved and sent to distant markets. It will be established in the latter phase of the second five years. It will start producing from the 11th year of the project.

For estimated requirements of raw materials, items produced and the value of production, please refer to Attachment 16.

Total costs come to Rs. 1,191,000, including Rs. 326.4 thousand capital costs and Rs. 865,000 operating costs.

d. Greenhouse Construction:

A lump sum of Rs. 150,000 has been allocated to provide a greenhouse at the central nursery. This would be constructed in the third five year phase. Size, construction materials, etc. should be worked out when the proposal is approved.

e. Natural Cold Room Construction:

A lump sum of Rs. 2,000,000 is allocated to build four natural cold rooms, one in the fourth year, one in the fifth year, and two in the second five years. The probable locations will be Shikha, Doba, Bhagavati and Ghatan Panchayats.

UPPER KALIGANDAKI CATCHMENT AREA MUSTANG

1. Existing Situation:

This area is located in the North-Central part of Nepal. This region consists of two physiographic zones, the Tibetan Plateau in the north and the Inner Himalayas to the south. Northward from Jomson (the district headquarters) there is a unique high-elevation desert environment. Most of the area lies between 2500 m. and 7000 m. altitude and falls in the headwaters of the Kaligandaki River.

This area comprises sixteen panchayats having a total area of 1665.23 km^2 (1565.23 ha.), of which only 3,764 ha. (2.3%) is cultivable. Of that, 12 ha. (0.3%) is situated at an elevation between 1220 m. and 1830 m.; 450 ha. (12.4%) lies between 1830 m. and 2440 m.; 2,090 ha. (56.9%) lies at elevations between 3400 m. and 3050 m.; and 1,116 ha. (30.4%) lies at elevations between 3050 m. and 3,960 m. The whole area has a temperate climate. Most of this region receives very little rainfall. The average annual precipitation is less than 300 mm. (For detailed physical environmental features, please refer to the watershed management report of the RCUP.)

This area has been identified as one of the best suited places in Nepal for the cultivation of high quality temperate fruits and grapes. The HMG/N is making every effort for the development of a horticultural industry in this region.

Except for a few native cultivars, most of the fruits now being cultivated were introduced to this area about 12 years ago when the Marpha horticulture farm was established in 1966. About 59,000 plants have already been distributed to the farmers. The RCU design survey team estimated the total number of existing fruit trees to be 43,344 of which 5,200 (12%) trees are in the fruit-bearing stage. (Attachment 1.4) Only temperate fruits are found in this area. The widely grown varieties are:

Apple: Delicious (Red, Golden and Royal), Winter Banana, Reeca Red, McIntosh

Pear: Pharping, Bartlett

Peach: Peregrine, Alberta, Red Heaven, June Golds

Plum: Santa Rosa, Mariposa

Almond: Paper shelled, Hard shelled

Walnut: Paper shelled, Thin shelled

Apricot

Grape

At present, the total area under fruit cultivation has been estimated to be about 168 hectares, which is about 4.6% of the total cultivated land. Apples are the most widely grown, covering about 117.6 ha. (70%); walnut (17.2 ha.) and peach (12 ha.) come second and third. Cultivation of fruit is mostly concentrated below the Jomsom area. Farmers of these areas are very much aware of fruit cultivation. It is generally observed that farmers of Marpha, Tukuche and Lete panchayats have planted mostly apples in their very fertile crop land. This certainly indicates the interest of farmers in fruit cultivation as opposed to field crops.

Annual production of fruit in this catchment area has been estimated to be about 241 tons (Attachment 10.4). The present consumption of fruit has been roughly estimated to 15 kg. per year per person, which means per year about 224 tons of fruit are consumed locally. About 17 tons of fruits are sold in the local market (mostly for tourists and visitors).

Fruits are mostly sold or consumed fresh although some are used to prepare beverages at the Marpha farm, where they have a distillery plant. Some farmers also use some fruits (culled ones) to make wine.

Constraints:

Development of large-scale fruit farming in this catchment area is limited by the following constraints:

1. Lack of transportation facilities:

From a climatic point of view, this is the best suited area for high quality temperate fruit and vegetable seed production.

But this potential cannot be realized until there is a proper transportation facility. At present the only access provided in this area is by foot trails. There is only one old trading route along the Kaligandaki River between Pokhara and the Tibetan border. Seasonal access is provided by a small plane to and from Jomsom. Neither of these routes are of any use for transporting a large bulk of fresh fruit to distant markets. Essential goods are brought in by porter or ponies from Pokhara, which takes about 10 or 20 days to reach.

2. Lack of markets:

There is no big market within the area or nearby places where a large quantity of fruits can be sold. The existing small markets are Jomsom, Tukuche, Lete and Marpha, which lie along the main trekking route for tourists in Nepal. The main consumers of fruit in this area are tourists, visitors and trekkers. According to the local people there, at present there is not much of a problem of marketing their produce, but in the near future when more fruits are available, there will certainly be a big problem with marketing.

3. Lack of irrigation:

This is a rain shadow area with little precipitation. The Kaligandaki River and its tributaries are the only sources of water, so cultivation is done in very limited areas, mostly in the irrigated terraces along the Kaligandaki River and its major tributary valleys where there is an adequate supply of water. Due to the lack of a water supply, a vast area of land is barren. Such land can be put under fruit cultivation if irrigation facilities are developed. Some irrigation schemes have been proposed in the irrigation report of the RCUP.

4. Lack of technology and inadequate extension services:

A lot of effort has been made through the Marpha Agriculture Station and the district Agriculture Extension Office to provide planting materials and technical know-how to the farmers. Still,

due to the lack of adequate manpower and limited resources, a majority of the famers have not received enough services or technology of fruit cultivation. This is expecially true in the areas north of Jomsom.

5. High Winds:

One of the main drawbacks of this region is the presence of high velocity winds throughout the year (data not available). In summer, winds funnel northward from Tukuche, and in winter the winds blow just in reverse, bringing cold air of the Tibetan plateau southward. As a result, most of the fruit trees are lopsided.

Government Efforts:

1. Marpha Agriculture Station:

This station is located in Marpha panchayat at the base of the Nilgiri Hills at an altitude of 2550 meters. It was started in 1966. This research station was established to find out the varieties of different fruits and vegetables most suited for cultivation in this region of the country, and to encourage farmers to grow such varieties of fruits by providing plants and seeds along with technology.

Briefly, the work being carried out is as follows:

a. Introduction and trial of different varieties of temperate fruits, like apples, pears, peaches, plums, apricot, walnut, almond, etc.
b. Trials of different root stocks for apples, pears, peaches and plum.
c. Trials of different varieties of vegetables.
d. Seed production of adapted varieties of different vegetables.
e. Production and distribution of adapted varieties of different fruits.
f. Experiments to combat pests and diseases of fruits and vegetables.

g. Help to establish private nurseries in the area.

h. Provide training to the farmers and the field workers (JT's and JTA's).

i, Provide technical know-how and supervision to the horticulture activities of the area.

j. Trials on storage of fruit (especially apples)..

Area:

The total area is 8.75 hectares. Of that only 6.85 ha. is used, as follows:

1. Orchard	3.50 ha.
2. Fruit Nursery	0.35 ha.
3. Vegetable crops	0.50 ha.
4. Vegetable Nursery	0.05 ha.
5. Other crops	0.75 ha.
6. Office building, roads	1.70 ha.

Physical Facilities:

This farm has the following facilities:

a. Office building	1
b. Staff quarters	5
c. Store	1
d. Distillery	1
e. Guest house cum store	1
f. Agriculture building	1

Staff Members:

The farm has a total of 27 staff members:

a. Gazetted officer, Class I	1
b. Gazetted officer, Class II	1
c. Gazetted officer, Class III	1
d. Non-Gazetted, Class I	6
e. Non-Gazetted, Class II	1
f. Non-Gazetted, Class IV	5
g. Gardeners	12

TARGETS AND ACHIEVEMENTS OF THE FARM IN DIFFERENT ACTIVITIES (1975/76 - 1979/80)

TABLE 24

S.N.	Year/Activities	Unit	1975/76		1976/77		1977/78		1978/79		1979/80		TOTAL	
			Target	Achieve-ment	Target	Achieve-ment	Target	Achieve-ment	Target	Achieve-ment	Target	Achieve-ment*	Target	Achieve-ment
1.	Root stock production	No	NA	4,000	NA	5,700	NA	1,300	NA	10,000	NA	NA	NA	NA
2.	Sapling production	No	NA	5,360	NA	3,000	NA	4,526	NA	6,150	NA	12,675	NA	31,711
3.	Vegetable seed production	Kg.	-	-	200	479	210	321	300	446	400	497	1,110	1,743
4.	Fresh fruit production	Kg.	NA	1,840	NA	2,187	NA	6,845	NA	16,471	NA	23,649	NA	50,992
5.	Fresh vegetable production	Kg.	-	-	NA	2,270	-	-	-	-	NA	1,954	NA	4,224
6.	Wine production	Ltr.	-	-	-	-	200	200	600	600	400	1,136	1,200	1,936
7.	Sapling distr.	No	NA	4,235	NA	11,200	NA	2,887	NA	19,666	NA	NA	NA	NA
8.	Veg. seed distr.	Kg.	-	-	-	-	NA	687	NA	1,012	NA	106	NA	1,805
9.	Veg. seedling distribution	No	-	-	NA	17,090	NA	70,994	NA	83,995	NA	36,425	NA	208,504
10.	Revenue	Rs.	NA	32,000	NA	28,249	NA	41,860	NA	123,344	NA	105,376	NA	330,829

Source: Ag. Station Mustang Studies on fruit

NA = Data not available

- = No target, no achievement

*This achievement is up to 6 months

EXISTING NO. AND VARIETIES OF PLANTS (1979) IN THE FARM

TABLE 25

Type of Fruit	Varieties	No. of Plants
Apple	1. Delicious a. Golden b. Royal c. Red d. Winter 2. Richa-Red 3. McIntosh	957
Pear	1. Pharping (8) 2. Bartlett (17) 3. Black Ben Davis (13)	38
Peach	1. Peregreen 2. Alberta 3. Triumph 4. Red Heaven 5. June Gold	106
Plum	1. Mariposa	122
Walnut	1. Thin shelled (71) 2. Hard shelled (141)	212
Pomegranate	1. Bedana 2. Kandhara	19
Hazelnut	1. Tonde Delle Langhe	20
Grape	1. Perlette 2. Beauty 2. Seedless 4. Thompson seedless 5. Cardinal Muscat	650
Apricot	1. Kaisha	94
Nectarine	1. Independence	2
TOTAL		2,220

Source: 1) Agriculture Farm, Mustang
2) Studies on Fruit Activities of Horticulture and Agriculture Stations in Nepal (1952 - 1978) Fruit Development Division, HMG/Nepal

2. A private nursery, Gopal Nursery, in Marpha village panchayat, has been established at the instigation of the farm for the production of more fruit saplings required in the region. It is under the supervision of the farm.
3. The ADB has provided long term credit for fruit cultivation for the past few years. In the last two years, the ADB supplied 336,000 rupees to the fruit growers of this district (ADB office - Mustang).
4. AIC supplies the inputs such as tools, chemicals, fertilizers, and vegetable seeds to the farmers.
5. A distillery plant has been established at Marpha farm recently for the preparation of wines and brandies from the unmarketable fruits, of apples, peaches, apricots and grapes.
6. A small co-operative fruit processing plant has been established at Tukuche under the UNDP program.

II. Proposed Activities:

A. Distribution of fruit saplings:

Going by the fruits presently grown, the eight most important types of temperate fruits have been selected for this region to distribute to the farmers (Attachment 34). The largest number is that of apple, followed by apricot and pear. The total number of saplings to be distributed in the first five years is approximately 61,500; in the second five years, 81,750; and the same number in the third five years. That is about 225,000 plants to be provided to farmers during the project period of 15 years.

Apples will cover the largest area of 412 ha. (46%). The total area which will come under fruit cultivation in this catchment is estimated to be about 896.7 ha., that is about 23.8% of the existing cultivated land. It is expected that about more land will come under cultivation due to development of irrigation facilities under the RCU program. Only about 25% of existing crop land will

be replaced by fruit. This has been worked out with the consultants of the Fruit Development Division of HMG/N.

Distribution program:

The number of plants proposed to be distributed every year under this scheme is presented in Attachment 3.4. The projected number of households reached in 15 years' time are 4,000. If an equal number of plants were distributed, it would work out to be 56 plants per household. The small farmers do not have enough land to accomodate so many trees. They will be provided with the maximum number they can use, and then the extra ones will be given to the interested bigger farmers. Note that at the beginning, the first priority in distribution will be to supply the small farmers who do not have fruit plants yet on their farms.

Sources of saplings:

The only source in this region is the Marpha Agriculture Station. Another small source is the Gopal Nursery which is in the beginning stage of production (Attachment 9.4). The Marpha Station will not only supply the plants but has the responsibility to look after all horticultural activities for the district including technology transfer and training for growers and field workers.

Production/Consumption:

Production of fruit from RCUP trees will only start from the 5th project year. The assumed yearwise production of fruits has been worked out in detail (Attachment 14.4). The projected production from the now existing (without project) trees has also been worked out (Attachment 1.4). The expected surplus of fruits (total production minus local consumption) is also presented in the same table. The present per capita consumption of fruits is taken to be 15 Kg. every year as more farmers start producing fruit in their home gardens. It is roughly estimated that after 15 years it will go up to 30 kilograms per annum.

Market:

- Actual data was not available, but on the basis of the information related by the farmers, about 17 tons of fruits were sold last year to tourists and visitors, and some was used for making wines. According to the people there, there was not much of a problem of marketing produce at present, but in the near future, there will certainly be a problem of marketing, when more fruit is produced. Efforts are being made by the HMG to reach distant markets. To this end, a small preservation plant has been established at Tukuche, with the assistance of UNDP. In addition, the Marpha farm has established a distillery to prepare wine and brandies from the perishable fruits like apricot, peaches, grapes etc. It has already started functioning and the results are quite encouraging. According to them, there is some interest in starting private distilleries in the area. On the same farm, a natural cold room was constructed on a trial basis two years ago, and it has proved to be quite useful and practical for storing fruits, especially apples. It is reported that apples can be stored in such a facility for as long as six months with minimal losses in weight and quality. More stores of such kinds may be constructed to store apples to regulate the market. Attempts have been made to air-lift fruits to Kathmandi and Pokhara, but these efforts have not proved economical.

Costs:

Yearwise estimated total costs of production of all fruits is presented in Attachment 14.4. Whereas the cost of production for each fruit in this catchment is given in Attachment 13, these estimates are based on infomation obtained from the best fruit growers and the Government farms of the area.

Benefits:

Based on the overall cropping pattern including field crops and inter-crops, the yearwise gross value of production of 896.7 hectares in presented in Attachment 14.4. This has been calculated based on the unit prices given in Attachment 21. This value minus the costs of production gives the net benefits on the basis of this value.The incrementai net value of production has been calculated. This value is negative from the first to the 6th year of the project. Only from the 7th year does it become positive. This value then increases from 673,000 rupees in the 7th year to 28.4 million rupees in the 15th year.

B. Kitchen Garden Vegetable Production:

It is planned that 3,999 farm houses will get a vegetable mini kit during the whole project period (Attachment 2.4) Total seed requirements for different vegetables has been worked out in Attachment 6. The total amount of seed needed for the first, second and third five-year phases is calculated to be 531 Kg. and 620 Kg. respectively.

Under this scheme about 362 tons of fresh vegetables will be produced in about 24 ha. during the first five years, and 422 tons in 28 ha. in each of the second and third five year phases (Attachment 5). Rs. 1,199,000 worth of vegetables is expected to be produced in this catchment under this scheme during the 15 year period (Attachment 15).

C. Fruit Nursery Establishment:

In order to support the Marpha farm in meeting the demand for fruit plants, a satellite fruit nursery will be established in the northern region, in Ghami panchayat, about two days' walk from Marpha. It is at the centre of six panchayats in the most remote area of the district. It is to be established in the fourth project year on a 0.5 ha. plot. It will have a capacity of producing 1,500 plants annually. The proposed fruits are apple, peach, plum, walnut, grape,

apricot, and almond. It would start producing plants after five years. Tentative production targets are given in the table below:

TABLE 26

Fruits	2nd 5 yr	3rd 5 yr
Apples (Grafts)	500	1,500
Peach (Grafts)	500	1,000
Walnut (Seedlings)	300	1,000
Plum (Grafts)	500	1,000
Grape (Cuttings)	300	750
Apricot (Grafts)	300	750
Almond (Grafts)	300	500
Others - Nuts	300	460
Vegetable seed production (Kg.)	250	300
TOTAL	3,000	6,960

Suitable varieties have to be chosen in consultation with the Marpha farm.

This nursery will require the following staff:

1. JTA — One permanent
2. Field Assistant — One permanent
3. Storekeeper — One permanent
4. Gardeners — Three permanent

A two-story building to accomodate an office, a store and staff quarters should be constructed and a separate shed should be provided.

Costs:

Tentative total costs during the project period come to Rs. 1,064,661, including Rs. 296,624 capital and Rs. 768,037 of operating costs.

D. Establishment of Semi-Commercial Fruit and Vegetable Processing Plant:

It is expected that after about 10 years' time a large quantity of fruits (about 6,000 tons) will be produced from existing plus RCUP trees. It will not be possible to send fresh fruits to other cities unless there is vehicular transport, which is a very long-range plan. Therefore, the only way to utilize such fruits is by processing. Such processed fruits can be sent to distant places. A processing plant is therefore proposed for this area. The actual site for setting up this factory should be determined later on but the possible areas are Jomsom, Marpha and Tukuche.

Tentative requirements of raw materials have been estimated to be about 92 tons of fruits and 66 tons of vegetables per year. At full functioning, about 1,730,000 rupees worth of processed fruits and vegetables can be produced. Work should begin on the plant in the 8th project year and it should begin functioning from the 11th project year.

Costs:

The estimated total costs come to about 3.27 million rupees including 1.34 million capital costs and 1.93 million as operating costs for the whole project period.

E. Natural Cold Room Construction:

Three such storage rooms will be constructed in this catchment area, one in the third year, one in the fifth year and one in the second five year phase. Probable places are Ghami, Kagbeni and Jomsom.

Additional facilities for Marpha Agriculture Station:

This Station is the key input in the horticulture development of this region. The inputs like plants, vegetable seeds and technical supervision are to be provided from this farm for the implementation of this RCUP scheme. It is therefore proposed to provide some facilities to this farm under this program. A lump sum of 150,000 rupees is allocated to construct one greenhouse in the third project year and 125,000 for one mist-cum-shade house, which is to be constructed in the second project year.

Attachment 1.1

KULEKHANI CATCHMENT AREA (MAKAWANPUR DISTRICT)

EXISTING NUMBER, AREA AND PRODUCTION OF FRUIT TREES (WITHOUT PROJECT)

	TYPES OF FRUIT	TOTAL # OF TREES	BEARING TREES	AREA (HA)	PRODUCTION
1.	Apple	6,563	2,588	27.70	103.52
2.	Pear	8,981	5,389	32.31	296.40
3.	Peach	5,978	3,480	29.26	107.88
4.	Plum	1,508	905	5.43	40.73
5.	Walnut	664	332	4.25	7.30
6.	Lime	1,350	888	2.17	22.20
7.	Orange	986	493	2.47	14.79
8.	Nibuwa (Hill lemon)	493	400	1.24	16.00
9.	Banana	375	375	0.15	1.88
10.	Others	499	311	1.42	6.22
	TOTAL	27,397	15,161	106.40	616.92

Attachment 1.2

DARAUNDI CATCHMENT AREA (GORKHA DISTRICT)

EXISTING NUMBER, AREA AND PRODUCTION OF FRUIT TREES

(WITHOUT PROJECT)

	TYPES OF FRUIT	TOTAL # OF TREES	BEARING TREES	AREA (HA.)	PRODUCTION
1.	Apple	727	2	3.07	0.078
2.	Orange	9,620	3,000	35.40	600.00
3.	Pear	2,645	1,587	9.50	126.96
4.	Peach	2,574	1,930	12.60	154.40
5.	Plum	602	533	2.175	29.85
6.	Lime	1,746	1,192	2.83	36.95
7.	Mango	4,315	1,500	53.15	375.0
8.	Banana	76,273	39,975	34.55	199.87
9.	Pineapple	39,000	32,405	3.90	16.20
10.	Nibuwa	5,160	3,875	17.99	193.75
11.	Guava	9,595	7,635	47.03	137.43
12.	Jack Fruit	698	300	8.98	150.00
13.	Litchi	159	60	1.02	3.36
14.	Walnut	8	1	0.048	0.03
15.	Pomegranate	181	98	0.290	0.18
16.	Papaya	1,523	1,180	2.17	35.40
17.	Others	435	400	1.368	28.73
	TOTAL	155,261	95,671	235.971	2,089.188

Attachment 1.3

LOWER KALIGANDAKI CATCHMENT AREA (MYAGDI DISTRICT)

EXISTING NUMBER, AREA AND PRODUCTION OF FRUIT TREES

(WITHOUT PROJECT)

	TYPES OF FRUIT	TOTAL # OF TREES	BEARING TREES	AREA (HA.)	PRODUCTION
1.	Apple	800	120	3.390	1.80
2.	Pear	1,000	700	3.597	56.00
3.	Peach	1,190	952	5.833	33.32
4.	Plum	420	252	1.516	7.56
5.	Orange	9,800	3,920	24.50	490.00
6.	Lime	1,120	336	1.792	6.72
7.	Walnut	210	42	1.346	0.63
8.	Apricot	20	6	0.098	0.15
9.	Grape	74	4	0.185	0.002
10.	Pomegranate	112	56	0.179	0.672
11.	Mausam	210	105	0.525	2.10
12.	Banana	2,000	1,500	0.80	7.50
13.	Nibuwa	980	686	2.450	34.30
14.	Guava	700	350	3.431	7.00
15.	Mango	50	20	0.50	1.20
16.	Others (Alaichi)	1,000	200	0.625	0.05
	TOTAL	19,686	9,249	50.767	649.004

Attachment 1.4

UPPER KALIGANDAKI CATCHMENT AREA (MUSTANG DISTRICT)

EXISTING NUMBER, AREA AND PRODUCTION OF FRUIT TREES

(WITHOUT PROJECT)

	TYPES OF FRUIT	TOTAL # OF TREES	BEARING TREES	AREA (HA.)	PRODUCTION (M/T)
1.	Apple	32,700	3,924	118.63	156.96
2.	Pear	329	39	1.18	0.975
3.	Peach	2,820	338	11.95	33.80
4.	Plum	309	37	1.31	0.37
5.	Apricot	1,002	120	4.25	6.00
6.	Walnut	1,723	207	17.23	41.40
7.	Grape	2,362	283	5.905	0.566
8.	Pomegranate	15	2	0.038	0.01
9.	Almond	2,084	250	8.83	1.25
	TOTAL	43,344	5,200	168.323	241.331

Attachment 2

PROPOSED PROGRAM SUMMARY

ACTIVITIES	UNIT OF ACCOMPLISHMENT	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	15 yr. TOTAL
A. Saplings Distribution (Home-Fruit Garden)	Numbers	15,900	26,700	36,900	52,900	76,400	208,800	403,800	365,235	977,835
B. Kitchen Garden Vegetable Production (Vegetable Minikit Distribution)	Minikit Numbers	1,580	1,981	2,772	2,772	2,772	11,877	22,210	22,210	56,297
C. Fruit Nursery Establishment	Number	2	2	2	2	-	8	-	-	8
D. Natural Cold Room Construction	Number	-	-	2	2	2	6	6	-	12
E. Establishment of Fruit and Vegetable Processing Plants	Number	-	-	-	-	-	3	3	-	3
F. Greenhouse Construction	Number	-	-	1	-	-	1	1	1	3
G. Mist/Shade House Construction	Number	-	1	-	1	-	2	-	-	2
H. In-service Training	Number (Man Days)	6 (90)	8 (120)	10 (150)	12 (180)	10 (150)	46 (690)	13 (390)	13 (390)	72 (1470)

Attachment 2.1

PROPOSED PROGRAM - SUMMARY FOR KULEKHANI CATCHMENT AREA

ACTIVITIES	UNIT OF ACCOMPLISHMENT	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	15 yr. TOTAL
1. Saplings Distribution (Fruit Garden)	Number	3,100	3,100	3,150	3,400	3,500	16,250	42,150	33,435	91,835
2. Kitchen Garden Vegetable Production (Minikit Distribution)	Minikit Number	350	441	618	618	618	2,645	3,090	3,090	8,825
3. Fruit Nursery Establishment	Number	-	-	1	-	-	1	-	-	1
4. Natural Cold Room Construction	Number	-	-	1	-	-	1	1	-	2
5. Mist House/Shade House Construction	Number	-	-	-	1	-	1	-	-	1
6. Inservice Training for Nursery Staffs	Number (Man Days)	-	-	2 (30)	1 (15)	1 (15)	4 (60)	1 (30)	1 (30)	6 (120)

Attachment 2.2

PROPOSED PROGRAM - SUMMARY FOR DARAUNDI CATCHMENT AREA

ACTIVITIES	UNIT OF ACCOMPLISHMENT	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	15 yr. TOTAL
1. Sapling Distibution (Fruit Garden)	Number	-	10,000	14,800	25,650	35,700	86,250	217,300	187,450	491,000
2. Kitchen Garden Vegetable Production (Minikit Distribution)	Minikit Number	668	835	1,169	1,169	1,169	5,010	14,193	14,193	33,396
3. Fruit Nursery Establishment	Number	1	1	1	1	-	4	-	-	4
4. Natural Cold Room Construction	Number	-	-	-	1	-	1	2	-	3
5. Establishment of Fruit & Vegetable Processing Plant	Number	-	-	-	-	-	-	1	-	1
6. Greenhouse Construction	Number	-	-	-	-	-	-	1	-	1
7. In Service Training for Nursery Staffs	Number (Man Days)	3 (45)	4 (60)	5 (75)	6 (90)	5 (75)	23 (345)	6 (180)	6 (180)	35 (705)

Attachment 2.3

PROPOSED PROGRAM - SUMMARY FOR MYAGDI

ACTIVITIES	UNIT OF ACCOMPLISHMENT	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	15 yr. TOTAL
1. Sapling Distribution (Fruit Garden)	Number	3,200	3,700	6,100	10,600	21,200	44,800	62,600	62,600	170,000
2. Kitchen Garden Vegetable Production (Minikit Distribution)	Minikit Number	403	505	705	705	705	3,023	3,527	3,527	10,077
3. Fruit Nursery Establishment	Number	1	1	-	-	2	2	-	-	2
4. Natural Cold Room Construction	Number	-	-	-	1	1	2	2	-	4
5. Fruit and Vegetable Processing Plant	Number	-	-	-	-	-	-	1	-	1
6. Greenhouse Construction	Number	-	-	-	-	-	-	-	1	1
7. In Service Training for Nursery Staffs	Number (Man Days)	3 (45)	4 (60)	3 (45)	3 (45)	3 (45)	16 (240)	4 (120)	4 (120)	24 (480)

Attachment 2.4

PROPOSED PROGRAM - SUMMARY FOR MUSTANG

	ACTIVITIES	UNIT OF ACCOMPLISHMENT	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	15 yr. TOTAL
1.	Sapling Distribution (Fruit Garden)	Number	9,600	9,800	12,850	13,250	16,000	61,500	81,750	81,750	225,000
2.	Kitchen Garden Vegetable Production (Minikit Distribution)	Minikit Number	159	200	280	280	280	1,199	1,400	1,400	3,999
3.	Fruit Nursery Establishment	Number	-	-	-	1	-	1	-	-	1
4.	Natural Cold Room Construction	Number	-	-	1	-	1	2	1	-	3
5.	Fruit & Vegetable Processing Plant	Number	-	-	-	-	-	-	1	-	1
6.	Greenhouse Construction	Number	-	-	1	-	-	1	-	-	1
7.	Mist/Shade House Construction	Number	-	1	-	-	-	1	-	-	1
8.	In Service Training	Number (Man Days)	-	-	-	2 (30)	1 (15)	3 (45)	2 (60)	2 (60)	7 (165)

Attachment 3.1

KULEKHANI CATCHMENT AREA - MAKAWANPUR DISTRICT

PROPOSED NUMBER AND AREA UNDER FRUIT PLANTS BY TYPE OF FRUITS AND YEAR

	1st yr.		2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
TYPES OF FRUIT	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Apple	500	1.799	500	1.798	500	1.798	500	1.798	500	1.798	2,500	8.99	6,700	24.10	3,300	11.87	12,500	44.96
2. Pear	500	1.798	500	1.798	500	1.798	500	1.798	500	1.798	2,500	8.99	7,200	25.899	5,800	20.863	15,500	55.755
3. Peach	600	2.542	600	2.542	600	2.542	600	2.542	600	2.542	3,000	12.71	8,700	36.864	6,300	26.694	18,000	76.271
4. Plum	400	1.694	400	1.694	400	1.694	400	1.694	400	1.694	2,000	8.47	5,200	22.033	5,000	21.186	12,200	51.695
5. Walnut	100	1.00	100	1.00	100	1.00	100	1.00	100	1.00	500	5.0	1,450	14.5	1,480	14.8	3,430	34.30
6. Lime	200	0.4	200	0.4	200	0.4	200	0.4	200	0.4	1,000	2.0	2,150	4.3	2,150	4.3	5,300	10.60
7. Orange	100	0.359	100	0.359	100	0.359	100	0.359	100	0.359	500	1.795	450	5.215	1,550	5.575	3,500	12.589
8. Nibuwa (Hill Lemon)	-	-	-	-	-	-	50	0.211	50	0.211	100	0.422	450	1.906	250	1.059	800	3.389
9. Banana	100	0.062	100	0.062	100	0.062	100	0.062	100	0.062	500	0.310	1,300	0.812	1,200	0.75	3,000	1.875
10. Apricot	-	-	-	-	-	-	100	0.423	150	0.635	250	1.058	1,250	5.296	1,200	5.084	2,700	11.441
11. Persimmon	-	-	-	-	-	-	100	0.416	150	0.625	250	1.041	1,100	4.583	850	3.541	2,200	9.167
12. Lemon	100	0.25	100	0.25	150	0.375	150	0.375	150	0.375	650	1.625	1,800	4.5	1,750	4.375	4,200	10.500
13. Other	500	2.50	500	2.50	500	2.50	500	2.50	500	2.50	2,500	12.5	3,400	17.00	2,605	13.025	8.505	42.525
TOTAL	3,100	12.403	3,100	12.403	3,150	12.528	3,400	13.579	3,500	13.999	16,250	64.911	42,150	167.008	33,435	133.122	91,835	365.041

(Area in HA.)

Attachment 3.2

DARAUNI CATCHMENT AREA - GORKHA DISTRICT

PROPOSED NUMBER AND AREA UNDER FRUIT PLANTS BY TYPES OF FRUIT AND YEAR

	2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
TYPES OF FRUIT	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Apple	100	0.36	100	0.36	150	0.539	200	0.72	550	1.979	1,000	3.6	750	2.698	2,300	8.277
2. Pear	200	0.72	200	0.72	1,000	3.597	2,000	7.194	3,400	12.231	10,000	35.97	7,000	25.18	20,400	73.381
3. Peach	200	0.847	200	0.847	1,000	4.237	2,000	8.475	3,400	14.406	10,000	42.375	5,700	24.152	19,100	80.933
4. Plum	200	0.847	200	0.847	500	2.119	500	2.119	1,400	5.932	6,500	27.542	4,700	19.915	12,600	53.389
5. Orange	1,000	3.597	1,000	3.597	3,000	10.791	4,000	14.388	9,000	32.373	20,000	71.94	18,900	67.986	47,900	172.299
6. Lime	500	1.00	1,000	2.00	2,000	4.00	2,000	4.00	5,500	11.00	13,000	26.00	9,600	19.20	28,100	56.20
7. Nibuwa (Hill lemon)	500	2.119	500	2.119	1,000	4.237	1,000	4.237	3,000	12.712	12,000	50.811	10,200	43.22	25,200	106.781
8. Banana	2,000	1.25	4,000	2.50	5,000	3.125	5,000	3.125	16,000	10.0	44,000	27.5	41,200	25.75	101,200	63.25
9. Pineapple	1,000	0.10	2,000	0.20	4,000	0.40	8,000	0.80	15,000	1.5	40,000	4.00	34,500	3.45	89,500	8.95
10. Mango	500	5.00	500	5.00	1,000	10.00	1,000	10.00	3,000	30.0	12,000	120.00	10,000	100.00	25,000	250.00
11. Litchi	200	1.28	300	1.92	500	3.205	1,000	6.41	2,000	12.815	4,800	30.771	4,600	29.487	11,400	73.073
12. Jackfruit	500	5.00	500	5.00	1,000	10.00	1,000	10.00	3,000	30.0	6,000	60.00	5,600	56.00	14,600	146.00
13. Guava	1,000	6.41	1,500	9.615	1,500	9.615	1,500	9.615	5,500	35.255	10,000	64.10	7,300	46.79	22,800	146.145

(Area in HA.)

Attachment 3.2
(con't)

TYPES OF FRUIT	2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
14. Papaya	1,000	0.83	1,500	1.25	1,500	1.25	1,500	1.25	5,500	4.58	9,000	7.50	9,700	8.08	24,200	20.161
15. Pomegramate	200	0.50	300	0.75	500	1.25	1,000	2.50	2,000	5.0	5,000	12.50	5,600	14.00	12,600	31.5
16. Others	1,000	4.00	1,000	4.00	2,000	8.00	4,000	16.00	8,000	32.0	14,000	56.00	12,100	48.40	34,100	136.4
TOTAL	10,100	33.86	14,800	40.725	25,650	76.365	35,700	100.833	86,250	251.783	217,300	640.648	187,450	534.308	491,000	1,426.739

(Area in HA.)

Attachment 3.3

LOWER KALIGANDAKI CATCHMENT AREA - MYAGDI DISTRICT

PROPOSED NUMBER AND AREA UNDER FRUIT PLANTS BY TYPES OF FRUIT AND YEAR

TYPES OF FRUIT	1st yr.		2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Apple	500	1.799	500	1.799	500	1.799	500	1.799	4,000	14.388	6,000	21.584	12,000	43.165	12,000	43.165	30,000	107.914
2. Pear	300	1.079	300	1.079	400	1.439	1,000	3.597	2,000	7.194	4,000	14.388	5,000	17.986	5,000	17.986	14,000	50.300
3. Peach	300	1.271	300	1.271	400	1.695	1,000	4.237	2,000	8.478	4,000	16.952	5,000	21.186	5,000	21.186	14,000	59.322
4. Plum	100	0.424	100	0.424	300	1.271	500	2.119	1,000	4.237	2,000	8.475	3,000	12.712	3,000	12.712	8,000	33.898
5. Orange	1,000	3.597	1,000	3.597	1,000	3.597	3,000	10.791	5,000	17.986	11,000	39.568	13,250	47.662	13,250	47.662	37,500	134.892
6. Lime	500	1.00	500	1.00	1,000	2.00	1,000	2.00	2,000	4.00	5,000	10.0	6,500	13.00	6,500	13.00	18,000	36.00
7. Walnut	-	-	500	5.00	1,000	10.00	1,500	15.00	2,000	20.00	5,000	50.0	5,000	50.00	5,000	50.00	15,000	150.00
8. Apricot	-	-	-	-	500	2.119	500	2.119	1,000	4.237	2,000	8.475	3,000	12.712	3,000	12.712	8,000	33.898
9. Almond	-	-	-	-	-	-	100	0.424	200	0.847	300	1.271	2,350	9.958	2,350	9.958	5,000	21.186
10. Lemon	300	0.75	300	0.75	400	1.00	500	1.25	1,000	2.50	2,500	6.25	3,000	7.50	3,000	7.50	8,500	21.25
11. Others	200	0.769	200	0.769	600	2.308	1,000	3.846	1,000	3.846	3,000	11.538	4,300	17.308	4,500	17.308	12,000	46.154
TOTAL	3,200	10.689	3,700	15.689	6,100	27.228	10,600	47.182	21,200	87.71	44,800	188.501	62,400	253.189	62,600	253.189	170,000	694.874

(Area in HA.)

Attachment 3.4

UPPER KALIGANDAKI CATCHMENT AREA - MUSTANG DISTRICT

PROPOSED NUMBER AND AREA OF FRUIT PLANTS BY TYPES OF FRUIT AND YEAR

TYPES OF FRUIT	1st yr.		2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Apple	5,000	17.985	5,000	17.985	6,000	21.582	6,000	21.582	7,000	25.179	29,000	104.313	42,875	154.226	42,875	154.226	114,750	412.765
2. Pear	1,000	3.597	1,000	3.597	1,500	5.395	1,500	5.395	2,000	7.194	7,000	25.178	7,750	27.877	7,750	27.877	22,500	80.932
3. Peach	1,000	4.237	1,000	4.237	1,200	5.084	1,250	5.296	1,300	5.508	5,750	24.362	7,090	30.042	7,090	30.042	19,930	84.446
4. Plum	550	2.33	550	2.33	600	2.542	700	2.966	900	3.813	3,300	13.981	3,725	15.783	3,725	15.783	10,750	45.547
5. Apricot	800	3.389	1,000	4.237	2,000	8.474	2,000	8.474	2,500	10.593	8,300	35.167	7,938	33.635	7,937	33.631	24,175	102.433
6. Walnut	250	2.5	250	2.5	300	3.00	400	4.0	500	5.00	1,700	17.0	3,425	34.25	3,425	34.25	8,550	85.5
7. Grape	200	0.5	200	0.5	250	0.625	300	0.75	500	1.25	1,450	3.625	2,650	6.625	2,650	6.625	6,750	16.875
8. Almond	500	2.116	500	2.118	600	2.542	600	2.542	700	2.966	2,900	12.284	3,837	16.258	3,838	16.262	10,575	44.804
9. Others	300	1.00	300	1.00	400	1.333	500	1.666	600	2.0	2,100	6.999	2,460	8.2	2,460	8.2	7,020	23.399
TOTAL	9,600	37.654	9,800	38.504	12,850	50.577	13,250	52.671	16,000	63.503	61,500	242.909	81,750	326.896	81,750	326.896	225,000	896.701

(Area in HA.)

Attachment 4.1

KULEKHANI CATCHMENT AREA

PROPOSED NUMBER AND AREA UNDER FRUITS BY PANCHAYAT AND YEAR

Panchayats	1st yr.		2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Palung	600	2.384	600	2.384	600	2.384	600	2.384	600	2.384	3,000	11.92	6,500	25.837	5,900	23.452	15,400	61.209
2. Damam	500	1.987	500	1.987	500	1.987	600	2.384	600	2.384	2,700	10.729	6,900	27.427	4,900	19.477	14,500	57.633
3. Thachok	400	1.589	400	1.589	400	1.589	400	1.589	400	1.589	2,000	7.945	6,500	25.837	5,700	22.657	14,200	56.439
4. Kulekhani	400	1.589	400	1.589	400	1.589	400	1.589	450	1.788	2,050	8.144	6,000	23.849	4,580	18,205	12,630	50.198
5. Chitlang	500	1.987	500	1.987	500	1.987	600	2.384	650	2.583	2,750	10.928	7,460	29.653	5,760	22.895	15,970	63.476
6. Simeri	300	1.192	300	1.192	350	1.391	400	1.589	400	1.589	1,750	6.953	3,404	13,538	3,406	13.538	8,560	34.029
7. Thakhel	400	1.589	400	1.589	400	1.589	400	1.589	400	1.589	2,000	7.945	5,386	21,409	3,189	12.676	10,575	42.030
TOTAL	3,100	12.317	3,100	12.317	3,150	12.516	3,400	13.508	3,500	13.906	16,250	64.564	42,150	167,550	33,435	132.90	91,835	365.041

(Area in HA.)

Attachment 4.2

DARAUNDI CATCHMENT AREA - GORKHA DISTRICT

PROPOSED NUMBER AND AREA UNDER FRUIT PLANTS BY PANCHAYATS AND YEAR

Panchayats	2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Manakamana	300	0.872	450	1.162	925	2.688	1,272	3.696	2,947	8.418	7,534	21.892	4,519	13.131	15,000	43.587
2. Bhogateni	500	1.453	750	2.179	1,125	3.269	1,472	4.277	3,847	11.178	9,534	27.704	6,619	19.233	20,000	58,116
3. Deorali	300	0.872	450	1.308	925	2.688	1,372	3.987	3,047	8.855	7,534	21.892	7,419	21.558	18,000	52.304
4. Dhowakot	350	1.017	450	1.308	925	2.688	1,272	3.696	2,997	8.709	6,534	18.986	6,459	18.798	16,000	46.493
5. Mirkot	200	0.581	350	1.017	824	2.394	1,170	3.40	2,544	7.392	7,432	21.596	7,024	20.41	17,000	49.398
6. Taranager	400	1.162	550	1.598	924	2.685	1,370	3.981	3,244	9.426	7,532	21.886	7,224	20.991	18,000	52.304
7. Ramiwara	600	1.743	950	2.760	1,324	3.847	1,570	4.562	4,444	12.712	9,732	28.279	7,824	22.735	22,000	63.927
8. Bunghot	650	1.889	950	2.760	1,324	3.847	1,670	4.853	4,594	13.349	9,332	27.117	8,074	23.461	22,000	63.927
9. Gorkhakali	650	1.889	850	2.470	1,224	3.557	1,770	5.143	4,494	13.059	9,734	28.285	6,772	19.678	21,000	61.022
10. Taple	600	1.743	850	2.470	1,324	3.847	1,770	5.143	4,544	13.203	9,832	28.600	8,624	25.060	23,000	66.833
11. Harewar	700	2.034	950	2.761	1,424	4.138	1,770	5.143	4,844	14.076	13,732	39.902	11,424	33.196	30,000	87.174
12. Khoplang	450	1.308	600	1.743	974	2.830	1,320	3.834	3,344	9.715	8,482	24.647	7,174	20.846	19,000	55.210
13. Chhoprak	200	0.581	350	1.017	824	2.394	1,270	3.690	2,644	7.682	7,682	21.596	6,924	20.120	17,000	49.398
14. Khanchok	250	0.726	350	1.017	474	1.377	820	2.383	1,894	5.503	7,482	21.741	4,624	13.436	14,000	40.681

(Area in HA.)

Attachment 4.2
(con't)

Panchayat	2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
15. Pandrung	200	0.581	350	1.017	824	2.394	1,270	3.690	2,644	7.682	7,432	21.596	6,924	20.120	17,000	49.398
16. Srimathkot	200	0.581	300	0.872	424	1.232	770	2.237	1,694	4.922	4,632	13.460	3,674	10.676	10,000	29.058
17. Taku	400	1.162	550	1.598	924	2.685	1,372	3.987	3,246	9.432	7,534	21.892	8,220	23.886	19,000	55.210
18. Jauhari	200	0.581	300	0.872	524	1.523	770	2.237	1,794	5.213	5,432	15.784	4,774	13.872	12,000	34.869
19. Muchhok	200	0.581	300	0.872	524	1.523	770	2.237	1,794	5.213	4,432	12.878	3,774	10.966	10,000	29.058
20. Swara	300	0.872	450	1.308	624	1.813	772	2.243	2,146	6.236	4,534	13.175	4,320	12.553	11,000	31.964
21. Saurpani	300	0.872	500	1.453	924	2.685	1,372	3.987	3,096	8.997	7,434	21.602	7,470	21.706	18,000	52.304
22. Sinjung	200	0.581	350	1.017	824	2.394	1,172	3.406	2,546	7.398	7,434	21.602	6,020	17.493	16,000	46.493
23. Barpak	150	0.436	250	0.726	424	1.232	672	1.953	1,496	4.347	3,034	8.816	2,470	7.177	7,000	20.341
24. Paklung	250	0.726	350	1.017	524	1.523	972	2.824	2,096	6.09	5,534	16.081	5,370	15.604	13,000	37.775
25. Harmi	200	0.581	350	1.017	824	2.394	970	2.819	2,344	6.811	6,432	18.690	5,224	15.180	14,000	40.681
26. Chalrung	350	1.017	400	1.162	774	2.249	820	2.383	2,344	6.811	5,482	15.930	4,174	12.129	12,000	34.869
27. Ampipal	350	1.017	450	1.308	924	2.685	1,370	3.981	3,094	8.991	7,532	21.886	7,374	21.427	18,000	52.304
28. Palung Tar	400	1.162	700	2.034	1,074	3.121	1,420	4.126	3,594	10.443	10,482	30.459	9,924	28.837	24,000	69.740
29. Gaikhur	250	0.726	350	1.017	974	2.830	1,320	3.836	2,894	8.409	8,082	23.485	7,024	20.41	18,000	52.304
TOTAL	10,100	29.346	14,800	43.006	25,650	74.532	35,700	103.734	86,250	250.472	217,300	637.459	187,450	537.689	491,000	1426.742

Attachment 4.3

LOWER KALIGANDAKI CATCHMENT AREA - MYAGDI DISTRICT

PROPOSED NUMBER AND AREA UNDER FRUIT PLANTS BY PANCHAYATS AND YEAR

(Area in HA.)

Panchayats	1st yr.		2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Dhatang	100	0.409	140	0.572	310	1.267	530	2.166	1,188	4.856	2,268	9.27	2,866	11.715	2,866	11.715	8,000	32.700
2. Them	100	0.409	140	0.572	310	1.267	530	2.166	1,188	4.856	2,268	9.27	2,866	11.715	2,866	11.715	8,000	32.700
3. Bakhapani	200	0.817	235	0.961	406	1.660	630	2.575	1,287	5.261	2,758	11.274	4,621	18.888	4,621	18.888	12,000	49.05
4. Kalme Mangale	200	0.409	135	0.552	306	1.251	530	2.166	1,187	4.852	2,258	9.23	2,871	11.735	2,871	11.735	8,000	32.700
5. Darwiza	300	1.226	335	1.369	506	2.068	930	3.801	1,787	7.304	3,858	15.768	5,071	20.728	5,071	20.728	14,000	57.224
6. Pipale	350	1.431	385	1.574	560	2.289	980	4.006	1,837	7.509	4,112	16.809	5,944	24.296	5,944	24.296	16,000	64.401
7. Bhagabati	350	1.431	385	1.574	560	2.289	980	4.006	1,837	7.509	4,112	16.809	5,944	24.296	5,944	24.296	16,000	65.401
8. Beghbola	300	1.226	335	1.369	506	2.068	930	3.801	1,787	7.304	3,858	15.768	5,571	22.771	5,571	22.771	15,000	61.31
9. Doba	300	1.226	335	1.369	506	2.068	930	3.801	1,787	7.304	3,858	15.768	5,571	22.771	5,571	22.771	15,000	61.31
10. Dana	300	1.226	335	1.369	506	2.068	930	3.801	1,787	7.304	3,858	15.768	5,821	23.793	5,821	23.793	15,500	63.354
11. Baraha	150	0.613	185	0.756	356	1.455	580	2.371	1,237	5.056	2,508	10.251	3,246	13.268	3,246	13.268	9,000	36.787
12. Sleh	350	1.431	385	1.574	556	2.273	980	4.006	1,837	7.509	4,108	16.793	5,696	23.282	5,696	23.282	15,500	63.357
13. Bistam Mandali	150	0.613	185	0.756	356	1.455	570	2.330	1,227	5.015	2,488	10.169	3,256	13.309	3,256	13.309	9,000	36.787
14. Ramache	150	0.613	185	0.756	356	1.455	570	2.330	1,227	5.015	2,488	10.169	3,256	13.309	3,256	13.309	9,000	36.787
TOTAL	3,200	13.08	3,700	15.123	6,100	24.933	10,600	43.326	21,200	86.654	44,800	181.116	62,600	255.876	62,600	255.876	170,000	694.868

Attachment 4.4

UPPER KALIGANDAKI CATCHMENT AREA - MUSTANG DISTRICT

PROPOSED NUMBER AND PRODUCTION OF FRUIT PLANTS BY PANCHAYATS AND YEAR

(Area in HA.)

Panchayats	1st yr.		2nd yr.		3rd yr.		4th yr.		5th yr.		1st 5 yrs.		2nd 5 yrs.		3rd 5 yrs.		TOTAL	
	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area	No.	Area
1. Jomsom	1,000	3.985	1,020	4.065	1,338	5.332	1,380	5.50	1,668	6.648	6,406	25.53	6,797	27.088	6,797	27.088	20,000	79.706
2. Marfa	1,400	5.579	1,430	5.699	1,874	7.469	1,932	7.70	2,332	9.294	8,680	35.741	15,516	61.836	15,516	61.836	40,000	159.413
3. Kagbeni	200	0.797	204	0.813	268	1.068	276	1.10	332	1.323	1,280	5.101	3,360	13.391	3,360	13.391	8,000	31.883
4. Chhusang	200	0.797	204	0.813	268	1.068	276	1.10	332	1.323	1,280	5.101	3,360	13.391	3,360	13.391	8,000	31.883
5. Chami	1,050	4.185	1,072	4.272	1,406	5.603	1,450	5.779	1,750	6.974	6,728	26.813	7,636	30.432	7,636	30.432	22,000	87.677
6. Charang	100	0.399	105	0.418	135	0.538	140	0.558	170	0.678	650	2.571	1,175	4.683	1,175	4.683	3,000	11.957
7. Lomthang	150	0.598	153	0.610	200	0.797	207	0.825	250	0.996	960	3.826	1,520	6.058	1,520	6.058	4,000	15.942
8. Bonhup	150	0.598	153	0.610	200	0.797	207	0.825	250	0.996	960	3.826	1,520	6.058	1,520	6.058	4,000	15.942
9. Chhoser	150	0.598	153	0.610	200	0.797	207	0.825	250	0.996	960	3.826	1,520	6.058	1,520	6.058	4,000	15.942
10. Surkahng	150	0.598	153	0.610	200	0.797	207	0.825	250	0.996	960	3.826	1,520	6.058	1,520	6.058	4,000	15.942
11. Muktangth	1,100	4.384	1,118	4.456	1,472	5.866	1,516	6.042	1,832	7.301	7,038	28.049	7,981	31.807	7,981	31.807	23,000	91.663
12. Jharkot	175	0.697	180	0.717	235	0.937	242	0.964	292	1.164	1,124	4.479	1,938	7.724	1,938	7.724	5,000	19.927
13. Kungo	175	0.697	180	0.717	235	0.937	242	0.964	292	1.164	1,124	4.479	1,938	7.724	1,938	7.724	5,000	19.927
14. Lete	1,200	4.732	1,225	4.882	1,605	6.396	1,656	6.60	2,000	7.971	7,686	30.631	8,657	34.501	8,657	34.501	25,000	99.633
15. Kobang	1,200	4.782	1,225	4.882	1,607	6.404	1,656	6.60	2,000	7.971	7,686	30.639	8,656	34.497	8,656	34.497	25,000	99.633
16. Tukuche	1,200	4.782	1,225	4.882	1,607	6.404	1,656	6.60	2,000	7.971	7,686	30.639	8,656	34.497	8,656	34.497	25,000	99.633
TOTAL	9,600	38.258	9,800	39.056	13,850	51.21	13,250	52.807	16,000	63.766	16,500	245.077	81,750	325.803	81,750	325.803	225,000	896.703

KITCHEN GARDEN VEGETABLE PRODUCTION

TOTAL AREA & PRODUCTION OF VEGETABLE IN THE PROJECT AREA

(WITH PROJECT)

Catchment	1st Yr.		2nd Yr.		3rd Yr.		4th Yr.		5th Yr.		1st 5 Yrs.		2nd 5 Yrs.		3rd 5 Yrs.		TOTAL	
	Area (Ha.)	Prod. (M.T.)	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.	Area	Prod.
1. Kulekhani (Makawanpur)	7.0	189.0	8.82	238.1	12.36	333.7	12.36	333.7	12.36	333.7	52.90	1428.2	61.8	1668.6	61.8	1668.6	176.5	4765.4
2. Daraundi (Gorkha)	13.39	360.7	16.70	451.0	23.38	631.4	23.38	631.4	23.38	631.4	100.20	2705.9	283.86	7664.3	283.86	7664.2	667.92	18034.5
3. Lower Kaligandaki (Myagdi)	8.06	217.7	10.10	272.7	14.10	380.7	14.10	380.7	14.10	380.7	60.46	1632.5	70.54	1904.4	70.54	1904.4	201.54	5441.3
4. Upper Kaligandaki (Mustang)	3.19	48.1	4.0	60.4	5.6	84.5	5.6	84.5	5.6	84.5	23.98	362.0	28.0	422.8	28.0	422.8	79.98	1207.6
TOTAL	31.60	815.5	39.62	1022.2	55.44	1430.3	55.44	1430.3	55.44	1430.3	237.54	6128.6	444.20	11660.1	444.20	11660.1	1125.94	29448.8

KITCHEN GARDEN VEGETABLE PRODUCTION

REQUIRED AMOUNT OF SEEDS & FERTILIZERS

Catchment	1st Yr.		2nd Yr.		3rd Yr.		4th Yr.		5th Yr.		1st 5 Yrs.		2nd 5 Yrs.		3rd 5 Yrs.		TOTAL	
	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.	Seeds	Fert.
1. Kulekhani	0.27	3.65	0.34	4.6	0.48	6.45	0.48	6.45	0.48	6.45	2.05	27.6	2.39	32.25	2.39	32.25	6.83	92.1
2. Gorkha	0.52	6.97	0.65	8.72	0.9	12.2	0.9	12.2	0.9	12.2	3.87	52.29	10.97	148.15	10.97	148.15	25.81	348.59
3. Myagdi	0.23	4.21	0.39	5.27	0.55	7.36	0.55	7.36	0.55	7.36	2.27	31.56	2.73	36.81	2.73	36.81	7.73	105.18
4. Mustang	0.07	0.89	0.09	1.12	0.12	1.57	0.12	1.57	0.12	1.57	0.52	6.72	0.62	7.85	0.62	7.85	1.76	22.42
TOTAL	1.09	15.72	1.47	19.71	2.05	27.58	2.05	27.58	2.05	27.58	8.71	118.17	16.71	225.06	16.71	225.06	42.13	568.29

(amounts in metric tons)

KITCHEN GARDEN VEGETABLE PRODUCTION

VEGETABLE MINIKIT

AREA - 200 sq. m./Household

VEGETABLES	AREA	SEEDS		FERTILIZER (Kg.)						TOTAL	PRODUCTION	
	sq. m.	gram	price	com.	urea	m. potash	t.s. pho.	TOTAL	price	cost	prod. (Kg.)	value of pro. (Rs)
A. WINTER: 1. Cold crops	20	1	0.07	0.25	0.108	0.136	0.148	0.642	1.61	1.68	30	27.48
2. Root veg.	60	60	1.80	0.678	0.30	0.408	0.096	1.482	3.28	5.08	120	126.0
3. Onion	60	60	3.30	0.90	0.396	0.612	0.126	2.034	4.45	7.75	108	86.4
4. Peas	40	320	2.88	0.252	0.112	0.272	0.316	0.952	2.48	5.36	20	30.0
5. Solanaceous	20	2	0.17	0.20	0.88	0.17	0.042	0.50	1.10	1.27	24	30.0
Sub-total	200	443	8.224	2.28	1.004	1.598	0.728	5.61	12.92	21.14	302	299.88
B. SUMMER: 1. Beans	100	250	3.50	0.63	0.28	0.68	0.19	2.38	6.21	9.71	100	90.0
2. Okra	60	60	0.66	0.60	0.264	0.51	0.126	1.50	3.29	3.95	90	135.0
3. Cucurbits	40	20	0.96	0.20	0.088	0.408	0.252	0.948	2.28	3.24	48	40.8
Sub-total	200	330	5.12	1.43	0.632	1.598	1.168	4.828	11.78	16.90	238	265.8
TOTAL (A & B)	400	773	13.34	3.71	1.636	3.196	1.896	10.438	24.70	38.04 +4.00 42.04	540	565.68

Attachment 8.1

REQUIREMENT OF SEEDS OF DIFFERENT VEGETABLES

KULEKHANI CATCHMENT AREA - MAKAWANPUR DISTRICT

(amount in Kg.)

VEGETABLE	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	TOTAL
A. WINTER									
1. Cole crops	0.4	0.4	0.6	0.6	0.6	2.6	3.1	3.1	8.8
2. Root veg.	21.0	26.5	37.1	37.1	37.1	158.8	185.4	185.4	529.6
3. Onion	21.0	26.5	37.1	37.1	37.1	158.8	185.4	185.4	529.6
4. Peas	112.0	141.1	197.8	197.8	197.8	846.5	988.8	988.8	2,824.1
5. Solanaceous	0.7	0.9	1.2	1.2	1.2	5.2	6.2	6.2	17.6
Sub-total	155.1	195.4	273.8	173.8	173.8	1,171.9	1,368.9	1,368.9	3,909.7
B. SUMMER									
1. Beans	87.5	110.3	154.5	154.5	154.5	661.3	772.5	772.5	2,206.3
2. Okra	21.0	26.5	37.1	37.1	37.1	158.8	185.4	185.4	529.6
3. Cucurbits	7.0	8.8	12.4	12.4	12.4	53.0	61.8	61.8	176.6
Sub-total	115.5	145.6	204.0	204.0	204.0	873.1	1,019.7	1,019.7	2,912.5
TOTAL (A & B)	270.6	341.0	477.8	477.8	477.8	2,045.0	2,388.6	2,388.6	6,822.2

REQUIREMENT OF SEEDS OF DIFFERENT VEGETABLES

DARAUNDI CATCHMENT AREA - GORKHA DISTRICT

(amount in Kg.)

VEGETABLE	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 Yrs.	2nd Yrs.	3rd 5 Yrs.	TOTAL
A. WINTER									
1. Cole crops	0.7	0.8	1.2	1.2	1.2	5.1	14.2	14.2	33.5
2. Root veg.	40.1	50.1	70.1	70.1	70.1	300.5	851.6	851.6	2,003.7
3. Onion	40.1	50.1	70.1	70.1	70.1	300.5	851.6	851.6	2,003.7
4. Peas	213.8	267.2	374.1	374.1	374.1	1,603.3	4,541.8	4,541.8	10,686.9
5. Solanaceous	1.3	1.7	2.3	2.3	2.3	9.9	28.4	28.4	66.7
Sub-total	296.0	369.9	517.8	517.8	517.8	2,219.3	6,287.6	6,287.6	14,794.5
B. SUMMER									
1. Beans	167.0	208.8	292.3	292.3	292.3	1,252.7	3,548.3	3,548.3	8,349.3
2. Okra	40.1	50.1	70.1	70.1	70.1	300.5	851.6	851.6	2,003.7
3. Cucurbits	13.4	16.7	23.4	23.4	23.4	100.3	283.9	283,9	668.1
Sub-total	220.5	275.6	385.8	385.8	385.8	1,653.5	4,683.8	4,683.8	11,021.1
TOTAL (A & B)	516.5	645.5	903.6	903.6	903.6	3,872.8	10,971.4	10.971.4	25,815.6

REQUIREMENT OF SEEDS OF DIFFERENT VEGETABLES

(amount in Kg.)

VEGETABLE	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	TOTAL
A. WINTER									
1. Cole crops	0.4	0.5	0.7	0.7	0.7	3.0	3.5	3.5	10.0
2. Root veg.	24.2	30.3	42.3	42.3	42.3	181.4	211.6	211.6	604.6
3. Onion	24.2	30.3	42.3	42.3	42.3	181.4	211.6	211.6	604.6
4. Peas	129.0	161.6	225.6	225.6	225.6	967.4	1,128.6	1,128.6	3,224.6
5. Solanaceous	0.8	1.0	1.4	1.4	1.4	6.0	7.1	7.1	20.2
Sub-total	178.6	223.7	312.3	312.3	312.3	1,339.2	1,562.4	1,562.4	4,464.0
B. SUMMER									
1. Beans	100.8	126.3	176.3	176.3	176.3	756.0	881.8	881.8	2,519.6
2. Okra	24.2	30.3	42.3	42.3	42.3	181.4	211.6	211.6	604.6
3. Cucurbits	8.1	10.1	14.1	14.1	14.1	60.5	70.5	70.5	201.5
Sub-total	133.1	166.7	232.7	232.7	232.7	997.9	1,163.9	1,163.9	3,325.7
TOTAL (A & B)	233.9	390.4	545.0	545.0	545.0	2,337.1	2,726.3	2,726.3	7,789.7

REQUIREMENT OF SEEDS OF DIFFERENT VEGETABLES

UPPER KALIGANDAKI CATCHMENT AREA - MUSTANG DISTRICT

VEGETABLES	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 Yrs.	2nd 5 Yrs.	3rd 5 Yrs.	TOTAL
A. WINTER									
1. Cole crops	0.2	0.2	0.3	0.3	0.3	1.3	1.4	1.4	4.1
2. Root veg.	9.5	12.0	16.8	16.8	16.8	71.9	84.0	84.0	239.9
3. Onion	9.5	12.0	16.8	16.8	16.8	71.9	84.0	84.0	239.9
4. Peas	50.9	64.0	89.6	89.6	89.6	383.7	448.0	448.0	1,279.7
5. Solanaceous	0.3	0.4	0.6	0.6	0.6	2.5	2.8	2.8	8.1
Sub-total	70.4	88.6	124.1	124.1	124.1	531.3	620.2	620.2	1,771.7

Attachment 9.1

SOURCES FOR SAPLINGS

KULEKHANI

(in numbers)

FRUITS	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
A. Horticulture Farm Daman								
1. Apple	500	300	300	300	300	5,025	2,475	
2. Pears	500	200	200	200	200	5,400	4,350	
3. Peach	600	300	300	300	300	6,525	4,725	
4. Plum	400	300	200	200	200	3,900	3,750	
5. Walnut	100	100	100	100	100	1,450	1,480	
6. Apricot	-	-	-	100	150	1,250	1,200	
7. Persimmon	-	-	-	100 (HFG)	150 (HFG)	1,100 (HFG)	850 (HFG)	2,200
8. Others	300	300	300	400	300	2,550	1,755	
	2,400	1,500	1,400	1,600	1,550	26,100	19,735	54,285
B. Brahamahal Nursery								
1. Orange	100	100	100	100	-	-	-	
2. Banana	100	100	100	100	-	-	-	
3. Nibuwa	-	-	-	50	-	-	-	
4. Others	100	100	100	100	150	-	-	
	300	300	300	350	150	-	-	1,400

Attachment 9.1
(con't)

FRUITS	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
C. Chai Nursery								
1. Lime	200	200	200	200	200	-	-	650
2. Lemon (Eureka)	100 (PAS)	100 (PAS)	150 (PAS)	150 (PAS)	150 (PAS)	-	-	
3. Others	100	100	100	-	-	-	-	
	300	300	300	200	200			1,300
D. Satellite Nursery Sisneri								
1. Lime	-	-	-	-	-	2,150	2,150	
2. Lemon (Eureka)	-	-	-	-	-	1,800	1,750	
3. Nibuwa	-	-	-	-	50	450	250	
4. Orange	-	-	-	-	100	1,450	1,550	
5. Banana	-	-	-	-	100	1,300	1,200	
6. Others	-	-	-	-	50	850	850	
	-	-	-	-	300	8,000	7,750	16,050
E. Kalidevi Nursery Kitini								
1. Apple	-	200	200	200	200	1,675	825	
2. Pear	-	300	300	300	300	1,800	1,450	
3. Peach	-	300	300	300	300	2,175	1,575	
4. Plum	-	100	200	200	200	1,300	1,250	
	-	900	1,000	1,000	1,000	6,950	5,100	15,950

PAS = Parwanipur Agriculture Station

HFG = Horticulture Farm Godavari

SOURCES FOR SAPLINGS

GORKHA

(In numbers)

FRUIT	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
A. Pokhara Hort. Farm							
1. Orange	500	500	2,000	2,500	10,000	3,900	
2. Lime	500	500	1,500	1,000	8,000	3,600	
3. Pomegranate	200	300	400	400	700	120	
4. Banana	500	1,000	1,500	1,000	10,000	1,500	
5. Pineapple	-	-	-	-	3,750	4,000	
6. Litchi	-	-	200	-	500	500	
7. Jackfruit	300	200	200	200	100	-	
8. Guava	500	-	-	-	-	1,300	
9. Papaya	600	500	-	-	2,400	1,820	
10. Nibuwa	200	200	700	300	8,000	4,200	
11. Others	500	500	800	1,300	2,300	1,000	
	3,300	3,700	7,300	6,700	45,750	21,040	93,190

(in numbers)

FRUIT	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
B. Hort. Farm Dhunbeshi							
1. Banana	500	1,000	1,000	500	4,500	500	
2. Pineapple	-	1,000	1,000	2,500	9,250	2,550	
3. Guava	500	1,000	1,000	1,000	5,000	1,000	
4. Papaya	400	400	600	600	600	880	
5. Others	200	200	500	900	2,200	600	
	1,600	3,600	4,100	5,500	26,950	5,530	47,280
C. Hort. St. Kirtipur							
1. Apple	100	100	150	200	500	-	
2. Pear	200	200	1,000	2,000	6,000	-	
3. Peach	200	200	1,000	2,000	6,000	-	
4. Plum	200	200	500	500	3,500		
5. Others	300	300	500	800	1,500	500	
	1,000	1,000	3,150	5,500	17,500	500	28,650
D. Ganesh Br. Nursery							
1. Orange	500	500	1,000	1,500	-	-	
2. Lime	-	500	500	500	-	-	
3. Nibuwa	300	400	300	400	-	-	
	800	1,400	1,800	2,400	-	-	6,300

FRUIT	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
E. Yagyapuri Hort. Farm							
1. Banana	1,000	1,900	2,000	2,000	11,000	4,500	
2. Mango	500	500	1,000	700	7,400	2,000	
3. Litchi	200	300	300	700	1,800	1,040	
4. Jackfruit	200	200	200	200	1,000	860	
5. Guava	500	500	500	-	1,500	1,300	
6. Pineapple	1,000	1,000	2,500	3,500	15,000	5,000	
	3,400	4,400	6,500	7,100	37,700	14,700	73,800

Attachment 9.2
(con't)

SOURCES FOR SAPLINGS GORKHA

PROJECT NURSERIES

(in numbers)

FRUIT	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
A. Central Nursery						
1. Mango	-	-	300	3,000	4,000	
2. Litchi	-	-	300	1,000	1,500	
3. Guava	-	-	500	2,000	3,000	
4. Banana	100	500	1,000	10,000	15,000	
5. Pineapple	-	500	2,000	10,000	15,000	
6. Jackfruit	300	600	600	3,000	3,000	
7. Papaya	300	900	900	3,000	4,000	
8. Others	-	200	500	4,000	5,000	
9. Pomegranate	-	100	300	1,500	1,480	
	700	2,800	6,400	37,500	51,980	99,500
B. S.N. Deorali						
1. Mango	-	-	-	1,600	4,000	
2. Litchi	-	-	-	1,500	1,500	
3. Guava	-	-	-	1,500	2,000	
4. Banana	-	-	-	4,000	1[illegible],000	
5. Pineapple	-	-	-	2,000	8,000	
6. Jackfruit	-	-	-	2,000	2,000	
7. Papaya	-	-	-	3,600	3,000	
8. Others	-	-	-	1,500	2,000	
9. Pomegranate	-	-	-	8,000	2,000	
				17,900	38,500	55,600
C. S.N. Gorkhakali						
1. Orange	-	-	-	10,000	15,000	
2. Lime	-	-	500	5,000	6,000	
3. Nibuwa	-	-	300	5,000	6,000	
4. Pomegranate	-	-	300	2,000	2,000	
5. Banana	-	-	500	5,000	5,000	
6. Others	-	-	500	2,000	2,000	
			2,100	29,000	36,000	67,100
D. S.N. Simijung						
1. Apple	-	-	-	500	1,000	
2. Pear	-	-	-	4,000	7,000	
3. Peach	-	-	-	4,000	7,000	
4. Plum	-	-	-	3,000	5,000	
5. Others	-	-	-	500	2,000	
				12,000	22,000	34,000

SOURCES FOR SAPLINGS

MYAGDI

(in numbers)

FRUIT	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yrs.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
A. Lumle Agri. Station								
1. Apple	500	200	200	300	500	-	-	
2. Pears	300	300	400	500	-	-	-	
3. Peach	300	-	-	-	-	-	-	
4. Plum	100	100	300	-	-	-	-	
5. Walnut	-	200	500	-	-	-	-	
6. Apricot	-	-	300	-	-	-	-	
7. Others	100	100	200	-	-	-	-	
	1,300	900	1,900	800	500	-	-	5,400
B. Marfa Agri. Station								
1. Apple	-	300	300	200	3,000	4,000	2,000	
2. Pear	-	-	-	500	1,500	3,000	1,000	
3. Peach	-	300	400	1,000	1,500	3,000	1,000	
4. Plum	-	-	-	500	700	2,000	500	
5. Walnut	-	300	500	1,500	1,500	3,000	1,000	
6. Apricot	-	-	200	500	700	2,000	500	

FRUIT	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
7. Others	100	100	400	900	300	500	500	
8. Almond	-	-	-	100	100	1,350	350	
	100	1,000	1,800	5,200	9,300	18,850	6,850	43,100
D. Tatopani Central Project Nurseries								
1. Orange	-	-	-	-	2,000	13,250	13,250	
2. Lime	-	-	-	500	1,000	6,500	6,500	
3. Lemon (Eureka)	-	-	-	-	500	3,000	3,000	
4. Others	-	-	-	100	500	3,000	3,000	
				600	4,000	25,750	25,750	56,100
E. Shika Satellite Nursery								
1. Apple	-	-	-	-	500	8,000	10,000	
2. Pear	-	-	-	-	500	2,000	4,000	
3. Peach	-	-	-	-	500	2,000	4,000	
4. Plum	-	-	-	-	300	[illegible],000	2,500	
5. Walnut	-	-	-	-	500	2,000	4,000	
6. Apricot	-	-	-	-	300	1,000	2,500	
7. Almond	-	-	-	-	100	1,000	2,000	
8. Others	-	-	-	-	200	1,000	1,000	
					2,900	18,000	30,000	50,900

FRUIT	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
F. Harilal Nursery (Baglung)								
1. Orange	500	500	500	1,500	1,500	-	-	
2. Lime	500	500	500	500	500	-	-	
3. Lemon (Eureka)	300	300	400	500	500	-	-	
	1,300	1,300	1,400	2,500	2,500			9,000
G. Karmacharya Nursery								
1. Orange	500	500	500	1,500	1,500	-	-	
2. Lime	-	-	500	-	500	-	-	
	500	500	1,000	1,500	2,000			5,500

SOURCES FOR SAPLINGS

MUSTANG

(in numbers)

FRUIT	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
1. Marfa Agri. Station								
1. Apple	4,500	4,000	5,000	5,000	5,700	37,375	37,375	
2. Pear	1,000	1,000	1,500	1,500	2,000	6,750	6,750	
3. Peach	1,000	1,000	1,200	1,000	1,000	6,090	6,090	
4. Plum	550	550	600	600	700	2,725	2,725	
5. Walnut	250	250	300	400	500	3,125	2,425	
6. Apricot	800	1,000	2,000	1,500	2,500	7,638	7,188	
7. Almond	500	500	600	600	700	3,537	3,338	
8. Grape	200	200	250	300	500	2,350	1,900	
9. Others	300	300	400	500	600	2,160	2,000	
	9,100	8,800	11,850	11,400	14,200	71,750	69,791	196,891
B. Gopal Nursery (Marfa)								
1. Apple	500	1,000	1,000	1,000	1,300	6,000	5,000	
2. Peach	-	-	-	250	300	500	-	
3. Plum	-	-	-	100	200	500	-	
4. Apricot	-	-	-	500	-	-	-	
	500	1,000	1,000	1,850	1,800	7,000	5,000	18,150

FRUIT	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
C. Project Nursery (Ghami)								
1. Apple	-	-	-	-	-	500	1,500	
2. Peach	-	-	-	-	-	500	1,000	
3. Walnut	-	-	-	-	-	300	1,000	
4. Plum	-	-	-	-	-	500	1,000	
5. Grape	-	-	-	-	-	300	750	
6. Apricot	-	-	-	-	-	300	750	
7. Almond	-	-	-	-	-	300	500	
8. Others	-	-	-	-	-	300	460	
						3,000	6,960	9,960

KULEKHANI CATCHMENT AREA (MAKAWANPUR DISTRICT)

Projected Population Consumption and Balance of Fruits

YEAR	Projected Population	Consumption of Fruit/Capital Annum (Kg.)	Total Consumption of Fruits (M.T.)	Production Without Project (M.T.)	Production With Project (M.T.)	Total Production (M.T.)	Balance (M.T.)
1979	36,197	17.0	615	617	-	617	+2
1980	36,951	17.3	639	642	-	642	+3
1981	37,731	17.6	664	670	2	672	+6
1982	38,527	18.1	697	705	3	708	+11
1983	39,340	18.6	732	750	5	755	+23
1984	40,170	19.3	775	795	24	819	+44
1985	41,018	20.0	820	830	76	906	+86
1986	41,883	20.8	871	848	182	1,030	+159
1987	42,834	21.6	925	868	315	1,283	+258
1988	43,807	22.5	986	806	484.4	1,290.4	+304.4
1989	44,802	23.4	1,048	751	716.4	1,467.4	+419.4
1990	45,819	24.3	1,113	656	1,004	1,660	+547
1991	46,860	25.1	1,176	616	1,373	1,989	+813
1992	47,924	25.9	1,241	580	1,789	2,369	+1,128
1993	49,012	26.5	1,299	547	2,259	2,806	+1,507
1994	50,125	27.0	1,353	517	2,789	3,306	+1,953

Population projection for 1979 - 1986 and 1987 - 1994 has been done by taking Average Annual Growth Rate r = 2.110 and 2.271 respectively. The value of r has been calculated from the projected population for Hills and Mountains of Central Region of Nepal (1971 - 1979) and (1971 - 1986).

Source: Population Projection for Nepal (1971 - 1986), CBS, Nepal

M.T. = metric ton

DARAUNDI CATCHMENT AREA (GORKHA DISTRICT)

Projected Population Consumption and Balance of Fruits

YEAR	Projected Population	Consumption of Fruit/Capital Annum (Kg.)	Total Consumption of Fruits (M.T.)	Production Without Project (M.T.)	Production With Project (M.T.)	Total Production (M.T.)	Balance (M.T.)
1979	123,998	16.5	2,046	2,089	-	2,089	+43
1980	126,364	16.8	2,123	2,155	-	2,155	+32
1981	128,775	17.1	2,202	2,227	-	2,227	+25
1982	131,232	17.6	2,310	2,318	33	2,351	+41
1983	133,736	18.1	2,421	2,436	92	2,528	+107
1984	136,288	18.8	2,562	2,554	176	2,730	+168
1985	138,888	19.6	2,722	2,646	302	2,948	+226
1986	141,538	20.5	2,902	2,692	535	3,227	+325
1987	144,668	21.4	3,096	2,745	932	3,677	+581
1988	147,663	22.4	3,308	2,536	1,584	4,220	+812
1989	150,72[illegible]	23.5	3,542	2,348	2,672	5,020	+1,478
1990	153,84[illegible]	24.5	3,769	2,178	4,220	6,398	+2,629
1991	157,02[illegible]	25.4	3,988	2,027	6,177	8,204	+4,216
1992	160,2[illegible]5	26.3	4,215	1,890	8,590	10,480	+6,265
1993	163,593	27.2	4,450	1,767	11,379	13,146	+8,696
1994	166,979	28.0	4,675	1,656	14,385	16,041	+11,366

Population projection for 1979 - 1986 and 1987 - 1994 has been done by taking Average Annual Growth Rate r = 1.908 and 2.07 respectively. The value of r has been calculated from the projected population for Hills and Mountains of Central Region of Nepal (1971 - 1979) and (1971 - 1986).

Source: Population Projection for Nepal (1971 - 1986), CBS, Nepal

M.T. = metric ton

KALIGANDAKI CATCHMENT AREA (MYAGDI DISTRICT)

Projected Population Consumption and Balance of Fruits

YEAR	Projected Population	Consumption of Fruit/Capital Annum (Kg.)	Total Consumption of Fruits (M.T.)	Production Without Project (M.T.)	Production With Project (M.T.)	Total Production (M.T.)	Balance (M.T.)
1979	39,342	15.0	590	649	-	649	+59
1980	40,093	15.4	617	675	-	675	+58
1981	40,858	16.0	654	704	-	704	+50
1982	41,638	16.6	691	740	-	740	+49
1983	42,432	17.3	734	787	2	789	+55
1984	43,242	18.1	783	834	16	850	+67
1985	44,067	18.9	833	871	63	934	+101
1986	44,908	19.8	889	889	179	1,068	+179
1987	45,838	21.7	995	910	374	1,284	+289
1988	46,787	22.7	1,062	845	740	1,585	+523
1989	47,755	23.7	1,132	787	1,314	2,101	+969
1990	48,744	24.9	1,214	734	2,057	2,791	+1,577
1991	49,753	26.1	1,299	687	2,899	3,586	+2,287
1992	50,783	27.1	1,376	644	3,913	4,557	+3,181
1993	51,834	28.1	1,457	606	5,027	5,633	+4,176
1994	52,907	29.0	1,534	572	6,106	6,678	+5,144

Population projection for 1979 - 1986 and 1987 - 1994 has been done by taking Average Annual Growth Rate r = 1.908 and 2.07 respectively. The value of r has been calculated from the projected population for Hills and Mountains of Central Region of Nepal (1971 - 1979) and (1971 - 1986).

Source: Population Projection for Nepal (1971 - 1986), CBS, Nepal

M.T. = metric ton

KALIGANDAKI CATCHMENT AREA (MUSTANG DISTRICT)

Projected Population Consumption and Balance of Fruits

YEAR	Projected Population	Consumption of Fruit/Capital Annum (Kg.)	Total Consumption of Fruits (M.T.)	Production Without Project (M.T.)	Production With Project (M.T.)	Total Production (M.T.)	Balance (M.T.)
1979	14,957	15.0	224	241	-	241	+17
1980	15,242	15.5	236	329	-	329	+93
1981	15,533	16.1	250	425	-	425	+175
1982	15,830	16.8	266	528	-	548	+282
1983	16,132	17.6	284	706	-	706	+422
1984	16,440	18.4	303	864	28.5	892.5	+589.5
1985	16,754	19.3	323	987	103	1,090	+767
1986	17,074	20.3	347	1,048	315	1,363	+1,016
1987	17,427	21.5	375	1,119	606	1,725	+1,350
1988	17,788	22.7	404	1,095	1,066	2,161	+1,757
1989	18,156	24.0	436	1,073	1,675	2,748	+2,312
1990	18,532	25.5	473	1,054	2,356	3,410	+2,937
1991	18,916	27.0	511	1,036	3,108	4,144	+3,633
1992	19,308	28.0	541	1,020	3,919	4,939	+4,398
1993	19,708	29.0	572	1,006	4,775	5,781	+5,209
1994	20.116	30.0	604	993	5,658	6,658	+6,047

Population projection for 1979 - 1986 and 1987 - 1994 has been done by taking Average Annual Growth Rate r = 1.908 and 2.07 respectively. The value of r has been calculated from the projected population for Hills and Mountains of Central Region of Nepal (1971 - 1979) and (1971 - 1986).

Source: Population Projection for Nepal (1971 - 1986), CBS, Nepal

M.T. = metric ton

TOTAL COST ESTIMATION FOR DIFFERENT ACTIVITIES

(Rs. in '000)

PROPOSED ACTIVITIES	Year One		Year Two		Year Three		Year Four		Year Five		1st 5 yr.		2nd 5 yr.		3rd 5 yr.		TOTAL	
	NRS	FE	NRS	FE	NRS	FE	NRS	FE	NRS	FE	NRS	FE	NRS	FE	NRS	FE	NRS	FE
1. Sapling Distribution (Fruits)	34.0	-	54.7	-	71.6	-	100.6	-	124.1	-	385.0	-	499.5	-	314.9	-	1,199.4	-
2. Kitchen Garden Veg. Production	63.7	43.8	79.9	53.8	118.8	76.3	111.8	76.3	111.8	76.3	479.0	326.5	910.0	607.5	910.0	607.5	2,299.0	1541.5
3. Fruit Nurseries Establishment	851.1	85.0	851.7	85.0	745.8	75.0	1019.3	100.0	532.0	50.0	3999.9	395.0	2947.6	142.5	3215.5	156.1	10,163.0	693.6
4. Semi-Commercial Fruit & Vegetable Processing Plants	-	-	-	-	-	-	-	-	-	-	-	-	2933.9	948.8	2726.3	368.8	5,660.2	1317.6
5. Mini-Fruit & Vegetable Processing Plants	-	-	-	-	-	-	-	-	-	-	-	-	506.0	96.3	685.1	66.3	1,191.1	162.6
6. Greenhouses	-	-	-	-	150.0	112.5	-	-	-	-	150.0	112.5	150.0	112.5	150.0	112.5	450.0	337.5
7. Mist-house/Shade House Construction	-	-	125.0	62.5	-	-	125.0	62.5	-	-	250.0	125.0	-	-	-	-	250.0	125.0
8. Natural Cold Room Construction	-	-	-	-	100.0	-	100.0	-	100.0	-	300.0	-	300.0	-	-	-	600.0	-
9. In-service Training for Nursery Staffs	3.7	-	3.7	-	5.6	-	5.6	-	7.4	-	26.0	-	33.2	-	33.2	-	92.4	-
10. Vehicle (Pick-up)	200.0	200.0	200.0	200.0	-	-	-	-	-	-	400.0	400.0	-	-	-	-	400.0	400.0
Total Cost	1152.5	328.8	1315.0	401.3	1184.8	263.8	1462.3	238.8	875.3	126.3	5989.9	1359.0	8280.2	1907.6	8035.0	1311.2	22305.1	4577.8
TOTAL COST: CAPITAL	879.8		888.1		627.7		747.9		110.0		3253.5		3158.4		203.3		6615.2	
TOTAL COST: OPERATING	272.7		426.9		557.1		714.4		765.3		2736.4		5121.8		7831.7		15689.9	

Attachment 11.1

KULEKHANI CATCHMENT AREA

TOTAL COST ESTIMATION FOR DIFFERENT ACTIVITIES

(Rs. in '000)

PROPOSED ACTIVITIES	Capital Cost / Operating Cost	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 yr.	2nd 5 yr.	3rd 5 yr.	TOTAL
1. Sapling Distribution (Fruits)	Capital Cost									
	Operating Cost	6.03	6.03	6.1	6.8	6.6	31.5	79.3	52.6	154.4
2. Kitchen Garden Vegetable Production	Capital Cost									
	Operating Cost	14.7	18.5	26.0	26.0	26.0	111.2	129.9	129.9	371.0
3. Fruit Nurseries Establishment	Capital Cost	-	-	172.4	-	-	172.4	4.0	5.5	181.9
	Operating Cost	-	-	33.3	34.4	35.7	103.4	206.7	222.6	532.7
4. Mist House/ Shade House Construction	Capital Cost	-	-	-	125.0	-	125.0	-	-	125.0
	Operating Cost									
5. Natural Cold Room Construction	Capital Cost	-	-	50.0	-	-	50.0	50.0	-	100.0
	Operating Cost									
6. In Service Training for Nursery Staffs	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	-	-	1.1	0.5	0.7	2.3	2.6	2.6	7.5
7. Vehicle (Pick-up)	Capital Cost	200.0	-	-	-	-	200.0	-	-	200.0
	Operating Cost	-	-	-	-	-	-	-	-	-
8. Total	Capital Cost	200.0	-	222.4	125.0	-	547.4	54.0	5.5	606.9
Total	Operating Cost	20.7	24.5	66.5	67.7	69.0	248.4	409.5	407.7	1,065.6
TOTAL COST		220.7	24.5	288.9	192.7	69.0	795.8	463.5	413.2	1,672.5

DARAUNDI CATCHMENT AREA - GORKHA DISTRICT

TOTAL COST ESTIMATION FOR DIFFERENT ACTIVITIES

(Rs. in '000)

PROPOSED ACTIVITIES		1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st. 5 yrs.	2nd 5 yrs.	3rd 5 yrs	TOTAL
1. Sapling (Fruits) Distribution	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	-	17.4	21.9	40.3	47.3	126.9	201.4	68.8	397.1
2. Kitchen Garden Vegetable Production	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	28.1	35.1	49.1	49.1	49.1	210.5	596.7	596.7	1,403.9
3. Fruit Nurseries Establishment	Capital Cost	310.7	238.7	202.8	240.3	5.0	997.5	22.0	25.0	1,044.5
	Operating Cost	79.1	130.3	171.5	233.7	245.8	860.4	1,384.9	1,513.5	3,758.8
4. Greenhouse	Capital Cost	-	-	-	-	-	-	150.0	-	150.0
	Operating Cost	-	-	-	-	-	-	-	-	-
5. Natural Cold Room	Capital Cost	-	-	-	50.0	-	50.0	100.0	-	150.0
	Operating Cost	-	-	-	-	-	-	-	-	-
6. Vehicle (Pick-up)	Capital Cost	-	200.0	-	-	-	200.0	-	-	200.0
	Operating Cost	-	-	-	-	-	-	-	-	-
7. Semi-commercial Processing Plants/Cold Storage	Capital Cost	-	-	-	-	-	-	991.9	-	991.9
	Operating Cost	-	-	-	-	-	-	243.4	1,150.4	1,393.8
8. In-service Training for Nursery Staffs	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	1.8	1.8	2.8	2.8	3.8	13.0	15.3	15.3	43.6
9. Total Capital Cost		310.7	438.7	202.8	290.3	5.0	1,247.5	1,263.9	25.0	2,536.4
Total Operating Cost		109.0	184.6	245.3	325.9	346.0	1,210.8	2,441.7	3,344.7	6,997.2
TOTAL COST		419.7	623.3	448.1	616.2	351.0	2,458.3	3,705.6	3,369.7	9.533.6

Attachment 11.3

LOWER KALIGANDAKI CATCHMENT AREA - MYADGI

TOTAL COST ESTIMATION FOR DIFFERENT ACTIVITIES

(Rs. in '000)

PROPOSED ACTIVITIES	Capital Cost / Operating Cost	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
1. Sapling Distribution (Fruits)	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	6.3	8.1	13.1	22.2	32.4	82.1	41.6	15.4	139.1
2. Kitchen Garden Vegetable Production	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	16.9	21.2	29.6	29.6	29.6	126.9	148.3	148.3	423.5
3. Fruit Nursery Establishment	Capital Cost	369.1	324.4	2.5	2.0	5.0	703.0	13.5	14.8	731.3
	Operating Cost	92.2	158.3	163.3	174.0	186.4	774.2	999.3	1,075.6	2,849.1
4. Greenhouse	Capital Cost	-	-	-	-	-	-	-	150.0	150.0
	Operating Cost	-	-	-	-	-	-	-	-	-
5. Natural Cold Room	Capital Cost	-	-	-	50.0	50.0	100.0	100.0	-	200.0
	Operating Cost	-	-	-	-	-	-	-	-	-
6. Semi-processing Plants	Capital Cost	-	-	-	-	-	-	326.14	-	326.14
	Operating Cost	-	-	-	-	-	-	179.9	685.1	865.0
7. In-service Training	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	1.9	1.9	1.7	1.4	2.2	9.1	10.2	10.2	29.5
8.	Total Capital Cost	369.1	324.4	2.5	52.0	55.0	803.0	439.6	164.8	1,407.4
	Total Operating Cost	117.3	189.5	207.7	227.2	250.6	992.3	1,379.3	1,934.6	4,306.2
TOTAL COST		486.4	523.9	210.2	279.2	305.6	1,795.3	1,818.9	2,099.9	5,713.6

UPPER KALIGANDAKI CATCHMENT AREA - MUSTANG

TOTAL COST ESTIMATION FOR DIFFERENT ACTIVITIES

(Rs. in '000)

PROPOSED ACTIVITIES		1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
1. Sapling Distribution (Fruits)	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	21.7	23.2	30.5	31.3	37.8	144.5	186.2	178.1	508.8
2. Kitchen Garden Vegetable Production	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	6.7	8.5	11.8	11.8	11.8	50.6	58.8	58.8	168.2
3. Fruit Nurseries Establishment	Capital Cost	-	-	-	280.6	-	280.6	8.0	8.0	296.6
	Operating Cost	-	-	-	54.3	54.1	108.4	309.2	350.5	768.1
4. Greenhouse	Capital Cost	-	-	150.0	-	-	150.0	-	-	150.0
	Operating Cost	-	-	-	-	-	-	-	-	-
5. Natural Cold Room	Capital Cost	-	-	50.0	-	50.0	100.0	50.0	-	150.0
	Operating Cost	-	-	-	-	-	-	-	-	-
6. Mist House/ Shade House	Capital Cost	-	125.0	-	-	-	125.0	-	-	125.0
	Operating Cost	-	-	-	-	-	-	-	-	-
7. Semi-commercial Processing Plants/ Cold Storage	Capital Cost	-	-	-	-	-	-	1,342.9	-	1,342.9
	Operating Cost	-	-	-	-	-	-	355.7	1,575.9	1,931.6
8. In-service Training	Capital Cost	-	-	-	-	-	-	-	-	-
	Operating Cost	-	-	-	0.9	0.7	1.6	5.1	5.1	11.8
Total Capital Cost		-	125.0	200.0	280.6	50.0	655.6	1,400.9	8.0	2,064.5
Total Operating Cost		28.4	31.7	42.3	98.3	104.4	305.1	915.0	2,168.4	3,388.5
TOTAL COST		28.4	156.7	242.3	378.9	154.4	960.7	2,315.9	2,176.4	5,453.0

Attachment 12

CAPITAL & OPERATING COSTS OF ALL PROJECT AREAS

(SUMMARY - TABLE)

(Rs. in '000)

ITEMS	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
A. CAPITAL COSTS									
1. Land	160.0	140.0	80.0	92.0	-	472.0	32.0	-	504.0
2. Buildings 1/	313.3	366.3	446.5	490.0	100.0	1,716.1	2,097.0	150.0	3,964.0
3. Fruit Plants (Nursery)	3.2	3.0	1.5	2.0	-	9.7	-	-	9.7
4. Furniture	9.3	4.3	4.5	5.0	4.5	27.6	85.5	23.5	136.6
5. Equipment 2/	24.9	23.9	24.2	29.1	5.5	107.6	795.5	29.8	932.9
6. Irrigation	70.3	62.8	28.0	41.8	-	202.9	-	-	202.9
7. Fencing	99.0	88.0	43.0	88.0	-	318.0	147.5	-	465.5
8. Vehicle	200.0	200.0	-	-	-	400.0	-	-	400.0
	800	888.3	627.7	747.9	110.0	3,253.9	3,158.4	203.3	6,615.6
B. OPERATING COSTS									
1. Working Materials	1.2	4.3	10.1	21.2	25.3	62.1	197.2	1,340.4	1,599.7
2. Manures & Fertilizers	2.7	4.6	5.3	7.1	8.0	27.7	50.9	62.0	140.6
3. Chemicals	0.8	1.6	1.6	3.0	3.1	10.1	19.2	28.0	57.3
4. Trials & Experiments	-	2.0	3.4	4.5	4.5	14.4	27.0	29.3	70.7
5. Services	1.0	1.9	2.7	3.0	4.0	13.6	23.2	67.5	104.3
6. Books & Magazines	1.3	2.4	3.0	3.8	3.8	14.3	21.5	35.2	71.0
7. Fuel	1.0	1.9	2.7	4.0	4.3	13.9	35.3	279.5	328.7
8. Stationery	1.1	2.4	3.4	6.2	6.5	19.6	39.0	78.0	136.6
9. Maintenance	-	1.1	3.1	4.1	5.9	14.2	39.0	156.1	209.3

ITEMS	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	TOTAL
10. Staff Salary 4/	141.8	232.4	295.2	379.0	390.2	1,438.6	2,778.7	3,659.0	7,876.3
11. Seasonal Labor	14.6	23.1	24.8	42.2	47.7	152.4	317.9	635.6	1,105.9
12. Plant Introduction	-	1.8	1.8	2.3	3.4	9.3	6.5	7.0	22.8
13. Miscellaneous	5.6	8.9	11.0	15.0	15.3	55.8	123.7	196.0	375.5
14. In-service Training	3.7	3.7	5.6	5.6	7.4	26.0	33.2	33.2	92.4
15. Plant Distribution	34.0	54.7	71.6	100.6	124.1	385.0	499.5	314.9	1,199.4
16. Kitchen Garden Vegetable Production 5/	63.7	79.9	111.8	111.8	111.8	411.0	910.0	910.0	2,299.0
Sub-total	272.5	426.7	557.1	714.4	765.3	2,736.0	5,121.8	7,831.7	15,689.5
Grand Total	1,152.5	1,315.0	1,184.0	1,462.3	875.3	5,989.9	8,280.2	8,035.0	22,305.1

Notes: 1/ This includes costs of building of fruit nurseries, processing plants, natural cold rooms, greenhouse and mist house

2/ This includes small farm tools, sprayers, calculators, typewriters, etc.

3/ This includes polythene sheets, bags, seeds, raw materials, packing materials and cloth

4/ This includes project allowances, (30%) TA/DA, field, regional & other allowances

5/ This includes vegetable seeds, fertilizers & packing materials

COST OF PRODUCTION OF FRUITS OF DIFFERENT CATCHMENT AREAS

FRUIT		1 yr.	2 yr.	3 - 4 yr.	5 - 6 yr.	7 - 8 yr.	9 - 10 yr.	11 - 12 yr.	13 - 14 yr.	15 yr.
1. Apple & Pear	KCA	1,445	783	1,010	1,315	1,419	1,874	2,051	2,104	2,104
	DCA	1,445	783	1,010	1,315	1,419	1,874	2,051	2,104	2,104
	LKCA	1,890	1,053	1,312	1,660	1,813	2,212	2,396	2,486	2,486
	UKCA	2,425	1,377	1,675	2,074	2,200	2,617	2,810	2,945	2,945
2. Apricot	KCA	1,021	494	940	1,172	1,473	1,773	1,773	1,773	1,773
Peach	DCA	1,021	494	940	1,172	1,473	1,773	1,773	1,773	1,773
Plum	LKCA	1,348	923	1,195	1,497	1,830	2,148	2,148	2,148	2,148
Almond	UKCA	1,740	1,103	1,501	1,889	2,001	2,598	2,598	2,598	2,548
3. Walnut	KCA	594	310	430	527	674	835	874	878	882
	DCA	594	310	430	527	674	835	874	878	882
	LKCA	826	425	571	679	863	1,052	1,094	1,101	1,109
	UKCA	1,105	564	649	860	1,089	1,313	1,359	1,370	1,380
4. Persimmon	KCA	1,260	758	962	1,257	1,398	1,774	1,911	1,921	1,921
5. Pomegranate	KCA	1,522	706	937	1,110	1,459	1,611	1,622	1,622	1,622
6. Orange	KCA	1,548	844	1,076	1,416	1,957	2,319	2,351	2,372	2,372
	DCA	1,548	844	1,076	1,416	1,957	2,319	2,351	2,372	2,372
	LKCA	2,043	1,154	1,400	1,960	2,294	2,684	2,738	2,774	2,774
7. Grape	UKCA	19,327	1,567	2,401	2,776	3,599	4,055	4,136	4,190	4,190
8. Lemon & Nibuwa	KCA	1,714	815	1,074	1,245	1,769	2,140	2,151	2,151	2,151
	DCA	1,714	815	1,074	1,245	1,769	2,140	2,151	2,151	2,151
9. Lime	KCA	1,515	832	1,074	1,245	1,769	2,140	2,151	2,151	2,151
	DCA	1,515	832	1,074	1,245	1,769	2,140	2,151	2,151	2,151
	LKCA	2,152	1,167	1,432	1,531	2,116	2,520	2,538	2,538	2,538

Attachment 13
(con't)

FRUIT		1 yr.	2 yr.	3 - 4 yr.	5 - 6 yr.	7 - 8 yr.	9 - 10 yr.	11 - 12 yr.	13 - 14 yr.	15 yr.
10. Mango	KCA	883	421	533	802	1,041	1,217	1,348	1,359	1,359
	DCA	883	421	533	802	1,041	1,217	1,348	1,359	1,359
11. Guava	KCA	902	615	744	974	1,220	1,271	1,271	1,271	1,271
	DCA	902	615	744	974	1,220	1,271	1,271	1,271	1,271
12. Litchi	DCA	1,136	451	640	795	1,059	1,341	1,531	1,513	1,513
13. Jackfruit	DCA	633	356	508	721	934	1,104	1,108	1,117	1,117
14. Others	KCA	1,165	513	923	1,180	1,395	1,699	1,699	1,699	1,699
	DCA	1,165	513	923	1,180	1,395	1,699	1,699	1,699	1,699
	LKCA	1,525	688	1,183	1,497	1,708	2,050	2,050	2,050	2,050
	UKCA	1,957	899	1,494	1,876	2,085	2,474	2,472	2,472	2,472
15. Pineapple	KCA	7,549	2,454	2,454						
	DCA	7,549	2,454	2,454						
16. Banana	KCA	2,703	2,252	2,105	2,105					
	DCA	2,703	2,252	2,105	2,105					
17. Papaya	KCA	2,468	2,280	2,229	2,236	2,226				
	DCA	2,468	2,280	2,229	2,236	2,226				

Note: KCA = Kulekhani Catchment Area - Kulekhani
DCA = Daraundi Catchment Area - Gorkha
LKCA = Lower Kaligandaki Catchment Area - Myagdi
UKCA = Upper Kaligandaki Catchment Area - Mustang

AREA PRODUCTION AND NET VALUE OF PRODUCTION OF FRUITS

TOTAL OF ALL CATCHMENT AREAS

Area in hectares
Production in metric tons

ITEM	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A. Field Crops Area	3,384	3,323	3,223	3,092	2,903	2,636	2,358	2,080	1,803	1,526	1,249	1,001	762	503	252	0
Production	2,749	3,074	2,702	2,586	2,429	2,215	1,982	996	1,516	1,281	1,052	842	625	424	227	0
B. Fruits Area	0	61.5	162	293.6	482.2	749.2	1,026.8	1,305.4	1,452	1,859.5	2,137	2,635.5	2,634.9	2,884.3	3,132.6	3,384
Production	-	-	2	36	99	245	544	1,211	2,193	3,525	5,504	8,072	11,200	7,514	8,997	8,313
C. Inter-crops Area	-	56	133	211	330	467	570	635	663	668	668	639	620	607	598	598
Production	-	53	112	189	284	388	473	528	553	563	563	537	522	511	50[illegible]	504
Gross Value of Production (Rs. 000)	10,098	10,071	9,849	9,828	9,685	9,606	9,800	11,152	13,305	17,076	22,817	30,197	39,027	49,577	60,126	73,517
Cost of Prod. (Rs. 000)	7,707	7,812.6	7,799	7,801.6	7,866	8,005.9	8,005.9	8,170	8,141	8,373	8,525	8,538	8,482	8,483	8,507	8,384
Net Value of Production	2,391	2,258.4	2,050	2,026.4	1,819	1,600.4	1,794.1	2,982	5,164	8,703	14,292	21,659	30,545	41,094	51,619	65,133
Incremental Net Value of Production	-	-132.6	-341	-364.6	-572	-790.6	-596.9	591	2,773	6,312	11,901	19,268	28,154	38,703	49,228	62,742

Attachment 14.1

AREA PRODUCTION AND NET VALUE OF PRODUCTION OF FRUITS

KULEKHANI CATCHMENT AREA - MAKAWANPUR DISTRICT

Area in hectares
Production in metric tons

ITEM	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A. Field Crops																
Area	365	353	341	328	314	300	266	232	198	165	132	106	80	54	28	0
Production	310	301	290	278	267	255	226	179	168	140	112	90	68	46	23	0
B. Fruits																
Area	-	12.5	25.0	37.6	51.2	65.2	98.8	132.4	166	199.5	233.0	259.5	285.9	312.3	338.6	365.0
Production	-	-	2	3	5	24	76	182	315	484	716	1,004	1,373	1,789	2,259	533
C. Inter-crops																
Area	-	11	20	26	31	32	51	65	74	81	81	74	69	66	63	63
Production	-	9	17	22	26	27	44	55	63	69	69	63	59	56	53	53
Gross Value of Production (Rs. 000)	601	601	599	588	575	578	617	726	872	1,079	1,390	1,778	2,305	2,902	3,610	4,446
Cost of Prod. (Rs. 000)	514	530.6	524	530.6	534	544.6	561.9	604	619	690	705	719	728	738	748	754
Net Value of Production	87	70.4	75	57.4	41	33.4	55.1	122	253	389	685	1,059	1,577	2,164	2,862	3,692
Incremental Net Value of Production	-	-16.6	-12.0	-29.6	-46	-53.6	-31.9	35	166	302	598	972	1,490	2,0[illegible]	2,775	3,605

AREA PRODUCTION AND NET VALUE OF PRODUCTION OF FRUITS

DARAUNDI CATCHMENT AREA - GORKHA DISTRICT

Area in hectares
Production in metric tons

ITEM	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A. Field Crops																
Area	1,427	1,427	1,393	1,353	1,276	1,175	1,047	919	792	664	536	430	323	216	109	0
Production	1,143	1,143	1,114	1,082	1,022	941	838	736	633	531	429	344	259	173	89	0
B. Fruits																
Area	-	-	34	75	151	252	381	509	637	765	893	999	1,106	1,213	1,320	1,427
Production	-	-	-	33	92	176	302	535	932	1,584	2,672	4,220	6,177	8,590	11,379	14,385
C. Inter-crops																
Area	-	-	30	60	114	175	236	279	300	308	308	287	273	263	257	257
Production	-	-	24	49	91	141	189	224	240	248	248	230	219	211	207	207
Gross Value of Production (Rs. 000)	2,715	2,715	2,704	2,736	2,781	2,825	2,871	3,205	3,348	3,997	5,244	7,118	9,550	12,620	16,198	20,074
Cost of Prod. (Rs. 000)	2,227	2,227	2,261	2,257	2,308	2,346	2,416	2,451	2,630	2,607	2,820	2,814	2,827	2,823	2,290	2,861
Net Value of Production	488	488	443	479	473	479	455	574	718	1,390	2,424	4,304	6,723	9,797	13,278	17,213
Incremental Net Value of Production	-	0	-45	-9	-15	-9	-33	86	230	902	1,936	3,816	6,235	9,309	12,790	16,725

AREA PRODUCTION AND NET VALUE OF PRODUCTION OF FRUITS

MYAGDI AREA

Area in hectares
Production in metric tons

ITEM	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A. Field Crops Area	695	684	668	641	595	507	456	406	355	305	254	203	133	102	50	0
Production	309	404	395	379	350	299	269	240	210	180	151	120	91	61	30	0
B. Fruits Area	-	11	27	54	101	189	239	290	340	391	441	492	542	593	643	695
Production	-	-	-	-	2	16	63	179	374	740	1,314	2,057	2,899	3,913	5,117	6,106
C. Inter-crops Area	-	10	22	41	72	129	138	139	133	122	122	122	122	122	122	122
Production	-	6	13	25	42	76	81	82	78	72	72	72	72	72	72	72
Gross Value of Production (Rs. 000)	1,244	1,248	1,242	1,230	1,194	1,162	1,153	1,265	1,526	2,130	3,275	5,001	7,102	9,797	11,743	15,819
Cost of Prod. (Rs. 000)	1,127	1,143	1,153	1,162	1,189	1,286	1,295	1,351	1,360	1,456	1,496	1,548	1,585	1,626	1,651	1,681
Net Value of Production	117	105	99	68	5	-124	-142	-86	166	647	1,779	3,453	5,517	8,171	10,092	14,138
Incremental Net Value of Production	-	-12	-18	-49	-112	-241	-259	-203	49	530	1,662	3,336	5,400	8,054	9,975	14,021

Attachment 14.4

AREA PRODUCTION AND NET VALUE OF PRODUCTION OF FRUITS

MUSTANG AREA

Area in hectares
Production in metric tons

ITEM	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A. Field Crops Area	897	859	821	770	718	654	589	523	458	392	327	262	196	131	65	0
Production	987	946	903	847	790	720	649	577	505	430	360	288	207	144	71	0
B. Fruits Area	-	38	76	127	179	243	308	374	439	504	570	635	701	766	831	897
Production	-	-	-	-	-	29	103	315	606	1,066	1,675	2,356	3,108	3,919	4,775	5,658
C. Inter-crops Area	-	34	61	84	113	131	145	152	156	157	157	156	156	156	156	156
Production	-	38	58	93	125	144	159	167	172	174	174	172	172	172	172	172
Gross Value of Production (Rs. 000)	5,538	5,507	5,304	5,274	5,135	5,041	5,159	6,136	7,559	9,870	12,908	16,300	20,070	24,258	28,575	33,178
Cost of Prod. (Rs. 000)	3,839	3,912	3,871	3,852	3,835	3,829	3,733	3,764	3,532	3,620	3,504	3,457	3,342	3,296	3,188	3,088
Net Value of Production	1,699	1,595	1,433	1,422	1,300	1,212	1,426	2,372	4,027	6,250	9,404	12,843	16,728	20,962	25,387	30,090
Incremental Net Value of Production	-	-104	-266	-277	-399	-487	-273	673	2,328	4,551	7,705	11,144	15,029	19,263	23,688	28,391

KITCHEN GARDEN VEGETABLE PRODUCTION

GROSS VALUE OF PRODUCTION

(Rs. in '000)

CATCHMENT	1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	1st 5 yr.	2nd 5 yr.	3rd 5 yr.	TOTAL
Myadgi	228.104	285.698	398.834	398.834	398.834	1,710.304	1,994.928	1,994.928	5,700.16
Gorkha	377.865	472.447	661.427	661.427	661.427	2,834.593	8,028.808	8,028.808	18,892.209
Kulekhani	197.988	249.426	349.581	349.581	349.581	1,496.157	1,747.968	1,747.968	4,992.093
Mustang	47.762	59.976	83.909	83.909	83.909	359.465	419.832	419.832	1,199.129
TOTAL	851.719	1,067.547	1,493.751	1,493.751	1,493.751	6,400.519	12,191.536	12,191.536	30,783.591

PRODUCTION OF FRUIT & VEGETABLE PROCESSING PLANTS

PRODUCT	ANNUAL TARGET (Rs. '000)	REQUIREMENT OF RAW MATERIALS		TOTAL VALUE OF PRODUCTION (Rs. '000)
		FRUITS (M.T.)	VEGETABLES (M.T.)	
A. MINI-PROCESSING PLANT				
1. Squash	5.7 bottles	2.4	-	57.0
2. Jam/Jelly	15.0 bottles	8.9	-	75.0
3. Tomato kitchens	2.0 bottles	-	7.0	10.0
4. Canned vegetables	3.0 cans	-	3.9	18.0
TOTAL		11.3	10.9	160.0
B. SEMICOMMERCIAL PROCESSING PLANT				
1. Squash	50.0 bottles	16.0	-	500.0
2. Jam/Jelly	150.0 bottles	46.0	-	750.0
3. Fruit juice	40.0 can/bo	7.0	-	240.0
4. Canned fruit	15.0 cans	17.0	-	90.0
5. Tomato kitchen	15.0 bottles	-	53.0	75.0
6. Canned vegetables	10.0 cans	-	13.0	60.0
7. Dry fruits	0.5 (Kg.)	6.0	-	15.0
TOTAL		92.0	66.0	1,730.0

Attachment 17

REQUIREMENT OF MANPOWER FOR DIFFERENT ACTIVITIES

STAFFS	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	1st 5 yrs.	2nd 5 yrs.	3rd 5 yrs.	TOTAL 15 yrs.
1. Food Technician (G III)	-	-	-	-	-	-	2	-	2
2. Asst. Food Tech. (NG I)	-	-	-	-	-	-	3	-	3
3. Lab Asst. (NG II)	-	-	-	-	-	-	3	-	3
4. Boiler Operators (NG II)	-	-	-	-	-	-	5	-	5
5. Asst. Accountants (NG II)	-	-	-	-	-	-	2	-	2
6. Junior Technician (JT(NG I)	2	-	-	-	-	2	-	-	
7. Junior Tech. Asst. (NG II)	2	2	2	2	-	8	-	-	8
8. Field Asst. (NG III)	2	2	2	2	-	8	-	-	8
9. Storekeeper (NG III)	2	2	2	2	-	8	1	-	9
10. Gardeners (Peon level)	16	10	6	8	-	40	5	-	45
	24	16	12	14	-	66	21	-	87

Staffs for extension have been included in the extension program of agronomy component paper.

EXISTING & PROPOSED YIELD RATE/HA. BY FRUITS

Yield M.T./HA.

FRUITS	KULEKHANI		GORKHA		MYADGI		MUSTANG		AVERAGE	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
1. Apple	9.48	14.18	9.18	12.50	3.5	14.00	11.12	17.00	8.32	14.00
2. Pear	15.29	18.08	22.24	25.00	22.2	25.00	6.95	17.00	16.67	21.00
3. Peach	6.32	14.00	15.32	20.00	7.01	20.00	23.60	24.00	13.31	19.50
4. Plum	12.46	14.00	15.51	16.50	8.30	18.00	2.36	12.00	9.66	15.00
5. Walnut	3.43	4.00	4.68	-	2.3	4.00	2.00	4.00	3.10	4.00
6. Lime	15.63	18.00	19.37	20.00	6.5	20.00	-	-	13.83	19.00
7. Orange	12.00	15.00	16.00	69.50	50.0	69.50	-	-	40.67	51.00
8. Hill Lemon	16.00	21.00	20.00	22.00	-	-	-	-	18.00	21.50
9. Banana	12.50	13.00	12.50	16.00	-	-	-	-	12.50	14.50
10. Apricot	11.02	14.00	-	-	5.10	14.00	11.80	14.00	9.30	14.00
11. Persimmon	-	10.00	-	-	-	-	-	-	-	10.00
12. Lemon	12.00	18.00	-	-	-	16.00	-	-	12.00	17.00
13. Pineapple	-	-	5.00	15.00	-	-	-	-	5.00	15.00
14. Papaya	-	-	21.00	30.00	-	-	-	-	21.00	30.00
15. Mango	-	-	25.00	30.00	-	-	-	-	25.00	30.00
16. Litchi	-	-	8.74	10.00	-	-	-	-	8.74	10.00
17. Guava	-	-	3.67	10.00	-	-	-	-	3.67	10.00
18. Pomegranate	-	-	7.50	8.00	-	-	-	-	7.50	8.00
19. Jackfruit	-	-	50.00	60.00	-	-	-	-	50.00	60.00
20. Almond	-	-	-	-	-	2.00	1.18	3.50	1.18	3.00
21. Grape	-	-	-	-	-	-	0.80	2.00	0.80	2.00
22. Others	7.00	9.00	40.50	45.00	5.60	13.00	10.08	13.50	15.80	20.00

Note: 1/ Since actual experimental data are not available at present, the yield rate of the existing varieties of fruits has been calculated by RCUP design survey team based upon the information obtained from horticulture farms and fruit growers in the particular catchment areas.

2/ This has been estimated based upon the data obtained from the best orchards where the farmers improved methods of cultivation.

Attachment 19

YIELD INCREMENT PER YEAR FROM THE FIRST YEAR OF BEARING TO THE FULL BEARING STAGE OF DIFFERENT FRUITS

(in percentage)

FRUIT	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	6 yr.	7 yr.	8 yr.
Apple, Lime, Guava (8) (5) (4)	14	21	50	79	86	93	100	
Pear, Peach, Apricot, (8) (5) (4) Pomegranate, Persimmon (6) (5)	14	39	82	89	96	100		
Plum, Walnut, Orange, Mango, (5) (9) (6) (5) Litchi, Jackfruit (5) (6)	10	21	35	53	71	85	92	100
Almond, Lemon, Grape (5) (4) (5)	13	28	66	88	100			
Banana, Pineapple, Papaya (1) (1) (1)	100	84	69	53				

Note: Since actual experimental data are not available at present, the above rate has been estimated on the basis of information obtained by RCUP design survey team from horticulture farms, fruit growers & personal experiences of field workers. Figures in the parantheses indicate the years to come into first bearing stage.

Attachment 20

PRICES OF FRUIT SAPLINGS & VEGETABLE SEEDS

COST OF SAPLINGS

1. Apple.....Rs. 2.0
2. Pear.....Rs. 2.0
3. Peach.....Rs. 1.5
4. Plum.....Rs. 1.5
5. Walnut.....Rs. 1.5
6. Lime.....Rs. 1.5
7. Orange.....Rs. 2.0
8. Lemon.....Rs. 1.5
9. Banana.....Rs. 0.7
10. Apricot.....Rs. 2.0
11. Persimmon.....Rs. 3.0
12. Nibuwa.....Rs. 1.5
13. Mango.....Rs. 4.0
14. Litchi.....Rs. 3.5
15. Guava.....Rs. 2.0
16. Pineapple.....Rs. 0.5
17. Papaya.....Rs. 0.4
18. Jackfruit.....Rs. 1.5
19. Pomegranate.....Rs. 1.55
20. Grape.....Rs. 1.5
21. Others.....Rs. 1.75

COST OF VEGETABLE SEEDS

1. Cole crops.....Rs. 75/kg
2. Roof.....Rs. 30/kg
3. Onion.....Rs. 55/kg
4. Peas.....Rs. 9/kg
5. Solanaceous.....Rs. 85/kg
6. Beans.....Rs. 14/kg
7. Okra.....Rs. 11/kg
8. Cucurbits.....Rs. 48/kg

Source: Fruits and Vegetable Development Divisions

Attachment 21

UNIT PRICES OF FRESH FRUITS & VEGETABLES

FRUITS	Kulekhani & Gorkha	Myadgi (Rs. '000/MT)	Mustang	VEGETABLE	Unit Price (Rs./MT)
1. Apple	5.0	5.5	6.0	1. Cole Crops	916
2. Pear	0.75	0.8	1.0	2. Solanaceous	1,250
3. Peach	1.0	1.2	1.5	3. Root Crops	1,050
4. Plum	1.0	1.3	1.5	4. Onion	800
5. Walnut	5.5	6.0	6.4	5. Beans	900
6. Apricot	4.0	4.3	4.5	6. Peas	1,500
7. Almond	30.0	30.0	32.0	7. Cucurbits	850
8. Persimmon	3.0	3.3	3.5	8. Okra	1,500
9. Orange	1.25	1.5	-		
10. Lime	1.6	1.6	-		
11. Lemon	1.0	1.2	-		
12. Nibuwa	0.8	1.0	-		
13. Guava	0.5	-	-		
14. Pomegranate	3.0	3.5	-		
15. Papaya	1.5	-	-		
16. Banana	1.5	-	-		
17. Pineapple	1.25	-	-		
18. Mango	2.0	-	-		
19. Litchi	1.5	-	-		
20. Jackfruit	1.2	-	-		
21. Grape	6.0	-	7.0		
22. Others	1.5	1.8	2.0		

FIELD CROPS	Kulekhani	Gorkha	Myagdi	Mustang (Rs./ton)
1. Maize	2,500	2,500	3,000	-
2. Barley	1,500	2,000	2,500	-
3. Wheat	-	-	-	6,000
4. Millet	1,400	1,500	-	-
5. Oilseeds	-	4,000	4,300	-
6. Cracked Barley	-	-	-	5,800
7. Buck wheat	-	-	-	4,800

Based on 1979 Market Price

REQUIREMENT OF FERTILIZERS FOR FRUIT PLANTS IN THE PROJECT AREA

In metric tons

CATCHMENT	FERTILIZER	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	6 yr.	7 yr.	8 yr.	9 yr.	10 yr.	11 yr.	12 yr.	13 yr.	14 yr.	15 yr.	TOTAL
Kulekhani	Complexal	1.0	0.3	5.0	7.0	11.0	16.0	29.0	36.0	52.0	60.0	65.0	76.0	83.0	90.0	97.0	629.3
	Urea	0.3	1.0	2.0	3.0	4.0	6.0	11.0	14.0	20.0	24.0	26.0	30.0	32.0	35.0	38.0	246.3
	Potash	0.3	1.0	2.0	3.0	4.0	6.0	11.0	14.0	17.0	20.0	21.0	25.0	27.0	29.0	32.0	212.3
	TOTAL	1.6	2.3	9.0	13.0	19.0	28.0	51.0	64.0	89.0	104.0	112.0	131.0	142.0	154.0	167.0	1,086.9
Gorkha	Complexal	-	3.0	6.0	20.0	34.0	67.0	81.0	139.0	167.0	231.0	259.0	277.0	322.0	350.0	378.0	2,334
	Urea	-	-	2.0	8.0	17.0	26.0	33.0	53.0	63.0	90.0	101.0	115.0	126.0	137.0	148.0	919
	Potash	-	1.0	2.0	7.0	12.0	25.0	31.0	53.0	64.0	78.0	87.0	90.0	106.0	115.0	124.0	795
	TOTAL	-	4.0	10.0	35.0	63.0	118.0	145.0	245.0	294.0	399.0	447.0	482.0	554.0	602.0	650.0	4,048
Myagdi	Complexal	1.0	2.0	7.0	14.0	33.0	38.0	63.0	74.0	101.0	114.0	123.0	144.0	157.0	171.0	184.0	1,226.0
	Urea	0.3	1.0	3.0	5.0	13.0	15.0	24.0	28.0	40.0	45.0	49.0	56.0	62.0	67.0	72.0	480.0
	Potash	0.3	1.0	3.0	5.0	12.0	14.0	24.0	28.0	34.0	38.0	40.0	46.0	52.0	56.0	60.0	413.3
	TOTAL	1.6	4.0	13.0	24.0	58.0	67.0	111.0	130.0	175.0	197.0	212.0	246.0	271.0	294.0	316.0	2,119.6
Mustang	Complexal	3.0	6.0	17.0	24.0	43.0	49.0	81.0	96.0	131.0	148.0	159.0	186.0	203.0	220.0	238.0	1,604
	Urea	1.0	2.0	6.0	9.0	17.0	20.0	31.0	36.0	51.0	58.0	64.0	73.0	80.0	86.0	93.0	627
	Potash	1.0	2.0	6.0	9.0	16.0	18.0	31.0	36.0	44.0	50.0	51.0	61.0	67.0	72.0	79.0	543
	TOTAL	5.0	10.0	29.0	42.0	76.0	87.0	143.0	168.0	226.0	256.0	274.0	320.0	350.0	378.0	410.0	2,774
TOTALS	Complexal	5.0	11.3	35.0	65.0	121.0	170.0	254.0	345.0	451.0	553.0	606.0	683.0	765.0	831.0	897.0	5,792.3
	Urea	1.6	4.0	13.0	25.0	51.0	67.0	99.0	131.0	174.0	217.0	240.0	274.0	300.0	325.0	351.0	2,272.6
	Potash	1.6	5.0	13.0	24.0	44.0	63.0	97.0	131.0	159.0	186.0	199.0	222.0	252.0	272.0	295.0	1,963.6
		8.2	20.3	61.0	115.0	216.0	300.0	450.0	607.0	784.0	956.0	1,045.0	1,179.0	1,317.0	1,428.0	1,543.0	10,028.5

APPENDIX Jc

HORTICULTURAL COMPONENT OF RCUP

Prepared by: Govind C. Sharma/SECID

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ABSTRACT

This component outlines site specific horticultural projects for RCUP based on the observations of the author during visits to Kulekhani, Gorkha, Mustang and Myagdi regions. It also outlines the principal responsibilities of horticultural and pest management subject matter specialists at the national level. The key components of the RCUP horticultural program are: introduction, culture and multiplication of introduced fruits and vegetables; establishment of catchment-level horticulture staff, distribution of fruit and vegetables for kitchen gardens along with extension assistance; and commercial development of fruit and vegetable industry in the catchment areas generally close to transportation links. Commercial vegetable and flower seed production, for Mustang, and fruit and vegetable processing aspects have also been discussed.

The author wishes to gratefully acknowledge valuable advice obtained from Dr. Dhruv Pande, Vegetable Division, Khumaltar, Dr. Anand B. Shrestha, Fruit Division, Kirtipur, Dr. Shiva Lohani, Agronomist, RCUP/APROSC, Mr. Loknath Devkota, Horticulturist, RCUP, and the horticulture baseline team of RCUP.

Horticultural Program of RCUP

Govind C. Sharma
RCUP Design Team

A. Preamble

The inclusion of a horticultural component in the RCUP is a prudent decision. Horticultural crops promote improved nutrition, intensify per unit land production and provide extra income for farmers. If practiced on a large scale basis for the market, it can be ar industry that employs local people, and increases the export potential from a Panchayat, Catchment or from a nation as whole. In addition, fruit crops on marginal lands also aid in the soil conservation process.

The purpose of this component is to outline programs based on the author's visits to three catchment areas - Kulekhani, Gorkha, Mustang and Myagdi. This section includes recommendations for both research/demonstration type of activities and project support, as well as the levels of community horticulture that could be initiated in these project areas.

This report was prepared before the final tabulation of the baseline surveys. Detailed information is being compiled by the horticulturists in these surveys and the recommendations in this report may need some modifications when those reports are completed.

B. Background

Topographically and climatically Nepal is an ideal horticultural country but in actual practice horticulture plays a very insignificant role in the agricultural economy. His Majesty's Government's Department of Agriculture has 23 horticultural research stations and farms specializing in temperate, sub-tropical and tropical horticultural crops.[1/2/]

1/ For detailed description of HMG's horticultural organizations and installations, see: Agricultural Projects Services Centre. 1978. Nepal Agricultural Extension Project Report. Phase II. Vol. I-IX, Lazimpat, Kathmandu.

2/ Studies on fruit activities of Horticulture and Agriculture Stations in Nepal (Nepal. Yr. 2008-2034). 1979. Shrestha A.B., N.S. Upadhyaya and C.C. Veerland, Fruit Dev. Div., Kirtipur, Kathmandu. 988 p.

Since the elevation in Nepal varies from below 200' to over 29,000' and the climate correspondingly shows a gradient from moist tropical to alpine, there is a tendency to think that any fruit crop can be grown in the country. A wide selection of fruit and vegetable species can be grown, but not necessarily economically. And though wild cherries and pears blossom and crop freely in many Himalayan valleys, it does not mean that any variety of temperate fruits transplanted from other world locations will thrive well here. The complicating factor is the unique succession of seasons. Most deciduous fruit tree varieties have been developed in more northerly climates where the bulk of rainfall occurs in the winter, and where winter is a longer and more pronounced season than it is in Nepal.[1/]

At present horticulture in Nepal suffers from the following constraints:

- Limited transport facilities;
- Absence of an organized market and grading infrastructure;
- Lack of storage and processing facilities;
- Limited pest control advisement and prohibitive cost of pesticides
- Natural hazards (hail, high winds, prolonged warm monsoon); and,
- A weak research and development base partially because of limited trained person power.

C. Kulekhani

a. Site Specific Observations

This team member made a brief 1 day helicopter and walking tour of the area and can offer the following observations related to horticulture:

1. Of all RCUP regions, Kulekhani is the most accessible catchment area. It is also in the proximity of the Kathmandu Valley, and Tribhuvan Rajpath, Nepal's main link with India passes through this region.
2. Both Daman Horticultural Farm and the vegetable section of the Khumaltar Experimental Station have already done outstanding extension and demonstration work in the catchment area.

1/ Thrower, L.B. 1967. Report of visit to Nepal. FAO, Rome, PL:T/51. 12 p.

An excellent vegetable and production and distribution effort is spearheaded by Dr. Pande of Khumaltar.

3. An old established sheep research farm and a RCUP forest tree nursery provide some of the basic facilities needed for a stepped up horticultural extension and research work in the area.
4. An addition to increasing limited irrigation and electrical resources, completion of a dam in Kulekhani will also provide an access gravel road from the Tribhuvan Rajpath into the catchment area.
5. The valley shows potential for low to moderate chilling varieties of apple, pear, peach, plum, almond and walnut preferably above 1,000 m. At lower elevations banana and guava are well adapted to this region. The citrus crops (sweet orange, lime and lemon) grow well in the intermediate elevations. Baseline surveys can be referred to for number and types of trees, their yield and income produced from such fruit crops in the region.
6. The Kulekhani area is also suited for vegetable culture. There is potential to grow offseason vegetables for, Terai and Indian markets. During August and September radishes (e.g. var. Japanese White Neck and Mino Early) can be exported to Hetauda, Kathmandu and to neighbouring cities in India. Peas are grown from September to January and are being exported to Terai. Cauliflower is a relatively new crop in the area and it is being encouraged for the October and November market. Potatoes for seed are being produced in Palung valley (5800') for June harvest. Corn-cauliflower and potato-radish rotation are being followed.

b. <u>Site specific Program Recommendations</u>

1. <u>Establishment of a Catchment Level Horticultural Sub-Centre</u>

A horticulturist and facilities should be provided in Kulekhani area to:

- Interface with Daman Horticultural Station, Khumaltar Vegetable Division and the Fruit Development Division Kirtipur;
- To conduct small scale adaptability trials of newly introduced fruit vegetable varieties, trial of new scion-stock combinations with emphasis of dwarfing and low chilling types;

- To facilitate multiplication and propagation of fruits (in the nursery) and vegetable seeds. Greater quality of vegetable seeds can be multiplied by innovative farmers as they already do at present;
- To provide assistance to farmers in marketing and in developing export strategies;
- To provide assistance in pest control, pruning and hail protection;
- To provide subject matter support to area JTAs and adult conservation education program.

2. Dissemination of fruit saplings and vegetable seeds among catchment farmers with the assistance of JTAs at Panchayat level. See Table 1 for types and approximate numbers to be distributed.
3. Identification and technical support to be provided for commercial vegetable and fruit production.

D. Gorkha

a. Site Specific Observations

1. A road is currently being built that will connect the town of Gorkha with the existing Pokhara - Kathmandu highway. This will facilitate marketing and export of horticultural products from the region. Pokhara as well as Kathmandu are also connected with the Terai and with neighbouring Indian cities. Therefore, similar to Kulekhani transport links will be available from the Gorkha area.
2. The lower elevations and the southern parts of the Daraundi catchment area are suitable for tropical and sub-tropical fruits. Following are currently being grown in Gorkha: lemons, limes, oranges, pineapples, bananas, litchies, jackfruits, guavas, and mangoes. Apples, pears and peaches seem to do well at higher elevations (2,500 m). However, adaptability work with low chilling temperate fruit varieties could certainly aid further expansion of temperate fruits.
3. Early summer vegetable production can be effectively carried out in Gorkha and these vegetables will have less competition in the market. Among them are cucumber, squash, palwal (Trichosanthus

dioca) and tomato. Another vegetable that holds potential is onions (e.g. Nasik Red, Red Creole, Gladalon Brown). Consideration for onion production in Gorkha merits greater attention since large urban centers of Nepal experience a shortage of onions. The summer vegetables, brinjal (egg plant) and red pepper (green and red, dry) also hold considerable promise. If early tomato production on irrigated lands in Gorkha does take hold, tomato processing for export from the catchment should be further explored.

4. No major horticultural farm or research station is located in the Gorkha catchment area, therefore RCUP's activities and personnel would fill this void.

5. Additional tropical and sub-tropical horticultural commodities should also be introduced in the region. Consideration should be given to culture of figs, berries (raspberry, boysenberries etc,) oranges, tangalos, malta, sweet potatoes and a fiber and alcohol producing crop, sisal. Sisal is effectively being utilized in Mexico. Its alcohol (tequila) could be used either for human consumption or, if proven economical, as a fuel. The energy report of this project paper further outlines use of sisal or other gasohol (petroleum supplement alcohol) development potential. Sisal-like plants are native to the Gorkha region.

6. Gorkha's most productive farming areas could be the tars, which are relatively low gradient alluvial deposits along the Daraundi River. At present the main production constraint in the tars is limited irrigation. A series of small impoundments (see watershed management report) and/or other methods of irrigation can convert them into highly productive farms for both agronomic and olericultural crops. In the long run if these tars do become more productive the migration trend towards higher elevations can be slowed and reversed. This will conserve the Gorkha region's soil and forest resources, make living easier for its residents and provide more employment to people.

7. In addition to tars, the wide Daraundi river bed has several sand flats with a high water table that could be effectively utilized for vegetable production before and after monsoon.

More stabilized sand flats are currently being used for production of sugarcane. It is suggested that cucurbitaceous crops (water melon, musk melon, squash, and, later, other vegetables) can be grown on these sand flats. Minimum requirement for the utilization of these sand flats would be:

Fencing, using either a live fence, or fence made out of branches as done presently on these sand flats;

Removal of rocks (such rocks can be used in fencing); and,

Inputs of improved needs, fertilizers, and pesticides.

8. The RCUP concept as detailed in this project paper could in its entirety be applied to small valley improvements. A case in point is the Choprak valley (below the town of Choprak). It is a rich valley already producing good crops and has sizeable areas of low and high elevation rangeland and forests. Comprehensive land use planning and improvements as shown in Fig. 1 can be applied during the RCUP project duration. Similar small valleys (e.g., in Deurali and Barpak) can be treated with similar concentrated resource improvement efforts including the use of horticultural crops.

b. Site Specific Program Recommendations

1. Establishment of Catchment Level Horticulture Centre:

A horticulturist, his staff and facilities should be set up at the Gorkha catchment conservation office to:

- Interface with the central horticultural staff in Kathmandu, Pokhara Horticultural Research Centre, and Lumle Training Centre, to improve horticultural enterprises in Gorkha area;
- To introduce and conduct adaptability trials for newly introduced fruit and vegetable varieties as outlined in the site specific observations for Gorkha;
- To facilitate propagation of fruits and vegetable seeds;
- To conduct marketing studies and accordingly develop vegetable and fruit enterprises for proper markets;
- To facilitate intensive vegetable production in tars and sand flats;
- To provide subject matter support to area JTAs, and adult conservation education programs.

2. Distribution of fruit saplings and vegetable seeds along with cultural knowhow with the assistance of JTAs at Panchayat level. See Table 1 for types and approximate number to be distributed.

E. Mustang

a. Site Specific Observations

1. Jomsom and northward is one of the unique high elevation desert environments. Its physical and environmental features have been discussed in detail in the Watershed Management report of this Project Paper.

2. The author and other members of the RCUP design team have learned of a fairly comprehensive horticultural development scheme that is being proposed by certain donor agencies, probably FAO and the World Bank. It was learned that a team of local and expatriate horticulturists have visited Mustang and the surrounding districts and have reported their findings. The report, however, is not yet available for review by other agencies. The recommendations for site specific projects for Mustang included herein should be considered only if they augment that program or if the proposed large scale programs for some unforeseen reason does not materialize.

3. The Mustang region at present is connected to large urban centers only by air or by a five day trek from Pokhara, by trail which can be traversed by people or animals. It seems that for the foreseeable future (10 years or so) lack of vehicular transport will be the greatest constraint on the development of large scale horticultural enterprises. A consideration may be given to a ropeway link between Jomsom and Baglung for materials shipment using hydropower. The region does have a fairly high local demand of horticultural products. This is primarily because of the contribution horticultural products make to this grain deficit region and also because of an increasing tourist traffic in the scenic Mustang.

4. During the trek up to Muktinath from Jomsom, we encountered many positive indications of community participation in agriculture and resource conservation efforts. It seems that the members of the communities jointly decide and then abide by the community's decisions. One custom of returning to the community by a specified date after winter migration is a case in point. Each able-bodied adult must return to her/his village by a specified date or pay a fine of certain amount of rice for each day's absence. Also the community jointly maintains its irrigation channels and impoundment. In the Jharkot village, all the farmers treat the tree planted by a member family as that family's property and its products (fodder, poles and wood) belong to the family. People in this region also have perfected a method of tree propagation which is quite unique. They only root large (8-12') branches of poplars so that the livestock would not be able to graze and destroy the propagular. Rooting of very large branches is done by submerging the cut end in a running stream for 4 to 6 days. When calli and roots appear, the trees are planted in a well watered pit. In this area (along the Muktinath stream) poplars are the dominant tree species and therefore, it is recommended that introduction of one or two other forest tree species would help to diversify fuelwood, timber and fodder sources. However, practices such as those cited above demonstrate considerable sophistication among the people. Such attitudes would be most useful in fruit-crop culture.
5. One of the key inputs in the region's horticultural industry has been the Mustang Agricultural Farm located at Marpha. The scientists and the extension workers have done an impressive amount of work in establishing this good horticultural enterprise in the Marpha/Tukche area. They have a strong desire to extend this program northward into Muktinath and in the upper Mustang area as well as south of Tukche but the main constraints seem to be monetary and personnel resources. The RCUP must cooperate in this effort and expand the programs.
6. Because of the leadership provided by the Farm, apples, peaches, apricots, plums, grapes, kagzi (paper shelled) almonds and walnuts

are being grown in the Marpha area. A similar range of temperate fruits was also observed by the baseline survey team and the design team in the villages close to Muktinath.

7. Several winter-season vegetables are being grown in the Mustang region. Future enterprises could include expansion of crucifers (cabbage, cauliflower mustard) and other crops, such as carrots, peas and potatoes. Seed production of the above vegetables and flowers should be explored on an experimental basis and to be expanded with proper arrangements with potential customers in Nepal and abroad. It would be beneficial if after exploratory adaptability work is done by RCUP horticulturists, several private seed companies from India, Western Europe and U.S. be contracted for their technical input and for any marketing opportunities they could offer for seeds produced in Mustang. The upper Mustang region, which consists of a relatively flat area with a suitable dry sunny environment, may be more suitable for large scale seed production than the other areas travelled by this design team. Development of irrigation would be a logical precedent of any large scale vegetable activity in Mustang. For example better management and use of existing surface water in the Muktinath stream would expand agriculture or vegetable (and seed) production on dry unirrigated plateaus in the lower Muktinath regions. A greenbelt concept can also be applied all along the Muktinath river and fruits, vegetables, and grasses can be planted. Considerable potential is also seen for subsurface water which is probably abundant in Muktinath and surrounding areas (refer to Watershed Management report in this Project Paper).

8. Similar to item 7, considerble potential exists for the systematic expansion of temperate fruit and vegetable culture in Marpha/Tukche and Lete area. Here also the available land close to the Kali Gandaki River is essentially utilized. However, large terrace plateaus approximately 100 to 500 m above the river bed are available, provided irrigation water is supplied to these areas. It is hoped that the irrigation design team of RCUP will consider such needs and plan supportive irrigation programs as mentioned in this section.

9. In appropriate infrastructure and production program planning, consideration should be given to horticultural product processing and marketing. In recognition of transport problem high return or reduced weight products shoulu be developed for export. Examples of such products are: dehydrated (freezedried) peas, other dehydrated vegetables, soups and fruits, raisins, wines, brandies, high grade vegetables, shelled nuts, canned juices or their concentrates, jams, jellies, and preserves. In this regard a good start has been made by the Marpha Horticultural Farm and by a very small processing facility in Tukche funded by FAO. Greater utilization of the Tukche food processing facility is dependent on an input of trained food processing specialists. A specific suggestion is offered here for encouraging women to undertake training in food science and processing.

10. In Mustang as well as in most other catchments visited by the design team considerable shortage of pesticides was observed. Where available, the choice of such materials was limited. Also the cost of such products was prohibitive as is true in other developing parts of world. For any viable, economical production of good quality fruits and vegetables, provision for such inputs is essential. Also proper liaison with the credit granting line agencies for expansion of horticultural industry is necessary. Another constraint for secure expansion of a horticultural program is the availability of pest management expertise. Perennial horticultural crops need considerable pest management input so that the investment in culturing them will not be wiped out by a sudden pest outbreak. Therefore, in the RCUP the services of a plant pathologist/entomologist have been considered as essential as that of a trained horticulturist.

b. <u>Site Specific Program Recommendations</u>

1. Establishment of horticultural nursery in conjunction with the forest nursery at Jharkot. Placement of a trained horticulturist supported by a pest control specialist at national level for the entire Mustang area. Responsibilities of such a team will be

similar to those outlined for the Gorkha and Kulekhani area.

2. Distribution of adapted temperate fruit saplings for kitchen garden plantings in the upper Mustang region through the RCUP extension program (Table 1). Also extension assistance in proper pruning, pest control, hail damage reduction and use of dwarfing rootstocks should be encouraged.
3. Establishment of commercial temperate fruit plantings in upper Mustang (North of Jomsom) as well as on the terrace plateaus in the Marpha, Tukche and Lete area. Such developments will need to be carefully planned with inputs from experts in marketing and horticulture in the area.
4. Distribution of vegetable seed and or seedlings for local consumption by extension personnel.
5. Exploration and subsequent vegetable and flower seed production program involving local growers under the supervision of horticulturists and seed production specialists in upper Mustang area.
6. Approximately five years after institution of the horticultural program, expansion of the food processing facilities should be planned. The site specific observations and the budget further provide information in this regard.

F. Myagdi

a. Site Specific Observations

1. Although Myagdi is part of the Kali Gandaki catchment area, agroclimatically it is quite different from Mustang. Also the travel time between the major towns of Myagdi and Mustang is three days. Myagdi seems to be horticulturally a less developed area than Mustang and would require a concentrated input of resources and technical support for its development. Therefore, a separate horticulturist is recommended for this district.
2. The region of Myagdi trekked by the design team (Pakhapani to Beni) appeared to be mostly suitable for sub-tropical to tropical fruit types. The Panchas also reported that some varieties of apples introduced from Kathmandu did not fruit probably because the

chilling requirement of those varieties was not met in the region. Peach trees (varieties unknown) invariably showed some fruits but leaf curl diseases and decline were prevelent. It seems that additional work with temperate fruits will be needed before they are recommended to the farmers. Since high winds and hail are a problem in this region, some work on this should also be done. Various local citrus types (large lemon, bhogate, etc.) are good indicators for possible expansion of other improved and marketable citrus species. Similarly large and prolific walnuts trees were observed generally close to a surface or subsurface water sources and in moist coves. Introduction of kagzi (papershelled, english) walnuts, pecans and possibly almonds (California types) should be considered. Grapes, preferably raisin types, should be grown to see if they can be produced in the monsoon environment of Myagdi. Farmers in the area also expressed a desire for obtaining guava saplings and considerable varietal introduction effort should be undertaken to satsify this expressed need. Guava varieties that mature at different times would extend the fruiting season and ease marketing and barter arrangements. At present farmers from upper Myagdi barter for guavas grown in Beni area with walnuts that they produce. Bananas which are currently grown in lower Myagdi should be supplemental with new improved varieties and other sub-tropical and tropical fruits such as pineapples could also be supplied. Mr. Bhim Prasad Gauchan, Member Rastriya Panchayat, from that region, indicated interest in introducing Pangra, an alkaloid producing tree fruit which seems to be in considerable demand for making shampoos in India. Therefore, such trees should also be introduced from western Nepal. Ipomea cornuta another alkaloid soap producing shrub can also be tried first in small experimental plantings.

3. Among vegetables the design team observed kitchen garden level culture of radishes, leafy vegetables, mustard and asparagus. Dr. Dhruv Pande of the Division of Vegetable Crops at Kumaltar is of the opinion that the same range of vegetables as described above for Gorkha area can be tested and distributed in Myagdi.

Interesting inter-cropping of corn/beans and potato/beans was also observed along the trek in Myagdi.

4. Dr. Anand B. Shrestha, Chief Pomologist at Kirtipur described HMG's plans for an Institute of Horticulture in Baglung, one day's trek from Beni. When this core of expertise would be available and because of the fact that Baglung will be connected by motorable road with Pokhara, the potential for commercial horticultural development in lower Myagdi seems promising. Beni itself is an old trade centre and now is a rapidly expanding town with its own needs for horticultural products. As the horticultural industry develops, attention should be focused on fruit and (possibly) vegetable processing facility for the area.

b. Site Specific Program Recommendations

1. Establishment of sub-catchment level conservation centre at Myagdi with a strong horticultural component. The functions of horticultural program in Myagdi are similar to those described for Gorkha and Kulekhani.
2. Distribution of adapted sub-tropical and tropical fruit saplings and vegetables for kitchen garden plantings in Myagdi area (Table 1). Support for this and other subsequent activities be conducted through the extension network as it develops in the district.
3. Development of commercial fruit and vegetable enterprises in Beni/Baglung area.
4. Development of fruit processing facility in the same area following item 3.

G. Consideration at the National Level

The horticulture program of RCUP should be fully coordinated with the similar programs of the HMG's Department of Agriculture. For this purpose a RCUP horticultural task committee is proposed. Membership of such a task committee is left open at present. However, RCUP could greatly benefit from the presence of Dr. Pande at Khumaltar, Dr. Shrestha at Kirtipur and horticulturists from the Daman and Marpha Stations and from Baglung Horticultural Institute. The RCUP horticulturist should convene this committee, and the RCUP pest management specialist should be a member of such group. Operating within the overall committee setup of RCUP such a

specialized task force is the best insurance for a coordinated horticultural program in the RCUP areas.

A major responsibility of the national horticultural staff will be to carryout plant and seed introduction, its proper culture and propagation of desired stock. This would require knowledge of horticultural varieties available and of mechanisms of obtaining them. In such a plant introduction program equal consideration should be given to rootstocks. Table 1 outlines the magnitude of introduction and propagation effort that should be supplied by either already introduced or newly introduced cultivars. The participating role of the Department of Agriculture and use of its facilities in this regard can not be over emphasized.

Realization of training and staff development at Panchayat and catchment level is a continuous process and it should be given prime consideration in program development. Periodic training programs at existing horticultural institutions of HMG, short training sessions at catchment level, tours of horticultural programs in Nepal and neighbouring countries should be a part of staff development.

An essential aspect of such staff development is involvement of women in the horticulture program. An obvi s choice would be to give preferential consideration to women in food processing training and employment. Similarly, positions for women can be developed in plant introduction and propagation aspects.

Support for extension publications and adult conservation education modules in the area of horticulture should be the responsibility of the national staff. The extension report of this Project Paper describes such responsibilities in detail.

The national horticultural staff should also strengthen school garden programs in all project area schools by providing similar assistance as provided to area farmers. Such participation of schools should not be limited to just horticulture. Other RCUP programs components should carry out a vigorous program in elementary (primary) middle and high schools. The adult conservation education modules and other extension publications should be liberally provided to schools f r their use. If vocational agricultural teachers express desire in undergoing horticultural training activities designed for Panchayat or catchment level staff, an

invitation should be extended to them and their expenses be paid for such training. The RCUP Project being a long term one, such investment in exposing young minds to conservation education would pay itself off quite nicely.

Of course, the ultimate achievement in this regard would be that school textbooks could include a chapter or two on conservation education along with horticultural aspects. It is, therefore, recommended that the Director of RCUP take necessary steps in coordinating such inclusion in the textbooks with the Department of Education. If necessary, RCUP staff could develop such chapters for their possible inclusion.

Monitoring and evaluation of the progress should be conducted at national, catchment and Panchayat levels. Suggestions in this regard are included in the Extension and Sociology components of this Project Paper.

TABLE 1

An estimation of the number (in thousands) fruit trees to be supplied to catchment areas for home plantings[1/ 2/ 3/]

Fruits	CATCHMENT AREAS											
	Kulekhani			Gorkha			Mustang			Myagdi		
Yrs:	5	10	15	5	10	15	5	10	15	5	10	15
Temperate												
Apple	1.0	2.0	3.0	1.0	2.0	3.0	10.0	20.0	30.0	1.0	2.0	3.0
Peach	0.5	1.0	1.5	0.5	1.0	1.5	3.0	5.0	7.0	0.5	1.0	2.0
Apricot	0.75	1.5	2.25	1.0	2.0	3.0	10.0	20.0	30.0	1.0	3.0	5.0
Plums	0.5	1.0	1.5	0.5	1.0	1.5	8.0	15.0	20.0	1.0	2.0	3.0
Almonds	0.5	1.0	1.5	0.5	1.0	1.5	5.0	10.0	15.0	1.0	2.0	3.0
Nectarines	-	-	-	-	-	-	2.0	4.0	6.0	-	-	-
Pears	2.0	4.0	6.0	2.0	4.0	6.0	10.0	20.0	30.0	2.0	4.0	6.0
Sub-Tropical												
Orange	3.0	6.0	9.0	4.0	8.0	12.0	-	-	-	4.0	8.0	12.0
Lime	3.0	6.0	9.0	4.0	8.0	12.0	-	-	-	3.0	6.0	9.0
Lemon	3.0	6.0	9.0	4.0	8.0	12.0	-	-	-	3.0	6.0	9.0
Other citrus	1.0	2.0	3.0	2.0	4.0	6.0	-	-	-	2.0	4.0	6.0
Grapes	3.0	5.0	7.0	5.0	10.0	15.0	20.0	30.0	50.0	3.0	6.0	9.0
Tropical												
Mango	3.0	6.0	9.0	5.0	10.0	15.0	-	-	-	5.0	10.0	15.0
Guava	4.0	8.0	12.0	5.0	10.0	15.0	-	-	-	10.0	20.0	30.0
Figs	0.5	1.5	2.0	3.0	6.0	9.0	-	-	-	2.0	4.0	6.0
Nuts and Berries												
Walnut	0.5	1.0	1.5	1.0	3.0	5.0	3.0	5.0	7.0	5.0	10.0	15.0
Pecans	1.0	2.0	3.0	1.0	2.0	3.0	1.0	2.0	3.0	2.0	4.0	6.0
Berries	1.0	2.0	3.0	1.0	2.0	3.0	3.0	6.0	9.0	1.0	2.0	3.0
Litchi	0.25	0.5	0.75	1.0	2.0	3.0	-	-	-	1.0	2.0	3.0
Jackfruit	0.1	0.2	0.3	0.25	0.5	0.75	-	-	-	0.5	1.0	1.5
Improved Rootstocks												
o For temperate fruit	6.0	11.0	13.0	6.0	12.0	17.0	50.0	95.0	140.0	7.0	15.0	25.0
o Other (citrus, mangoes etc.)	18.0	25.0	37.0	25.0	50.0	65.0	-	-	-	20.0	40.0	60.0

1/ For distribution by Panchayats refer to extension program budget.

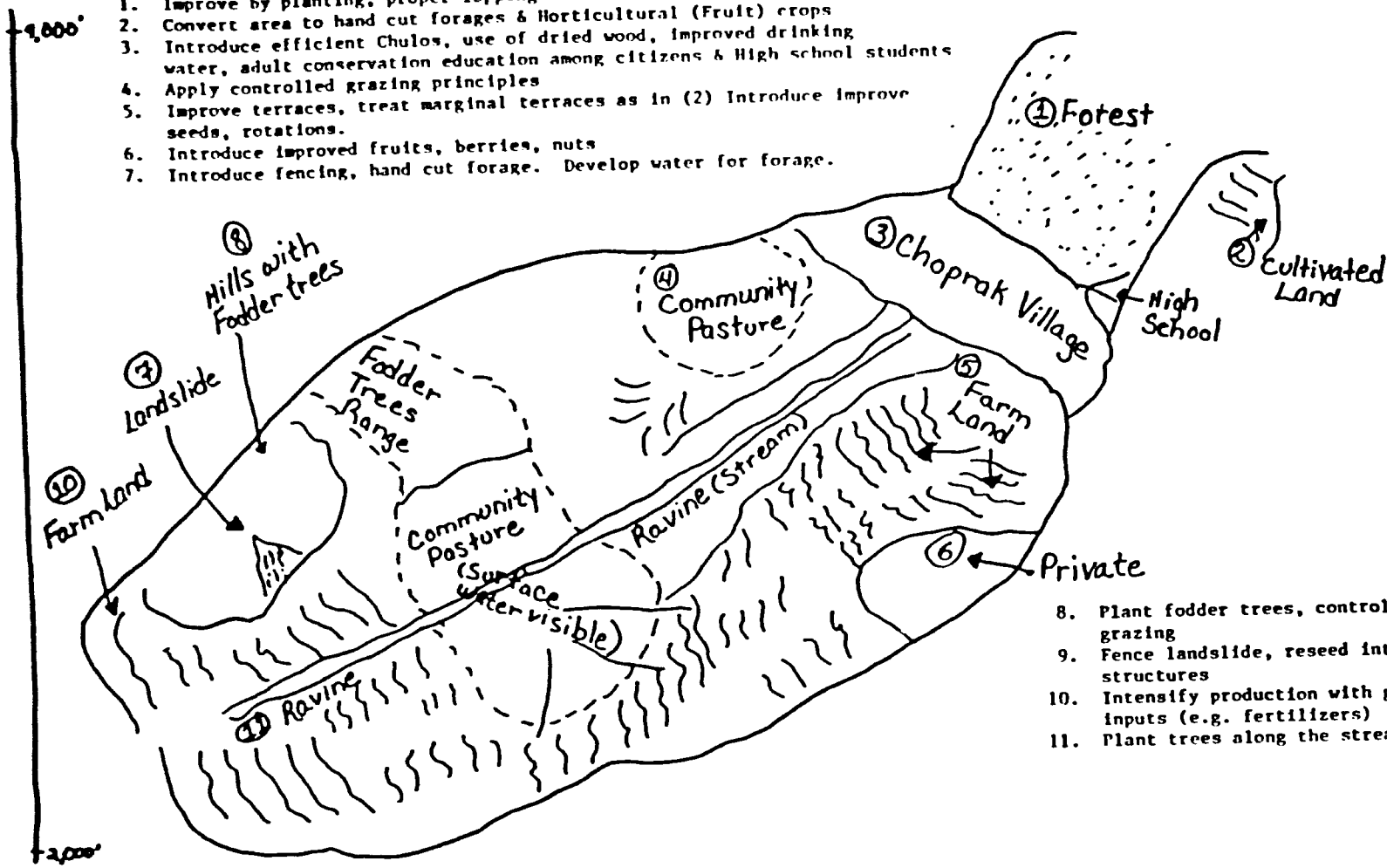
2/ Additional fruit trees for commercial plantings as they are planned will be needed.

3/ Other trees such as Pangra for shampoos as they are needed should also be multiplied. Number on banana are not given but their multiplication and distribution be carried out.

FIG. 1 PROPOSED CHOPRAK VALLEY IMPROVEMENT PLAN

Measures by Site

1. Improve by planting, proper lopping
2. Convert area to hand cut forages & Horticultural (Fruit) crops
3. Introduce efficient Chulos, use of dried wood, improved drinking water, adult conservation education among citizens & High school students
4. Apply controlled grazing principles
5. Improve terraces, treat marginal terraces as in (2) Introduce improve seeds, rotations.
6. Introduce improved fruits, berries, nuts
7. Introduce fencing, hand cut forage. Develop water for forage.



8. Plant fodder trees, controlled grazing
9. Fence landslide, reseed introduce structures
10. Intensify production with greater inputs (e.g. fertilizers)
11. Plant trees along the stream

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year		
	Year 1			Year 2			Year 3			Year 4			Year 5			Total cost in M$						
HORTICULTURE PERSONNEL	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
-Horticulturist, National staff	.3 M	1	2.1	.3 M	1	2.1	.3 M	1	2.1	.3 M	1	2.1	.3 M	1	2.1		1.5 M	5	10.5	1.5 M	5	10.5
-Plant Pathologist, National staff	.3 M	1	3.0	.3 M	1	3.0	.3 M	1	3.0	.3 M	1	3.0	.3 M	1	3.0		1.5 M	5	15.0	1.5 M	5	15.0
-Horticulturist, catchment level (5)	1.5 M	5	10.5	1.5 M	5	10.5	1.5 M	5	10.5	1.5 M	5	10.5	1.5 M	5	10.5		7.5 M	25	52.5	7.5 M	25	52.1
-Assistants at National & catchment level for care of introduction Propagation (6) Non Gazetted Technical (Class 1)	1.8 M	6	9.0	1.8 M	6	9.0	1.8 M	6	9.0	1.8 M	6	9.0	1.8 M	6	9.0		9.0 M	30	45	9.0 M	30	45
Consultants, short term, two months																						
Each on fruits, veg., seed, prod., marketing (All Nepalese except for seed prod.), 2nd and 7th year				240	4	15											240	4	15			
-Seed production (veg. & flowers) expert - Mustang (Nepalese)										.3 M	1	2.1	.3 M	1	2.1		1.5 M	5	10.5	1.5 M	5	10.5
-Fruit & vegetable processing specialist (Nepalese): In Mustang (Start yr. 3), Gorkha(start yr. 4) and Myagdi (start yr. 5)							.3 M	1	2.1	.6 M	2	4.2	.9 M	3	6.3		4.5 M	15	31.5	4.5 M	15	31.5
Budders & grafters 20/catchment in cereal (peon level)				30 M	100	40	30 M	100	40	30 M	100	40	30 M	100	40		150 M	500	200	150 M	500	200

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year		
	Year 1			Year 2			Year 3			Year 4			Year 5			Total						
Horticulture	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
Plant Introduction & Nursery Expenses																						
Introduction expenses																						
Temperate fruits: Apples,			5			15			5			5			5				25			25
Peaches, Plums, Pears,																						
Apricots, Meatasing			5			15			5			5			5				25			25
Citrus fruits: Mango,																						
guava banana, etc.			3			10			3			3			3				10			10
Rootstocks: Temperate			5			10			5			5			5				25			25
Root streks: Tropical			1			2			1			1			1				5			5
Vegetable red flower seeds			5			15			5			5			5				25			25
Nursery expenses*																						
To HMG's Horticutural farm			10			30			10			10			5				25			25
Catchment & Panchayat level demonstration, operation, plantings			60		-	60			60			100			100				500			500
Vegetable Seed Production Expenses																						
Catchment level			50			50			50			50			50				250			250

* For construction cost of nuseries refer Forestry component of this project paper.

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year		
	Year 1			Year 2			Year 3			Year 4			Year 5			Total						
Horticulture	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
Suppliers																						
Tools-Propagation, shorals, hoest, etc. Pesticides, fertilizers			10			30			50			50			50				250			250
Office supplies, books national and the catchment level			3			4			5			7			10				12			18
Plastic bags & midia expenses			1			3			4			5			6				30			30
Fruit processing facilities buildings & equipment services cold storage, grading area																						
Mustang									150													
Gorkha												150										
Myagdi															150							
Fruit processing supplier cans, bags, bottles, chemicals									10			20			30				150			150

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost in th. dollars

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year		
	Year 1			Year 2			Year 3			Year 4			Year 5			Total						
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3
Inservice staff training																						
Plant propagation training						5						5							15			15
Seed production training						5						5							15			15
Fruit processing						5						5							15			15
Marketing training						5						5							15			15

APPENDIX Jd

MISCELLANEOUS

Prepared by: Govind C. Sharma/SECID

LEECH CONTROL RESEARCH

A BRIEF STATEMENT

Leeches inhabit hills (5,000' to 8,000') of Nepal and are a general nuisance to livestock and humans. Their numbers increase considerably during the monsoons. In Pakhapani, a remote area where the design team's helicopter landed in May, 1979, the villagers thought that the team had come to help them eradicate leeches. Leech control is clearly one of the 'felt needs' of the rural people.

The author of this brief note is not a leech specialist; however, it was felt that the design team should recommend some measures for leech control. Therefore, it is proposed here that an interested research group be identified in Tribhuvan University's Department of Entomology or in a university abroad with an interest in leech research. A review of existing information on leech biology should be the first step. Several avenues of control of leeches can be studied, including (and preferably) biological control or management of the leech population. An interesting avenue to pursue would be to identify leech specific pathogens that can be introduced in the leech habitats. However, considerable laboratory and pilot level tests will need to be conducted before area wide leech control can be effected.

It is proposed that RCUP institute a five- to seven-year program for leech control with a modest budget. An opportunity should be provided to a Nepalese student to pursue this problem as a part of an advanced degree program. Such an individual, after completion of the degree, should return to Nepal to try leech control at a pilot and then at a large scale level. It is felt that a modest program for this activity can be supported by a grant of $25,000 to $50,000.

AN APPLIED RESEARCH PROGRAM FOR USE OF TISSUE CULTURE TECHNIQUE FOR RAPID MULTIPLICATION OF FODDER AND FUEL WOOD TREES OF NEPAL

Tissue culture techniques are increasingly becoming an effective applied method for multiplication of superior forest tree types. Basically the techniques consists of propagation of juvenile cells or small tissues from forest trees in a sterile environment. Such tissues are grown in a media of known composition (agar, minerals, carbon source, vitamins and phytohormones). Tissues selected for propagation through tissues culture are species dependent, but generally, needle vascicles, young cotyledonary buds, apical meristems, shoot tips, etc. are grown and progressively subdivided to obtain literally hundreds of thousands of plantlets with similar genetic makeup from a mother tree. Many forest industries are currently experimenting and utilizing this technique for rapid multiplication of genetically superior forest trees. Numerous universities and research organizations have added measurably to development of tissue culture of forest, horticultural and agronomic plant species. The technique is fairly well established now and it can not be brushed aside as a theoretical or basic research fancy. It could be a very effective and fast method of propagation of forest tree plants.

The RCUP Project or other agencies may wish to conduct a literature review to see what has already been done in use of tissue culture on trees native or potentially useful to Nepal. Experts in this field may be consulted to determine feasibility and merit of such technique or propagation for Nepal. If the use of this technique does seem desirable then studies could be undertaken to propagate fodder and/or fuel wood trees using this technique first on experimental then as the pilot and finally on a large scale basis by an organization in Nepal.

It is felt that up to $10,000 should be sufficient for literature review and consulting assistance. For a full fledge tissue culture facility with trained personnel large outlays (approximately $50,000/year) will be needed.

APPENDIX K

TRAINING IN RENEWABLE RESOURCES IN NEPAL

Prepared by: ODM/SECID
P.J. Wood
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J.D. Gregory
D.H. Wallace

ABBREVIATIONS USED IN THE TEXT

AA	Agricultural Assistant (Ministry of Agriculture)
ADB	Asian Development Bank
DCO	District Conservation Officer
DFO	Divisional Forest Officer
HMGN	His Majesty's Government (Nepal)
JT	Junior Technician (Ministry of Agriculture)
JTA	Junior Technical Assistant (Ministry of Agriculture)
KHARDEP	Khosi Hills Area Rural Development Programme
MFTW	Ministry of Forests Trainng Wing
ODM	Ministry of Overseas Development (U.K.)
PFF	Panchayat Forest Foreman
SATA	Swiss Association for Technical Assistance
SLC	School Leaving Certificate
SWC	Soil and Water Conservation
RNR	Renewable Natural Resources
TETOC	Technical Education and Training Organization for Overseas Countries
USAID	United States Agency for International Development
FD	Forest Department (Ministry of Forest)
Minfor	Ministry of Forests
CFD	Community Forestry Development

Exchange rates: NRe 11.90 = $1.00 (U.S.)
NRe 24 = £1.00

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I. Summary of Main Conclusions and Recommendations

A. Introduction

The environmental problems of Nepal, which are worse in the hill areas of the country, are closely inter-related. Increasing soil erosion is destroying land productivity, and floods and droughts are increasing occurrences, the effects of which are felt beyond the borders of the Himalayan kingdom. Agricultural production is falling, deforestation is accelerating, and the continued degradation of natural resources is reflected in deteriorating health, nutrition and well being of the people. The solutions to these problems are no longer simple, and they must be attacked in an integrated way; training for the personnel who are to spearhead this attack must therefore also take account of this integration.

The joint ODM/USAID mission on training addresses itself to the needs of the Ministry of Forests, and through them to the education carried out by the Tribhuvan University of the Ministry of Education. The mission is therefore concerned with training in renewable natural resources, and with some extent wildlife. The mission was impressed with the urgency of increasing both the numbers and quality of manpower involved in the management of renewable natural resources, and became aware early on that a basic understanding of ecosystems as well as techniques and management expertise were an essential part of any education and training program. Overall, the importance of an ability to reach the rural people became apparent at all levels of training.

B. Main Conclusions and Recommendations

1. Tribhuvan University

The existing technical grade school at Hetauda (Institute of Forestry) currently runs three types of courses:

a. Certificate course in forestry (2 years)

b. Certificate course in soil and water conservation (2 years)

c. Senior Certificate course in forestry (1 year following a. above)

We recommend, and this has been agreed by HMG(N), that these are replaced by a single course leading to a Certificate in Renewable Natural Resources, with an entry of about 110 students covering techniques and extension work in forestry, soil and water conservation and wildlife management. To assist in

this we recommend that some improvements to the facilities at Hetauda be made, and that some extra training for the teaching staff there is undertaken.

We also recommend setting up a new Certificate Course campus at Pokhara (Dungesangu) to start teaching in 1981, also with a student entry of 110.

Hitherto, all education to degree/diploma (B.Sc.) level in forestry, soil and water conservation, and wildlife management has been undertaken in foreign countries. In accordance with the education policy of HMG(N), we recommend the setting up of a course for a Diploma in Renewable Natural Resources, also at Pokhara, in 1981. This would consist of a basic three year course for officers of both the Forestry and Soil and Water Conservation Departments. The first two years would be common and the third year would allow specialization in either soil and water conservation or forestry. A fourth year for B.Sc. (honours) is also proposed.

C. Ministry of Forests Training Courses

In service training must be carried out by the Ministry of Forests staff. It is proposed to set up a training wing (MFTW) with headquarters in Kathmandu, and training facilities there and in Chautara.

The components of the recommended project include the following:

a. Incremental or new buildings at Hetauda, Pokhara, Kathmandu and Chautara
b. Equipment, furniture and vehicles for the new institutes
c. Provision of out-country training for university lecturers and MFTW training officers
d. Provision of expatriate assistance whilst Nepali officers are undergoing training
e. Recurrent costs.

II. Background to the Mission, TOR, and Acknowledgements

A. A joint ODM/USAID mission, requested by HMG(N), was in Nepal from November 1978 to December 1978 to identify training needs and to draw up plans to meet these needs. Their report (Wood et al., 1979), which covered the need for formal education at the Tribhuvan University, and also the need for job-specific training by short courses in the Ministry of Forests itself, represented the ODM/USAID input requested by HMGN to the World Bank/FAO Community Forestry Project (latest report 11th April, 1979), and its findings largely comprise the Training Appendix to the report of the appraisal mission, which was in Nepal from 10 May 1979 to 6 June 1979.

The Community Forestry Project embraces only the activities of the Forest Department, whereas the ODM/USAID mission has covered the training needs of the Soil and Water Conservation Department and the wildlife office of the Forest Department. Indeed, it is the view of the mission that Soil and Water Conservation should be given special prominence for the next few years, especially in training.

The report of the November 1978 mission drew up the following terms of reference for the current mission.

B. Terms of reference

1. Examine and confirm numbers of trainees in each category and activity using a 10 year time horizon.
2. Outline curriculum details for the Diploma and Certificate courses.
3. Prepare details for staffing, courses and guidelines required to establish a Ministry of Forests Training Wing.
4. Outline out-country training requirements, including wildlife needs.
5. Prepare terms of reference for expatriate requirements on a phased schedule.
6. Prepare costing requirements and donor contributions on an initial 5 year time horizon to meet outlined training programs to include staffing, buildings, overseas training, equipment, etc.

C. Acknowledgements

The team is very grateful to the many officers of Tribhuvan University, the Ministry of Forests (Minfor), USAID and the British Council who contributed to making their stay a pleasant one, and enabled them to work effectively while in Nepal. In particular they wish to mention the following:

Mr. N.N. Rimal	Ministry of Forests
Mr. M. Haque	Dean, Institute of Forestry
Mr. M. Stevens	USAID
Mr. A. Russell	British Council
Mr. W. Ross	British Council

III. Staff Training Requirements and Predictions for the Ministry of Forest

Appendix 3 of the earlier ODM/USAID report (Wood et. al, 1979) listed the existing and proposed levels of staffing for different grades of staff in the Forest Department. Table I shows the positions as revised for the whole Ministry, and given to the Mission on 24 April 1979. These figures differ from those used by FAO/CP, but it is to be hoped that they represent final estimates by the Ministry, as they were produced after several days of intra-ministry discussions during the Mission's visit. Modifications to their figures were made in accordance with the estimates for the Community Forestry Program being drawn up by the World Bank team.

Summarizing, the deficits on a 10 year basis, and the estimated annual requirements to meet these deficits, and to make an estimated 10% annual replacement to the existing establishment, are as follows:

Deficits (10 years)	Officers	Technicians
SWC	161	330
Forestry	219	970
Private Sector	4	10
Total	384	1,310
Annual requirement (deficit)	38	130
Annual requirement (replacement	10	70
Total	48	200

The planning figures are taken as 40 and 200 respectively, these being realistic in the light of probable developments, and the supply of suitably qualified course entrants.

These figures are estimates only, but should be completely adequate for the Ministry's needs for the next 10 years. The positions should be carefully monitored, and care taken to see that the numbers of students accepted do not exceed those that can be taught effectively. It is possible that as resource management programs develop, demand for suitable training will increase.

TABLE I

10 YEAR MANPOWER REQUIREMENT PREDICTIONS DIPLOMA AND CERTIFICATE LEVELS

MINISTRY OF FORESTS

Revised figure as supplied by Forestry & Soil and Water Conservation Departments on 24/4/79 and confirmed 14/5/79.

Employing Section	Level	Diploma	Certificate
Departmental & Territorial Staff	Existing (1)	62	540
	Proposed (2)	119	815
	Deficit (3)	57	275
Afforestation Office	(1)	6	26
	(2)	8	26 5/
	(3)	2	
Forest Research & Resources Survey	(1)	13	33
	(2)	29	38
	(3)	16	5
National Park & Wildlife	(1)	13	20
	(2)	28	45
	(3)	15	25
Forest Products Development Board	(1)	1	50
	(2)	5	138
	(3)	4	88
Chief District	(1)	-	10
	(2)	-	225
	(3)	-	215
Timber & Fuelwood Corporations of Nepal	(1)	4	8
	(2)	7	108
	(3)	3	100

Employing Section	Level	Officers (Diploma)	Rangers/Foresters (Certificate)
Ministry of Forests Training Wing	(1)	-	-
	(2)	3	5
	(3)	3	5
Community Forestry	(1)	-	-
	(2)	34	22[4/]
	(3)	34	22
Community Forestry H.Q.	(1)	1	-
	(2)	12	-
	(3)	11	-
Institute of Forestry	(1)	4	5
	(2)	28	5
	(3)	24	-
Integrated Rural Development Project	(1)	2	-
	(2)	24	116
	(3)	22	116
Silvicultural Research (ODM Project)	(1)	2	-
	(2)	10	27
	(3)	8	27
Soil & Water Conservation	(1)	4	-
	(2)	150	300
	(3)	146	300
Totals	(1)	112	692
	(2)	457	1870
	(3)	345	1178
Add 1% to deficit figures (excluding S.W.C) for Private Forestry.		4	12
		349	1190

Employing Section - Level	Officers (Diploma)	Rangers/Foresters (Certificate)
Brought forward	349	1190
Add 10% to total For Droupouts when calculating intake	35	120

Note: These figures are the same as those supplied on April 24, 1979, except for the following:

1/ Soil & Water Conservation Officers have been reduced from 170 to 150 because earlier figure duplicated 10% drop-out allowance.

2/ An addition of one percent of total deficit excluding SWC has been added for private forestry. The previous 10% addition is now considered too large.

3/ Community Forestry needs for officers increased from 31 to 34 and requirements for HQ increased by 2.

4/ Community Forestry needs for technicians reduced from 550 to 221.

5. Afforestation office already has 26 certificate holders which are considered entirely adequate.

A staff review seems to be urgent in order to ensure that all staff in post and required are fully employed, especially for departmental and territorial staff, as many of the figures appear to be high.

IV. Formal Training (Tribhuvan University)

A. The Present Situation

The Forestry Training Institute at Hetauda in the inner Terai is currently the only university campus at which forestry and soil and water conservation are taught. The current session covers the following subjects, all demanding a School Leaving Certificate (SLC) for entry:

1. Two year course leading to Certificate in Forestry (began in 1957). 1978 entry: 150.
2. Two year course leading to Certificate in Soil and Water Conservation (began 1977). 1978 entry: 25.
3. One year course leading to senior Certificate in Forestry, requiring Certificate for admission. 1978 entry: 35.

The Senior Certificate Course will be dropped from the next semester; it was an anomaly in the university system, and was required for the larger grade in the Forest Department (FD).

Diploma (B.Sc.) training in Forestry and SWC was done in other countries as a post-graduate course.

B. Proposed Training Programs

The anticipated demand for diploma and certificate holders (Table I) necessitates development of staff and training facilities.

The proposed courses are as follows:

1. Two year certificate course at Hetauda in forestry and soil and water conservation. No separate courses are recommended at this level. New course to start 1980. Estimated intake: 110/year
2. Two year certificate course at Pokhara as above. New course to start 1981 if buildings ready. Estimated intake: 110/year.
3. Three year Diploma Course in Forestry and Soil and Water Conservation at Pokhara, near Dungesangu, with an optimal honours year for exceptional candidates. Entry requirements:
   (a) Certificate plus practical year for entry in first year. Estimated intake: 30/year
   (b) Diploma in other sciences plus special orientation course for entry at second year. Estimated intake: 10/year
   Year 1: General and applied science
   Year 2: Combined Forestry and SWC

The sites for the proposed courses are:

1. Hetauda as at present.
2. Dungesangu, Pokhara. A joint campus for a diploma level course, and a second certificate course is recommended.

C. Recommendations for Staff

1. Staffing

a. Existing staff. Staff at Hetauda are more than adequate for the proposed Certificate Course, and therefore two lecturers a year should be sent overseas for further training for three years. The mission does not regard obtaining an MSC degree as vital for teaching. If staff enter for such degrees, special arrangements (not covered by the project) will be needed to replace them, e.g., by finding donors to provide temporary expatriates.

b. New staff. Diploma Course at Pokhara. A student intake of about 40 is expected when the Diploma Course is operational; 140 students would then need about 14 lecturers at a ratio of 1:10. Twelve new lecturers are required; it is recommended that six new science/agriculture graduates, and six active-duty forest/soil and water conservation officers are recruited for future training. The timing of the return of these officers from overseas is critical in staffing the course. (See Annex 2, Appendix 3 and 4).

Certificate course at Pokhara

A total student number of 200-220 a year will require about 12 lecturers and five demonstrators. A list of the 12 lecturers is given in Annex 2, Appendix 3A. However, this number of lecturers will not need to be recruited directly, as there is currently a surplus at Hetauda and at least six may be expected from there. The suggested sources are as follows:

From Hetauda	6
Shared with Diploma Course	3
Volunteers	2
New recruitment (from active-duty officers)	2

Training for these staff is recommended as follows:

Two month attachments, USA or UK	4
FAO training officers' course, Philippines	4 1/

3. Stipends and scholarships

It is recommended that a stipend of NR 120 per month be paid to each Certificate student to assist with living expenses. This is especially important for the period spent in the field. It is also recommended that a scholarship of NR 80 be paid per month to candidates from the hill districts who would otherwise not be able to afford training. This is estimated at 50% of the student number. (See Annex 2, Appendix 5-2).

4. Equipment and civil works

a. Hetauda. Building improvements and additions (see Annex 2, Appendix 5-6), equipment (Annex 2, Appendix 5-9), and vehicles (Annex 2, Appendix 5-9) are required.

b. Dungesangu campus (see Annex 2, Appendix 6 for report on the selection of this campus). A complete new campus for the Certificate and Diploma Courses is recommended, including buildings (Annex 2, Appendix 5-5 to 5-7), equipment (Annex 2, Appendix 5-8 to 5-9) and vehicles (Annex 2, Appendix 5-9).

1/ One course a year for three years. Early application will be needed for Nepali entrants.

V. In-Service Training (Ministry of Forests Training Wing)

A. The Present Situation

Since technical training was handed over to the university in 1957, the need for in-service training facilities within the Ministry has been increasingly felt. The formal forestry education as carried out by the university is aimed at producing Government Officers with a broad understanding of land use in Nepal, and in particular sufficient details and practical knowledge of Soil and Water Conservation and Forestry to enable them to be effective in Government service posts. However, the University cannot teach on-the-job experience, and its organization is such that it cannot respond to short-term and even ephemeral demands by the Ministries. In fact it would be unreasonable to expect a university in any country to do this.

B. Proposed Training Programs

The Forestry and SWC authorities need to carry out short-term, job-specific training, with strictly defined aims to suit changing local conditions. The MFTW has a particularly important part to play during periods of policy change and development and it aims at helping active-duty officers who may not have had the advantage of the most up-to-date types of university education.

Its purpose is:

1. to carry out short, in service, job related courses for staff already working in the Ministry and to provide facilities for these;
2. to work out guidelines and assist Forest Divisions in implementing in service training programs for Panchayat Forestry Foremen, workers and watchmen;
3. to work out guidelines and provide materials for courses at the Panchayat level;
4. to make its facilities available to the Ministry's Department for publicity campaigns, conferences etc. as feasible;
5. to maintain a working library for training purposes in the Ministry.

Courses, as detailed in Annex 3, would be run either in training centres in Kathmandu or Chautara, or in the field. They would meet the needs of all grades of employees in the Ministry, with particular emphasis on those required for community forestry.

C. Staffing

A chief training officer, two training officers, two training technicians and anxillary staff are required. They would be assisted by two expatriate training officers, who would take up two-year posts in about March 1980. Overseas training is recommended for the three training officers, and in-country training for the technicians, who would both be stationed at Chautara.

D. Equipment and Civil Works

To make an effective contribution to the Ministry's needs, the MFTW will need simple but efficient printing and copying equipment, a visual aids room and library. Preparation of manuals and other training aids for the whole country, and particularly the Community Forestry Projects, will be necessary very early on. Details of equipment advised are in Annex 3, Appendix 4.

Buildings will be needed for a centre in Kathmandu and for a field station at Chautara, 87 km NE of Kathmandu. Land is available at the Ministry at Ba'ar Mahal and at Chautara. The centre buildings require about 360 m^2 of floor area, plus 40% of wall, corridor and toilet space, giving about 505 m^2.

This building is required to harmonize with a new building for the SWC to be built adjacent to it. The same architects have tendered for the building, and quoted a figure of NR 1760 per m^2, including supervision.

A realistic cost would be NRs 890,000. Two technical staff houses, dormitory and simple teaching block at Chautara are estimated at NRs 550,000. Furniture, equipment and vehicles are estimated at NRs 1,416,000. Totals are NRs 2.86 million or $238,000.

TABLE II. SUMMARY OF ESTIMATED EXPENDITURE, PHASED BY YEARS, in $'000

INST. OF RENEWABLE NAT. RESOURCES	TOTAL	1979-80	1980-1	1981-2	1982-3	1983-4	1984-5	ANNEX	APPENDIX
Overseas staff training	*459.6	*5.7	*215.2	*185.4	*53.3	-	-		
Stipends etc. in Nepal	356.5	37	45.4	48	64	78.1	84	2	5 - 2
Salaries of staff in Nepal	219.8	-	5.2	27.8	50.8	66.8	69.2	2	5 - 3
Expatriate costs	*970	*30	*230	*380	*230	*50	*50	2	5 - 4
Buildings	1620.5	-	447.1	771.8	401.6	-	-	2	5 - 7
Equipment, vehicles, etc.	358.1	-	48.3	235.7	74.1	-	-	2	5 - 9
Recurrent costs	224.6	-	25.8	32.4	44.1	59.9	62.4	2	5 - 10
TOTAL AID DONORS	1429.6	35.7	445.2	565.4	283.3	50	50		
TOTAL IDA	2779.5	37	571.8	1115.7	664.6	204.8	215.6		
OVERALL TOTAL IRNR	4209.1	72.7	1017.0	1681.1	947.9	254.8	265.6		
MINOR TRAINING WING									
Overseas staff training	*25.3	-	*25.3	-	-	-	-	3	3 - 2
Salaries of staff in Nepal	54.9	-	8.1	11.7	11.7	11.7	11.7	3	3 - 1
Expatriate costs	*310.0	*30	*140	*110.0	*10	*10	*10	3	3 - 4
Buildings	1440	-	800	640	-	-	-	3	3 - 6
Equipment, vehicles, etc.	1416.0	-	755	591	70	-	-	3	3 - 8
Recurrent costs	278.1	6.5	46.1	49.5	59.8	58.1	58.1	3	3 - 9
TOTAL AID DONORS	335.3	30	165.3	110	10	10	10		
TOTAL IDA	3189.0	6.5	1609.2	1292.2	141.5	69.8	69.8		
OVERALL TOTAL MTW	3524.3	36.5	1774.5	1402.2	151.5	79.8	79.8		
TOTAL TRAINING FOR PROJECT:	7733.4	115.2	2791.2	3082.8	1069.8	334.6	345.4		

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Appendix 1

ITINERARY

2/4/79	Henry arr. Kathmandu
3	Wood. Danbury ar. Kathmandu a.m. Discussions at British Council p.m. Discussions with Mr. M. Stevens (USAID) and Mr. Peter Ellwood (British Council) evg. Reception at Mr. M. Stevens' house.
4	Public holiday - background reading
5	Henry and Danbury visited University Campuses in Kathmandu valley with Mr. N. Regmi (USAID) - Institute of Engineering, Mani Campus (Kirtipur), and Vocational Training Institute.
6	a.m. Meeting at Ministry of Forests - Mr. N. Rimal and staff p.m. Henry and Danbury meet Mr. R.C. Gupta, Chief, Extension and Training Division, Dept. of Agriculture.
7	Gregory arrives Kathmandu. Holiday.
8	Meeting with British Council representative. Background reading.
9	Travel to Hetauda, Institute of Forestry campus, met by Mr. V. P. Jaiswal.
10	Henry, Gregory and Danbury at Hetauda with Mr. M. Haque, Dean. Tour of campus, parquet factory and TCN sawmill. Individual discussions with members of Institute of Forestry teaching staff. evg. Discussions with Mr. N.B. Basnyat, Dean of IAAS, Rampur.
11	Travel Hetauda - Rampur. Tour of IAAS campus and discussion with Mr. F.P. Neupane, Asst. Dean. Visit Royal Chitwan National Park Headquarters.
12	Visit Horticultural Research Station, Bharatpur, Mr. S.K. Thapa, Manager. Group together again travel to Butwal.
13	Travel to Pokhara, visiting silvicultural trial plots at Tansen.
14	Visit University campus at Pokhara (Prithwi Narayan) - tour and discussion with Mr. G. Johns, Asst. Dean. Visit proposed site at Khairenitar and tour German Aid Research Farm.
15	Re-visit Prithwi Narayan campus - closer look at facilities and discussion with Asst. Dean. Return to Kathmandu.
16	Discussion and writing-up p.m. Meeting at Ministry of Forests evg. Reception at Mr. A. Russell's house.
17	Discussion and writing-up
18	a.m. Discusiion and writing p.m. Meeting and discussions with Mr. K.P. Chitraker " " " " Dean M. Haque Discussion with Dr. D.M. Wood (U.S. Nat. Acad. of Sciences)
19	D. Wallace arrives Kathmandu a.m. Discussion and writing - meeting with H. Sjoholm p.m. Further disucssions with dean M. Haque
20	Meetings with Dean, Adviser to Secretary, Head of Research and Survey Writing.

21/4/79	Holiday. Danbury leaves.
22	Meeting 10 a.m. DG of SWC; with Project Manager FAO, Integrated Watershed project; with Adviser to Secretary; with Architect for new SWC building.
23	Meetings with architect, Deputy Chief Conservator, Wildlife Officer, Dean.
24	Meetings with Secretary Minfor and USAID staff
25	Wood and Gregory leave Nepal
26	Meeting with University staff
27	Meeting with Ministry of Education Staff.
28	Travel to Chautara
29	Meeting with DFO, staff and T. Grunenfelder (SATA)
30	" " " " " return to Kathmandu
11/5	Kathmandu - meeting with Henry, Mr. Chitraker (Minfor)
2-5/5	Hetauda - meetings and field visits with Dean, Institute of Forestry and local C.C.F. and staff
6-8/5	Kathmandu - project details and meetings
9-11/5	Pokhara - visit with Dean, Institute of Forestry and Dr. Henry, re. possible site for Pokhara campus
12-27/5	Kathmandu - project costings and other details re. buildings
28/5	Pakhribas - visit G.R.S. centre re. facilities available Wood (team leader) returns
29/5-10/6	Kathmandu - complete project details, discussion with World Bank team including round up meeting on 4/6/79. Wood leaves Nepal 7/6/79.
10/6	Wallace leaves Nepal.
12/6	Henry leaves Nepal.

Appendix 2

PERSONS MET

Mr. A. Russell	British Council
Mr. P. Ellwood	British Council
Mr. M. Stevens	USAID
Mr. N. Regmi	USAID
Mr. N. N. Rimal	Advisor to Secretary for Forestry
Mr. B. P. Shrestha	DFO, Dept. of Forestry
Mr. K. B. Chitraker	DFO, Community Forestry Division
Mr. T. N. Bhattarai	DFO, " " "
Mr. K. K. Nepal	Sections Officer, Ministry of Forests
Mr. K. P. Upadhaya	Team Leader, RCU Project
Mr. K. Watanabe	FAO
Mr. D. Westerberg	Team Leader, SECID/AID RCU Design Team
Mr. R. C. Gupta	Chief Extension and Training Division, Dept. of Agriculture
Mr. V. P. Jaiswal	Senior Lecturer, Institute of Forestry, Hetauda
Mr. M. Haque	Dean, Institute of Forestry, Hetauda
Mr. N. B. Basnyat	Dean, Institute of Agriculture and Animal Science
Mr. S. B. Joshi	Lecturer, Institute of Forestry, Hetauda
Mr. B. L. Ching	" " " " "
Mr. D. Mishra	" " " " "
Mr. S. L. Das	" " " " "
Mr. R. Carlson	" " " " ")Peace Corps
Mr. J. O'Donell	" " " " ")Volunteers
Mr. A. K. Das	Asst. Lect.,
Mr. I. C. Dutta	" " " " " "
Mr. C. M. L. Das	Instructor, " " " "
Mr. N. Rasaily	Dept. Instructor, " " "
Mr. J. N. Yadava	Ranger, " " " "
Mr. D. Synder	Chief Sales Executive, Nemo Parquet, Hetauda
Mr. B. P. Dhakal	Deputy General Manager, TCN, Hetauda
Mr. N. P. Upadhya	Logging Manager, TCN, Hetauda
Mr. D. R. Joshi	Seasoning and Preservation Manager, TCN, Hetauda
Col. Jagat B. Khatri, M.C.	O.I.C., Chitwan National Part Guard
Mr. F. P. Neupane	Asst. Dean, Institute of Agriculture and Animal Science, Rampur
Mr. C. Barron	British Council, English Teaching Adviser
Mr. S. K. Thapa	Manager, Horticultural Research Station, Bharatpur
Mr. G. John	Asst. Dean, Tribhuvan University, Prithivi Narayan Campus, Pokhara
Mr. D. M. Wood	U.S. National Academy of Sciences
Mr. J. Sjorholm	FAO
Mr. P. Nottidge	Program Chief, IBRD, Washington
Mr. T. M. Maskey	Warden, Chitwan National Park
Mr. H. R. Misra	Ecologist, " " "
Mr. S. M. Pathak	Asst. Warden" " "
Mr. A. Fearnside	Project Manager, FAO/UNDP Integrated Watershed Project

Mr. & Mrs. M. L. Kayastha	Architect (for SWC building) Kathmandu
Mr. Bruce Jeffries	Project Manager, Sayarmatha National Park
Mr. B. N. Upreti	Director, Wild Life
Mr. R. Bista	Ecologist, Wild Life
Mr. N. B. Basnyat	Deputy Chief Conservator of Forests, M. of F.
Mr. S. B. Shrestha	Head, Forest Resources Research M. of F.
Mr. M. D. Joshi	Director General, Soil & Water Conservation M. of F.
Dr. Pradhan	Tribhuvan University
Dr. P. Timilsena	Dean of Humanities, Pokhara, Tribhuvan University
Mr. D. R. Upreti	Dean of Science, Tribhuvan University
Mr. Malla	Forest Officer, SWC
Mr. A. B. Rajbhandari	Secretary, Ministry of Forests
Mr. T. S. B. Mahat	DFO, Chautara
Mr. Tom Grunenfelder	Forest Officer, S.A.T.A.
Mr. R. B. Gupta	Conservator, Hetaura
Mr. N. Khanal	DFO, Hetaura
Mr. G. D. Joshi	Attached Officer, Hetaura
Mr. K. B. Thapa	Ranger, Hetaura
Mr. D. B. Joshi	TCN, Hetaura
Mr. R. Upadhya	Accountant, T.C.N., Hetaura
Mr. L. Shakya	DFO, Pokhara
Mr. P. B. Chhetri	Town Planning Officer, Pokhara
Mr. R. Singh	Zonal Commissioner, Pokhara
Mr. S. M. Sruwastaw	Chief District Commissioner, Pokhara
Mr. G. O'Sullivan	Technical Coordinator, G.R.S. Pakhribas
Mr. Y. B. Malla	Forestry Instoructor, G.R.S., Pakhribas
Mr. A. Pritchard	World Bank Appraisal Mission Leader
Mr. W. Ellis	" " " " Member
Dr. K. Kim	" " " " "
Dr. R. Noronha	" " " " "

ANNEX 2

Details of Proposals for Tribhuvan University

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Annex II. Tribhuvan University

Appendix A. Certificate Course in Renewable Natural Resources

Course objectives

The course has been designed to run over three years and to provide a suitable education for Forest Officers and Soil and Water Conservation Officers to be employed by the Ministry of Forests. Whilst it is not possible to give a complete training of the kind required by the National Parks and Wildlife Office, it is intended that an adequate grounding for further training and experience in this discipline will also be given. The course aims to cover all the technical material required by the SWCD and FD, with particular emphasis on effectiveness in the rural situation. As a background to the application of scientific principles in practice, there would be foundation courses in sciences relevant to resource management and conservation. For the most academically able, a fourth year leading to B.Sc. (Honours) is proposed; this qualification should be acceptable internationally for entrance to postgraduate research or course work.

Entry to the course

Candidates for entry to the Course should possess one of the following:

a. A Certificate in Renewable Natural Resources (Forestry and Soil and Water Conservation) from Hetauda or Pokhara, plus one year's practical experience.

b. A diploma in Agriculture or another scientific subject.

There will be an entrance examination in English, Nepali, and on rural science. Stress will be placed on leadership, self-reliance and motivation.

Course outline

The Course is completed in six semesters (three academic years). For Certificate level entrants, the first two semesters concentrate largely on the basic sciences; for the small number of entrants that may be expected as Diplomates from other disciplines, a short introductory course in renewable resource management plus suitable work experience will be needed. In the third and fourth semesters, the basic applied sciences of Forestry and Soil and Water Conservation will be covered: In the final year candidates will have the

opportunity to specialize either in SWC or in Forestry. There will, however, be a number of courses in common, and there will be an elective or special subject presented as part of the iploma requirements.

For the honours year there will be an opportunity to study a wide range of subjects in more depth.

The subjects are given below, with the credit hours allotted to each subject. Numbers in brackets refer to lecture and practical 'contract' hours per week.

Teaching methods

As befits a university-level course, a measure of self-discipline in study will be expected. The basic method of instruciton will be lectures and practicals, but individual study using the library and field observations will be expected of all candidates. The maximum size of class expected is 36: half this is the maximum that can be taught effectively in a practical class.

Assessment

Course work assessment will be continuous, taking the form of written, practical and oral testing. It is also highly desirable that a final comprehensive examination be held. Although this is at present under review owing to student pressure, the international respectability of the Diploma depends on international standards being applied. As suggested for the Certificate Course, the weighting given to continuous assessment: comprehensive examination could be 3:2.

Suggested Syllabus for Diploma Course

The first students are expected to enter the Diploma Course in August 1981, commencing with the science background. The first studies on Soil and Water Conservation and Forestry at this level will thus not take place until 1982. The syllabus at these levels must therefore be considered as provisional only, and open to further discussion between the Departments, offices and the university.

It is unfortunately impossible to include sufficient options in the first three years to enable a student to major in wildlife biology and management. However, any person destined for service in the National Parks and Wildlife Office will first be able to obtain a Diploma in Renewable Natural Resource Management (Forestry) and then try for the honours year. The elective

or special project in the third year would normally, of course, be wildlife orientated for such people, and it is possible that the options listed in the fourth year could be taken. As the structuring of the course progresses, the possibility of further options, in the light of staff availability, can be discussed.

For the Botany and Medicinal Plants Department, the normal recruitment would presumably be from graduates in Botany. Diplomates from the new course should have a broad university education however, and should be well able to take up posts in the Departments.

In the descriptions which follows, the number of credits given per semester refers to the contact hours per week, which are given in brackets e.g. (3+2). The first figure is lecture time, the second is practical time, of which only half counts as credit time.

DIPLOMA COURSE IN RENEWABLE NATURAL RESOURCES

These course descriptions should be regarded as guidelines to the teaching staff of the Institute of Renewable Natural Resources. They may of course be modified, though the range of subjects covered should meet the needs of all sections of the Ministry.

YEAR ONE

Title	Credit hours Semester 1	Credit hours Semester 2
English	3 (3+0)	3 (3+0)
Maths (Algebra and Trigonometry)	3 (3+0)	3 (3+0)
Geology	4 (3+2)	-
General Botany	4 (3+2)	-
Field Botany	-	3 (2+2)
Inorganic Chemistry	4 (3+2)	-
Zoology	4 (3+2)	-
Organic and Biochemistry	-	4 (3+2)
Physics	-	4 (3+2)
Plant and animal physiology	-	4 (3+2)
TOTAL:	22	21

DIPLOMA COURSE IN RENEWABLE NATURAL RESOURCES

YEAR TWO

Title	Credit Hours Semester 1	Semester 2
Plant and Animal Ecology	4 (3+2)	-
Introductory Soil Science	4 (3+2)	-
Hydrology and Meteorology	4 (3+2)	-
Surveying, Mapping and Draughtmanship	5 (3+2+2)	-
Agriculture, and Range Management	4 (3+2)	-
Tree seed, Nurseries and Arboriculture	-	4 (3+2)
Engineering - roads, bridges, etc.	-	4 (3+2)
Extension Methods and Personnel Management	-	3 (3+0)
Forest, Landuse and Panchayat Law	-	3 (3+0)
Soil Conservation	-	4 (3+2)
Management Science	-	3 (3+0)
TOTAL:	21	21

DIPLOMA COURSE IN RENEWABLE NATURAL RESOURCES

YEAR THREE - Forestry

Title	Credit Hours Semester 1	Semester 2
Forest Mensuration	4 (3+2)	-
Silviculture	4 (3+2)	4 (3+2)
Forest Production and Management Plans	-	4 (3+2)
Harvesting, Conversion and Utilization	4 (3+2)	-
Forest Protection	3 (3+0)	-
Land Use	-	3 (3+0)
Accounting and Economics	-	3 (3+0)
Statistics and Sampling	-	3 (3+0)
Wildlife Biology and Management	4 (3+2)	-
Remote Sensing	2 (2+0)	1 (1+0)
Elective or Special Project	-	3
TOTAL:	21	21

DIPLOMA COURSE IN RENEWABLE NATURAL RESOURCES

YEAR THREE - Soil and Water Conservation

Title	Credit Hours Semester 1	Semester 2
Soil Genesis, Classification and Mapping	-	4 (3+2)
Silviculture	4 (3+2)	4 (3+2)
Statistics and Sampling	3 (3+0)	-
Soil and Water Conservation Engineering	4 (3+2)	-
Irrigation and Drainage		4 (3+2)
Watershed Management	4 (3+2)	4 (3+2)
Land Use	3 (3+0)	-
Accounting and Economics	3 (3+0)	-
Remote Sensing	1 (1+0)	2 (2+0)
Elective or Special Project	-	3
TOTAL:	22	21

DIPLOMA COURSE IN RENEWABLE NATURAL RESOURCES

YEAR FOUR - Elective Subjects

Advanced forest evaluation and mensuration
Wood Technology
Soil Physics
Soil Fertility
Water Resource Planning and Development
Business Management and Law
Tree Improvement and Forest Genetics
Economics and Project Analysis
Accounting
Inorganic Chemistry
Ornithology
Mammalogy
Animal Behaviour
Wildlife Habitat Analysis

DIPLOMA COURSE IN RENEWABLE NATURAL RESOURCES

YEAR FOUR - (Selective B.Sc. Honours) - Core Subjects

Students will choose from the following topics, subject to an average of 15 credit hours of core work 13-16 credit hours of elective subjects and about 12 credit hours for a special project.

Technical Literature and Writing
Mathematics and Computing
Humanities and Social ciences
Experimental Design and Biometrics
Special Project (6 credit hours per semester)

YEAR ONE

ENGLISH Credits: 6

Learning objectives: The student will be able to:

1. Read general or technical English language papers, and make oral or written abstracts in English or Nepali.
2. Prepare literature summaries based on the use of the library, including international journals, text books and abstracts.
3. Understand and use a working range of technical terms used in resource management, forestry and soil and water conservation.
4. Prepare reports, papers and letters in English, in clear unambiguous style.

Syllabus: Preparation of precise and study notes from literature. Guided reading in the library. Definitions of technical terms and comprehension of typical scientific literature. Use of library, classification systems, storage and retrieval of data. Report, essay and letter writing.

MATHEMATICS Credits: 6

Learning objectives: The student will be able to:

1. Calculate areas, volumes and quantities used in soil engineering, roads, bridges, building construction, and in land surveying.
2. Understand and use trigonometrical functions in the volumetric mensuration of individual trees, forest stands, and felled timber.
3. Use co-ordinate geometry and graphical methods.

Syllabus: Will cover the above subjects.

GEOLOGY Credits: 4

Learning objectives: The student should be familiar with the formational process of various rocks and minerals, with common geologic formations, with the geologic history and major geologic formations of Nepal, and should be able to identify common minerals, rocks, and geologic formations.

Syllabus: Composition of the earth's crust, process of formation of minerals and rocks, uplift and degradative processes in the earth's crust, geologic formations, geologic history and the geologic history of Nepal, major geologic formations of Nepal, relationships of geology to forestry, soils, and hydrology.
Identification of common rocks and minerals, field visits to examine various types of geologic formations, use of geologic maps.

GENERAL BOTANY Credits: 4

Learning objectives: The student should be able to recognize important plant families, and understand the classification of the plant kingdom. The form of plants in relation to function.

Syllabus: The theory and practice of taxonomy. The species concept and the origin and evolution of domestic plants. The biological site responses of some important species.

FIELD BOTANY Credits: 3

Learning objectives: The Course is designed to enable the student to recognize flowering plants in the field, at least to the family level, and to the specific and variety level, for a selection of plants of importance in conservation, forestry, agriculture and range management.

Syllabus: The classification and field identification of flowering plants found in Nepal. Botanical collections at different seasons. The use of herbarium material. Variation within and between individuals, provenances and species.

INORGANIC CHEMISTRY Credits: 4

Learning objectives: The student should be familiar with the principles of inorganic chemistry and should be able to utilize knowledge of chemical structures and reactions in subsequent courses in the natural sciences.

Syllabus: States and general properties of matter; symbols, formulas, and equations; atomic and molecular structure; chemical bonding; properties of gases; properties of solids; properties of water and liquids; properties of solutions; chemical equilibria; acids, bases, and salts; the periodic measuring properties of matter; identification of elements and compounds; gravimetric determinations; solutions experiment - making known solutions, solution properties, quantitative analysis, pH and buffers; experiments with important elements.

ZOOLOGY Credits: 4

Learning objectives: The student should be able to recognize important animal groups, and have a basic understanding of their classification.

Syllabus: The classification and phylogeny of the animal kingdom, and study of the internal structure and organization of important representatives. Speciation and interrelationships, and the origin and evolution of domestic and other important animals. Life history of selected species.

ORGANIC AND BIOCHEMISTRY Credits: 4

Learning objectives: The student should be familiar with the properties of organic compounds and the important internal chemical processes of plants and animals and should be able to utilize that knowledge in subsequent courses in the natural sciences.

Syllabus: Structure and properties of organic compounds, alkanes, alkenes, alcohols, ring structures, organic acids, carbohydrates, amino acids and proteins, enzymes, cellular organization and functions of components, metabolism, photosynthesis, nucleic acids and gene function.

PHYSICS Credits: 4

Learning objectives: The student should obtain a basic understanding of the physical principles underlying the properties of living organisms, and of the physical features of the earth's surface.

Syllabus: Mechanics, strength of materials, forces, moments, vibrations and waves. Heat transfer especially in relation to meteorology. The properties of fluids. Simple electromagnetics. Atomic theory, the nature of light and its measurement, other radiation. Microscopy. Simple experimentation on mechanics, light and electromagnetics.

PLANT AND ANIMAL PHYSIOLOGY Credits: 4

Learning objectives: The student should obtain the necessary background in understanding the biology of organisms, especially those utilized or protected in rural land use.

Syllabus: Elementary cell biology. The physiological processes of higher plants in relation to their environment. The biology of micro-organisms and fungi, physiology, symbiosis and parasitism. The physiological processes of animals and their adaptation to the environment. Experiments on green plants and lower animals.

YEAR TWO

PLANT AND ANIMAL ECOLOGY Credits: 4

Learning objectives: The student will acquire a background to the understanding of plant and animal communities in Nepal, and the effects that different management practices, physical and biotic factors may have on them.

Syllabus: The physical, chemical and biotic factors of the environment. The structure and classification of ecosystems, growth and limitations of plant and animal populations. Definition and characteristics of communities. Control of numbers, biomass and energy flow. Identification of organic compounds; separations and quantitative analyses; experiments with solutions, reactions, and enzymes.

INTRODUCTORY SOIL SCIENCE Credits: 4

Learning objectives: The student should know the nature and properties of soils and be able to apply that knowledge to soil management for forestry in Nepal.

Syllabus: The soil and the soil profile, important physical properties of soils; nature and significance of soil mineral constituents (sand, silt and clay); soil parent materials; soil formation, classification and survey; the soil reaction and soil solutions; soil organisms and organic matter; supply and availability of important plant nutrients; soil management; evaluation of forest site quality, evaluation of physical properties for road maintenance, erodibility, etc., nursery soil management; soil management for silvicultural operations. Soil sampling for physical and chemical analyses; soil profile evaluation and development of soil management plans for silviculture.

HYDROLOGY AND METEOROLOGY Credits: 4

Learning objectives: The student should be familiar with the basic concepts of meteorology and hydrology, should be able to measure important meterologic and hydrologic factors and should be able to evaluate meteorologic and hydrologic factors in relation to forestry and soil conservation management planning.

Syllabus: Structure and organization of the atmosphere; solar radiation and the heat balance; atmospheric circulation; storms, fronts, and weather patterns; the hydrologic cycle; water resources and water problems; drainage basin morphology; atmospheric moisture and precipitation; evapotranspiration; infiltration and subsurface water; runoff and components of streamflow; water yield; water

quality. Data collection and compilation for meteorologic and hydrologic factors (temperature, wind, rainfall, evaporation, water yield, etc.); measurement and estimation of factors in the hydrologic cycle; water yield prediction; water quality measurement.

SURVEYING, MAPPING AND DRAUGHTSMANSHIP Credits: 5

Learning objectives: The student should be conversant with all the main methods of land surveying and be capable of carrying out basic surveys and plot with accuracy, relevant information onto the general base maps available in Nepal. He should be capable of preparing small-scale maps, appropriate to land use management and updating them as required and should be able to draw good quality general diagrams, charts, etc.

Syllabus: Terms, definitions and units. Chain and chain and compass surveying. Traverse survey, use of simple theodolite. Line and are a levelling. Fieldwork and plotting techniques for these methods. Setting out for simple construction works. Plane tabling and its applications. Maps available in Nepal - planimetric and topographic, scales and information available. Principles of serial survey, planning and specification for serial photographs; elements of photogrammetry, plotting and mapping, interpretation of serial photographs in forestry and land use applications. General principles of good draughtsmanship - methods and instruments for general technical drawing, layout, lettering, scales. Types of maps used in resource conservation and conventions normally adopted.

AGRICULTURE Credits: 4

Learning objectives: The student should be familiar with the requirements and production practices for farm and garden crops, livestock and natural and improved range and should be able to evaluate field sites in different regions and design optimum crop and livestock systems for those sites.

Syllabus: Should include soils and climatic requirements and cultural practices for the common fruit, vegetable and grain crops of Nepal, management of livestock; range management; farm planning, combination forest tree and food crop production systems. Field trips to observe and discuss various crop and livestock systems; farm planning; evaluate resources in a rural farming area and develop optimized plans for farming operations; range management; field trips to observe and discuss various types of natural and improved range, identification of common forage plants; develop management plan for a section of natural range.

TREE SEED, NURSERIES AND ARBORICULTURE Credits: 4

Learning objectives: The student will be capable of selecting appropriate seed sources and organizing the collection and raising of tree and other plant seed in nurseries. He should be able to select, establish and maintain individual specimen trees for the provision of shade, shelter and visual amenity.

Syllabus: Factors affecting production of seed by trees and shrubs. Recognition of good seed crops and determination of collection times. Seed collection techniques, cleaning, grading, testing and storage. Raising planting stock from seed and by vegetative means. Container and open-root techniques. Selection of nursery sites, maintenance of fertility, protection and weed control, stocktaking, nursery records and accounts. Forward planning and estimating quantities of planting stock required. Monitoring and supervising nursery work.

Raising of specimen amenity trees in nurseries. Types and sizes of stock. Choice and siting of specimen and shade trees in villages and towns, value to the community. Planting, protection and maintenance of individual trees. Basic tree surgery - tools and equipment and techniques for pruning, lopping and felling large specimen trees.

ENGINEERING - ROAD, BRIDGES ETC. Credits: 4

Learning objectives: The student should be capable of determining the needs for rural engineering works and designing, estimating for, and supervising the construction of the simpler types of road, culverts, bridges and buildings.

Syllabus: Terminology used in road construction, fair weather and all weather roads. Planning road systems - density, standard, and alignment. Gradients and drainage problems. Bearing capacities of soils and base materials. Culverts; beam, simple trestle and wire rope bridges. Setting out, construction and maintenance of roads, culverts and bridges. Tools and equipment required. Construction and maintenance of simple buildings - characteristic of local buidling materials, brick, stone and timber; setting out foundations, construction of walls, windows, floors, roofs, fireplaces and chimneys.

EXTENSION METHODS AND PERSONNEL MANAGEMENT Credits: 3

Learning objectives: The student should understand various information sources, and be able to plan and execute a regional natural resources extension program. He should be able to administer effectively in the framework of the civil service, particularly subordinate personnel for maximum job effectiveness.

Syllabus: Principles, development and execution of extension programs; public speaking; short courses; teaching aids, posters, leaflets, newspapers and radio. Personnel management, job description and work organization. Leadership, motivation, supervision and performance evaluation.

FOREST, LAND USE AND PANCHAYAT LAW Credits: 3

Learning objectives: The student must be sufficiently familiar with law and custom in rural Nepal to be able to discharge his duties in relation to them, and to work effectively with other government officers.

Syllabus: Definition and legal terms, origins and legal system in Nepal. Laws enacted relating to forests, including those for community forestry and wildlife. Preparation of charge sheets and legal procedure. Civil Service Acts, Rules and Regulations.

SOIL CONSERVATION Credits: 4

Learning objectives: The student should know the processes of erosion and sedimentation, the erosion problems of Nepal and should be able to evaluate a drainage basin and design a complete soil and water conservation plan.

Syllabus: Problems of wind and water erosion and sedimentation with particular reference to Nepal; physical principles of erosion processes; ecosystem factors that affect erosion rates, measurement and prediction of erosional soil losses; soil and water conservation measures - design and implementation; drainage basin evaluation and development of conservation plans. Evaluation of erosion hazard, measurement of erosional soil loss; design layout and construction of terraces, channels, runoff control structure; gully rehabilitation, etc., evaluate a drainage basin and develop a conservation plan. Emphasis should be placed on the planning, design and management aspects of conservation implementation.

MANAGEMENT SCIENCE Credits: 3

Learning objectives: The student should be familiar with the principles of management science and be able to apply those principles to problems in forestry and soil conservation.

Syllabus: Principles of management and the functions of a manager; the planning function; information systems; decision making; the organizing function; directing-supervision, leadership motivation; the controlling function and performance evaluation.

YEAR THREE

SOIL GENESIS, CLASSIFICATION AND MAPPING Credits: 4

Learning objectives: The student should be able to describe, classify, and map the major soil types of Nepal.

Syllabus: Soil morphology, soil composition, and characterization, weathering and soil formation, pedogenic processes, factors of soil formation, principles of soil classification, the FAO/UNESCO system and its application to Nepal, soil mapping. Extensive practice in soil profile descriptions and laboratory characterizations for soil classification, soil mapping.

SILVICULTURE Credits: 4

Learning objectives: The student shall have a sound knowledge of the principles and practice of silviculture and its application to Nepal. In accordance with management objectives he should be capable of planning and executing appropriate silvicultural techniques for existing high forest, degraded forest and new plantations.

Syllabus: Systems of forest, stand and tree classification. Silvicultural characteristics, identification, morphology, phenology, and physiology of the major forest trees of Nepal. Silvicultural systems - regular and irregular high forest, natural and artificial regeneration - coppice and other systems. Plantation formation - choice of species, mixed and pure stands, spacing and stocking. Appraisal of planting sites - bare ground, scrub and old forest sites. Ground preparation and amelioration. Methods of planting, weed control, fencing and protection. Maintenance of young forest crops - cleaning, pruning, thinning. Rehabilitation of degraded forest - selective felling, enrichment planting and underplanting.

STATISTICS AND SAMPLING Credits: 3

Learning objectives: The student will be taught the mathematical and statistical background to sampling and testing field data as the basis for forest inventory and assessing developments in rural situations. Also the elements of experimentation based on simple statistical method.

Syllabus: Measurements, probabilities, distributions. Means, tests of significance and confidence limits. Sampling and estimation of natural population. Replication and randomisation in experiments. Simple regression and correlation.

SOIL AND WATER CONSERVATION ENGINEERING Credits: 4

Learning objectives: The student will be able to design and implement varius structures for soil and water conservation and flood control.

Syllabus: Design, layout and construction of terrace systems, grassed wate.ways, holding basins, drop control structures, ponds, dams, levees, floodways, etc. Field problems in layout and construction of structures discussed in lecture.

IRRIGATION AND DRAINAGE Credits: 4

Learning objectives: The student will be able to design and implement irrigation and drainage systems for agriculture and forestry in Nepal.

Syllabus: Water resources for irrigation; water transport in the ecosystem; chemistry of irrigated soils; measurements for irrigation design and control - soil survey, water status of the soil, evapotranspiration, water status in plants, design of irrigation systems for various types of topography; crop water requirements and prediction of irrigation needs; drainage systems for removal of excess water. Land evaluation for irrigation; measurement of water status of the soil and plants, measurement of evapotranspiration; design and layout of an irrigation and drainage system; estimation of water requirment and irrigation scheduling.

WATERSHED MANAGEMENT Credits: 4

Learning objectives: The student should be able to evaluate a drainage basin and develop a management plan that optimizes water yield, regimen, and quality within the constraints of multiple use.

Syllabus: Institutional and social considerations - water law, regional codes of water use, constraints on ecosystem manipulation; drainage basin treatments - water quantity, water conservation and utilization, control of streamflow regimen, control of water quality; the management plan - objectives of management, watershed inventory and analysis, the treatment plan, implementation and evaluation. Develop a complete management plan for a watershed with mixed forestry and agricultural land uses.

LAND USE Credits: 3

Learning objectives: The student will become familiar with the concepts of land resource evaluation, conservation, and planning, and will be able to apply that knowledge in natural resource problems of Nepal.

Syllabus: Concepts of land-general nature and land resources and their uses; conservation of land resources and maintenance of environmental quality; land tenure and ownerhsip; land use evalaution, classification and mapping; land use planning and control; case studies of land use problems in Nepal.

ACCOUNTING AND ECONOMICS Credits: 3

Learning objectives: The acquisition of the principles of bookkeeping, accounts, costing and estimating. Simple company accounts, material and store control. The student will also gain a background to the economics of land use, forestry and conservation practices in Nepal.

Syllabus: Cost recording in the field, and estimation for expenditure and revenue. Account bookkeeping. Wage payments. Stores and materials accounting, depreciation, indirect and overhead expenses. Simple accounting for an enterprise, e.g. a firewood business. Economic theory, land, manpower and capital; simple and compound interest; discounted cash flows and cost benefit analysis.

REMOTE SENSING Credits: 3

Learning objectives: The use of remote sensing for mapping, evaluating and monitoring the environment will be covered using all technology available to Nepal, including oblique photography carried out by the Ministry of Forests itself. The emphasis will be repeated monitoring of land use and rural degradation in Nepal, and recovering therefrom.

Syllabus: Aerial photography in black and white, real and false colour. Satellite imagery, SLR. Preparation of maps. Assessment of land use patterns site degradation. Forest evaluation from the air. Evaluation of trends from repeated pictures.

FOREST MENSURATION Credits: 4

Learning objectives: The student should be capable of accurate measurement and recording of felled and standing timber, be able to carry out larger scale forest inventories and be aware of the advantages and limitations of the methods chosen, in relation to the management objectives.

Syllabus: Units of measurement for standing, felled and converted timber. Measurements of standing and felled trees - principles of tree shape, length, timber and total height, taper, bark measurements. Volume calculations by direct

measurement, use of form factor, volume tables. Measurement of forest produce. Measurement of stands and forests, stand variables, stand tables and basal area. Increment and its measurement - current and mean annual increment, yield class and site quality concepts, preparation and use of yield tables. Principles of forest inventory - current and mean annual increment, yield class and site quality concepts, preparation and use of yield tables. Principles of forest inventory - sampling methods and units, periodic and continuous inventory, applications of inventory to forest management. Organization of forest inventories - timing, staffing and equipment requirements.

FOREST PRODUCTION AND MANAGEMENT PLANS Credits: 4

Learning objectives: The student shall be able to organize forest production, according to stated management objectives. He should be able to prepare and implement management plans for the forests under his control and plan and execute annual work programs with optimmum efficiency.

Syllabus: Objects of management. Concepts of sustained yield, types of rotations. The normal forest. Organization of forest into territorial and management units. Yield regulation - classical methods and modern concepts. Forest economics - net discounted revenue, financial yield, cost-benefit analysis. Valuations of land and forest crops. Preparation of forest management plans. Implementation of management plans - production forecasting and manpower planning, planning to estimates, work organization and effective use of resources. Works and method study.

HARVESTING, CONVERSION AND UTILIZATION Credits: 4

Learning objectives: The student will cover the range of economically effective methods of forest harvesting now in use, and their application in Nepal. The application of appropriate conversion technology in different parts of Nepal, and the use of wood (including fuel) in rural and urban situations will also be covered. The student should be able to supervise work sites effectively.

Syllabus: Felling, bucking, stacking of trees. Extraction and skidding. Use of cables, skidders, tractors and animals. Marketing of produce. Types of sawmill and layout. Conversion of fuel for sale. Charcoal production. Grading and utilization of forest products. Strength, stability, workability, natural durability and preservative treatment of wood. Rural wood use, and forest products other than wood.

FOREST PROTECTION Credits: 3

Learning objectives: The student will gain an understanding of the risks to which forests and other natural and man-made ecosystems are liable, and should be able to take appropriate action to combat these risks. Legal questions are dealt with elsewhere.

Syllabus: Pests and diseases of trees and higher plants. Assessment of damage, biological, sanitary and chemical control. Fire as a factor of the environment, its control and use as a management tool. Fire fighting. Other physical factors affecting ecosystems. Biotic effects, including wildlife domestic animals and human interference. Forest influences.

WILDLIFE BIOLOGY AND MANAGEMENT Credits: 4

Learning objectives: The student will receive an introduction to the management of wildlife populations in Nepal, both within and outside the National Parks.

Syllabus: An outline of wildlife distribution in Nepal, ecological and historical factors. The behavioural and genetic aspects of population manipulation. Economic management of population and methods of increasing numbers through capture, breeding and reintroduction. The management of habitats for specific groups. Effects of culling, hunting, etc.

YEAR FOUR

TECHNICAL LITERATURE AND WRITING

Learning objectives: The student will be able to effectively utilize technical literature and will demonstrate mastery of technical writing skills.

Syllabus: Technical literature of natural resources and use of the library; characteristics of good technical writing; technical and business correspondence; library research papers; technical reports; writing for journals; effective oral communication; (should include extensive practice in writing technical materials and presenting oral reports); use of visual aids.

MATHEMATICS AND COMPUTING

Syllabus: Matrix algebra, Calculus, differential equations etc., as necessary for statistics and computing methods.

Introduction to computers - use and advantages.

Principles of Programming illustrated by the BASIC language.

Applications.

HUMANITIES AND SOCIAL SCIENCE ELECTIVES

Learning objectives: Adequate technical training should be tempered with some training in the humanities and social sciences in order to develop in the student an appreciation of people and the social structures within which people live and work.

Suggested subjects: General Psychology
Ethics and Philosophy, religions
Sociology
Governmental Systems
Political Science
Art and Literature

EXPERIMENTAL DESIGN AND BIOMETRICS

The statistical foundation; sampling methods, standard error and confidence limits. Methods of assessment. Designs: randomised, blocked, Latin square, split plot. Comparisons and confidence limits. Factorial designs, response surfaces, Covariance, missing observations, non-orthogonal designs, transformations and systematic designs. Field work, recording and writing-up.

Practical will also include the use of hand calculators in computing results, based on Statforms (Dawkins, 1975).

ADVANCED FOREST EVALUATION AND MENSURATION

Aspects of this elective subject could include:

Systems of forest and land-use classification, inventory sampling designs, photogrammetry and photo-interpretation. Stem form studies, stem analysis and dendrochronology. Yield and increment studies - preparation of volume and yield tables, production forecasting, assortment tables. Further forest biometrics.

WOOD TECHNOLOGY

Syllabus: Variation within and between trees, species and sites. Structure and properties of wood, its use and competitors. Patterns of growth and features. Timber identification, visual, lens and microscopic. Wood properties - moisture content, specific gravity, fibre dimension, strength, calorific value, chemical use. Stability and durability of wood. The study of "minor" forest products. Industrial uses of raw material from forests.

SOIL PHYSICS

Learning objectives: The student will become familiar with the principles of soil physics and applications of those principles in forestry and soil conservation.

Syllabus: The soil as a disperse system - particle size analysis; chemical nature of various types of soil particles; characteristics of clays - particle size and shape, surface behaviour of clay particles, viscosity and swelling of collodial suspensions; dynamic properties of soils - consistency, plasticity, shear strength, compaction, etc., soil structure; soil aeration; thermal regime of soils; retention and movement of water in soils; soil water - plant relations. Laboratory analyses of physical parameters - particle size analysis, porosity, water content, aggregation, plasticity, consistence, bulk density, shear strength, drying curves, hydraulic conductivity, etc. Field sampling and analyses - bulk density, aggregation, structure, aeration, water content, temperature, etc.

SOIL FERTILITY

Learning objectives: The student will become familiar with the principles of soil fertility and fertility management and be able to prescribe soil amendments for agricultural and forestry situations.

Syllabus: Plant growth and nutritional requirements; basic soil-plant relationships; soil and fertilizer nitrogen; soil and fertilizer phosphorus; soil and fertilizer potassium, calcium magnesium, and sodium; sulfur and microelements; use of organic amendments; manufacture and properties of fertilizers; liming; soil fertility evaluation; soil fertility management.

WATER RESOURCE PLANNING AND DEVELOPMENT

Learning objectives: The student will be familiar with the water resources of Nepal and be able to plan development of water resources for various uses.

Syllabus: Water and man-uses of water and the importance of water in sociology and economics; water resources of Nepal; water quality and water treatment for various purposes; water supply development and management for home, municipal, industrial and agricultural uses; long-term planning for water resource management, use, and conservation.

BUSINESS MANAGEMENT AND LAW

Learning objectives: The student should become familiar with laws relating to business in Nepal, and with the general concepts of business management and their application to the forest industry of Nepal.

Syllabus: Laws and administration in Nepal; public and private companies; monetary policy, taxation, contracts and agreements. Business systems; capital structure and long term objectives. Organization and staffing; monetary concepts and accounting. Planning and decision making; work organization control and evaluation; inventory control logistics and marketing. Forest industries in Nepal.

TREE IMPROVEMENT AND FOREST GENETICS

Syllabus: Important tree species used in plantations in Nepal. Variation between individuals and populations within species. The genetic basis for improvement; range-wide and restricted provenance testing; breeding and mating designs; the calculation and use of heritabilities. Experimental designs and methods for species introduction, provenance and progeny trials. Evaluation of tree improvement work.

ECONOMICS AND PROJECT ANALYSIS

Syllabus: The application of economic theory to the preparation of development projects in rural Nepal. Cost benefit analysis, net discounted revenue and internal rate of return. The review of ongoing projects, and post-project evaluation.

HARVESTING, CONVERSION AND UTILIZATION

Learning objectives: The student will cover the range of economically effective methods of forest harvesting in use, and their application in Nepal. The application of appropriate conversion technology in different parts of Nepal, and the use of wood (including fuel) in rural and urban situations will also be covered. The student should be able to supervise work sites effectively.

Syllabus: Felling, bucking, stacking of trees. Extraction and skidding. Use of cables, skidders, tractors and animals. Marketing of produce. Types of sawmill and layout. Conversion of fuel for sale. Charcoal production. Grading and utilization of forest products. Strength, stability, workability, natural durability and preservative treatment of wood. Rural wood use, and forest products other than wood.

ACCOUNTING

Syllabus: Double entry bookkeeping; the preparation and reading of Company or Corporation accounts. Cost recording in the field and at Divisional or other headquarters.

ADVANCED INORGANIC CHEMISTRY

Learning objectives: To acquire more in-depth knowledge of inorganic chemistry for those students who have an interest in chemistry or who need the background for graduate work.

Syllabus: Should build on the background provided in General Inorganic Chemistry in the subjects that are common; chemical bonding; chemical thermo-dynamics; the kinetic-molecular theory of gases and the general gas law; solutions and chemical equilibria; electrochemistry; chemical kinetics; in-depth study of important elements. Laboratory experiments to illustrate principles covered in lecture.

ORNITHOLOGY

Syllabus: Prinicples of Classification, structure, distribution, migration, life histories and habits, laboratory and field identification of bird by size, form colour, song and habit.

MAMMALOGY

Syllabus: Classification distribution and economic relations of mammals. Field studies also included.

ANIMAL BEHAVIOUR

Syllabus: Description of the known behaviour of the various vertebrates and invertebrate such as mating, defensive, nutritive behaviour. Behaviour will be related to the ecology of various animal populations.

WILDLIFE HABITAT ANALYSIS

Syllabus: Evaluation of environmental factors affecting wildlife species, food and cover measurement. Determination of limiting factors. Monitoring, data recording and retrieval.

Annex II. Tribhuvan University

Appendix B. Certificate Course in Renewable Natural Resources

Course objectives

The course has been designed primarily to provide over a period of two years suitable education and training for young men who wish to work in the Ministry of Forests initially at junior supervisory level (foresters and soil and water conservation technicians). The course is broadly-based and is intended not only to convey knowedge and skills, but to make the student competent in the application and transmission of knowledge and skills in the practical situation. Bearing in mind the likely demands of future employment, often in remote situations, considerable emphasis is also placed on self reliance, leadership and general personal development. A secondary objective is to give the basic grounding in practical resources conservation which, together with appropriate field experience, will (for some students) be the pre-requisite for futher formal studies in diploma level.

Entry to the course

Candidates for entry to the course must be aged 16 or over and possess the Nepal School Leaving Certificate or equivalent qualification.

In addition there will be a short oral interview and a written entrance examination in basic mathematics and English. Candidates must show evidence of basic practical aptitude and positive motivation towards a rural-based occupation.

Course outline

The course is completed in two academic years (four semesters). The whole of the first year (first and second semesters) and the fourth semester in the second year will be campus-based, with the third semester being spent in supervised field experience.

The subjects of the course are shown below, together with credit hours allotted to each subject.

Teaching methods

Different subjects lend themselves to different teaching methods and a variety of means of communication will be used during the course. Formal

lecturers will be used for basic instruction in most subjects and will be assisted by appropriate visual aids. A primary object of such lecturers is to foster a sufficiently enquiring mind in the student for him to follow up the formal instruction by self learning from notes, published material and field observations. Supervised project work, particularly in the second year of the course provides additional opportunity for individual self-learning.

Practical work in laboratory and field will be in as small groups as possible. Good practical teaching is not possible in groups of over 20 students, and this figure is still higher than ideal for many tasks. Demonstration by the teacher is no substitute for the student doing the task himself. Two-way communication and good staff-student relationships are seen as an integral part of good teaching method.

Assessment

Coursework assessment will be continuous and take the form of written, practical and oral testing. Such tests will be spaced at appropriate intervals in each subject so as to provide the best opportunities for testing and in order not to overlead the student with assessment during any part of the course.

Assessments shall be in percentages to the nearest 1% in written work, and the nearest 5% in practical, project and oral work. The pass mark shall be 50%. Students will have to achieve satisfactory standards in each course unit to enable them to continue in the course.

To obtain good assessment marks, as indicated in the general objectives, students must demonstrate not only the acquisition of knowledge, but also the application of that knowledge to practice. Emphasis will be on competency and accuracy rather than excessive speed. The field practical period is designed to assist the development of students in this regard. In the subject details outlined for the course specific learning objectives have been given to indicate to both teacher and student some of the particular tasks that the student should be able to carry out, after completion of the course and the sum total of the objectives give a clear overall profile of the successful candidate.

At the end of the course, in accordance with University Regulations, the student will be required to pass a comprehensive examination covering all subjects. It is suggested that the overall award of the certificate be based on a weighted average in the ratio of continuous assessment: comprehensive examination of 3:2.

YEAR ONE

Subject Code	Title	Credit hours 1st semester	Credit hours 2nd semester
101	Introduction to Renewable Natural Resource Management in Nepal	1	-
102	Practice of Renewable Natural Resource Conservation	5 (3+2)	5 (3+2)
103	Mathematics and Calculators	3 (2+1)	3 (2+1)
104	Introduction to Biology and Plant Identification	3 (2+1)	3 (2+1)
105	Rural Sociology and Village Economics	2	2
106	Nepali Language	2	-
107	Technical English	-	2
108	Village Crop and Livestock Systems	3 (2+1)	3 (2+1)
109	Introduction to Extension Work in Renewable Natural Resources	2 (1+1)	2 (1+1)
110	Work Practice, Hand Tool Development Efficiency and Maintenance	2 (1+1)	2 (1+1)
111	First Aid, Health and Hygiene	-	1
	Total Credits Hours	23	23

YEAR TWO

201	Field Experience period	Whole of 1st (3rd) semester - 23 credit hours

YEAR TWO

		(4th) Second semester
202	Evaluation of Field Experience Period	3
203	Law and Administration Related to Renewable Natural Resources	2
204	Soil and Water Conservation	3 (2+1)
205	Wildlife Conservaton in Nepal	2 (1+1)
206	Simple Accounts, Recording and Stocktaking	2 (1+1)
207	Timber Utilization and Intermediate Technology	2 (1+1)
208	Basic Forest Protection	3 (2+1)
209	Technique of Supervision	1
210	Individual Project Work	3 (0+3)
	Total Credit Hours	21

(Total credit hours for the course = 90)

Subject details

In accordance with the general objective, all students will undertake the same course of study. No specific options are available, but there will be opportunity both during the field experience period and in the 4th semester project work, for individual students to followup areas of particular interest to them.

An outline of subject details is given below, with learning objectives and syllabus for each subject.

(Note: In this report these are only in draft form and will require considerable amendment and additions following consultation with local staff, both from the University and the Ministry of Forests).

Certificate Course in Renewable Natural Resources

YEAR ONE

101 Introduction to Renewable Natural Resource Management in Nepal — 1st semester, 1 credit hour

Learning objectives - at the completion of the course the student will be able to:

a. Describe the main physical features of Nepal.

b. Describe the climate of Nepal in different regions, and collect and record basic weather data.

c. Outline the climax vegetation and wildlife in different parts of Nepal, and describe changes and developments to the present day.

d. Outline the structure and responsibilities of Government and other agencies associated with renewable natural resources in Nepal.

Course syllabus

Geographical position of Nepal and its neighbors. Physiography and physical geology - main physical features. Climate of Nepal - precipitation, temperature, relative humidity, sunshine, windspeed. Weather recording - basic instruments and their use. Regional variation in climate. Basic concepts of plant and animal ecology. Climax vegetation and wildlife in Nepal. Changes in historical time. Forest clearance for agriculture. Development in use of forest products - fuelwood, fodder and industrial wood. Government departments, semi-governmental, overseas and private agencies concerned with renewable natural resources - their basic structures, functions and interaction.

102 Practice of Renewable Natural Resource Conservation — 1st & 2nd semester, 5 credit hours (3+2)

Learning objectives

At the completion of the course the student will be able to:

a. Select suitable seed trees, collect, prepare and store seed for subsequent use.

b. Organize a forest nursery for the production of a range of plantation stocks.

c. Carry out all work necessary to the establishment of tree and cover crops across the range of site types in Nepal.

d. Ensure the appropriate maintenance of these crops to bring them into systematic production at the appropriate time to meet the objectives of long term conservation.

Course syllabus

Seed production by coniferous and broadleaved trees and shrubs - methods of seed collection. Seed cleaning, grading, testing and storage. Plant production - container and open-root nursery techniques for seedlings and cuttings. Selection of nursery site, maintenance of fertility, protection, stocktaking and basic nursery organization. Appraisal of planting sites - slope, aspect, exposure, vegetation and soil. Suitability for planting and appropriate choice of species. Protection of planting sites - fence layout, erection and maintenance. Other boundaries - walls and hedges. Planting of trees and cover crops. Ground preparation, correct timing, reasons for plant spacing and care to be taken in handling. Methods of planting - setting out the work, appropriate tools and planting methods. Assessment and replacement of losses. Cultural operations - weeding and cleaning. Thinning for production of fuelwoood and fodder. Effect on the development of the crop.

103 Mathematics and Calculations — 1st & 2nd semester, 3 credit hours (2+1)

Learning objectives

At the completion of the course the student will be able to:

a. List the basic units of measurement in use in Nepal.

b. Solve simple mathematical problems.

c. Calculate quantities of materials appropriate to the practice of renewable resource conservation.

d. Conduct simple land area surveys and lay out areas on the ground.

e. Measure accurately the volumes (and weights) of felled trees and fuelwood,

f. Apply appropriate sampling techniques to determine the volume of standing trees and forest crops.

Course syllabus

Units of measurement, metric, imperial and local. Elementary mensuration - area and volume measurement of simple geometric figures. Basic trigonometry. Algebra - simple equations, simulatneous and quadratic equations. Ratio and proportion. Presentation of data in tabular and graphical form. Practical forest mensuration. Weight and volume calculations for seed, fertilizer, herbicides and other materials. Land area measurement - simple chain and chain and compass survey. Plant table survey. Maps and their interpretation. Transfer of map and survey data to the ground. Slope measurement and basic levelling technique including setting out on the ground. Measurement of felled trees and fuelwood. Volume/weight conversions. Measurement of standing trees and forest crops. Basic concepts of sampling for crop measurement.

104 Introduction to Biology and Plant Identification — 1st & 2nd semester, 3 credit hours (2+1)

Learning objectives

a. Outline the structure of the plant and animal kingdoms and define the characteristics of living things.

b. Identify the main features of plants and describe their functions.

c. Recognize important forest fungi, insects, birds and mammals, and describe their life cycles and habits.

d. Describe site conditions associated with particular plant communities.

e. Identify accurately the important forest trees, shrubs and ground cover plant of Nepal, indigenous and introduced.

Course syllabus

Characteristics of living things, plants and animals. Divisions of the plant and animal kingdoms. Woody plant morphology - stem, root, leaf, flower and seed, angiosperms and gymnosperms. Basic plant physiology - water relations, photosynthesis, translocation and growth, development and reproduction of plants - sexual and asexual propagation. Classification, structure and life cycles of forest fungi, insects, birds and mammals. Plant community as indicators of site conditions. Characteristics and identification of forest trees, shrubs and ground cover plants, (including student collections). Suggest a checklist be included in the syllabus.)

105 Rural Sociology and Village Economics — 2 credit hours

1st & 2nd semesters

Learning objectives

At the completion of the course the student will be able to:

a. Describe the social structure of rural communities in Nepal in different regions.

b. State the influences which can shape particular societies and say how they can operate.

c. Give examples of the working of village economies in different regions.

d. Illustrate positive and negative aspects of natural resource conservation in local community development.

Course syllabus

The nature and characteristics of rural social systems in general. Particular social and ethnic groupings of people in Nepal. Their interactions in rural communities, status, role, caste, values. Culture and religion and its role in shaping societies. Community health, welfare and education.

Social and economic power. Exchange of goods, services and cash in rural communities. Creation and distribution of wealth. Self sufficiency and interdependence.

Role of natural resource conservation in community development - benefits and problems.

107 Technical English — credit hours
1 semester

Learning objectives

At the completion of the course the student will be able to:

a. Read general and technical English language publications, and make oral or written summaries of their content.

b. By the use of the library, prepare a simple bibliography on a stated subject.

c. Outline basic English language terminology related to a particular aspect of renewable natural resource conservation.

d. Communicate effectively in written English, in letter or report forms. Prepare written projects in good English giving due attention to presentation and style.

Course syllabus

Effective reading and comprehension - general material, newspapers, magazines, etc. Reading technical journals and textbooks - preparation of precise or study notes. Preparation of a simple bibliography - use of library - classification systems. Sources of information. Common terminology in technical publications on renewable natural resources - conventions in different countries.

Written English expression - general prose writing. Letter, memoranda and report writing. Preparation of written projects - layout, written presentation and style. Oral communication (see also 109).

108 Village Crop and Livestock Systems — 1st & 2nd semester
3 credit hours
(2+1)

Learning objectives

At the completion of the course the student will be able to:

a. Recognize the major crop and livestock types used in farming in Nepal.

b. Outline the main methods of crop and animal production in the various regions.

c. Give examples of the impact of farming systems on the land.

d. Describe the usual methods of processing and marketing farm produce.

Course syllabus

Major crops of Nepal, distribution and production. Irrigation, drainage and nutrient requirements. Common farm operations in crop production - different types of farming. Crop maintenance and harvesting. Special farming systems - terrace farming, ley farming, stubble mulch farming. Soil conservation and crop production. Animals of economic and domestic importance in Nepal. Basic methods of animal management - housing, feeding, cleaning, treatment of commmon disorders. Milk, meat, wool and poultry production. Different breeds of cattle, buffalo, sheep, goats, swine and poultry - their importance in different regions of Nepal. Grazing and browsing habits of domestic animals. Principles of range management. Processing and marketing of farm produce.

109 Introduction to Extension Work in Renewable Natural Resources

1st & 2nd semester
2 credit hours
(1+1)

Learning objectives

At the completion of the course the student will be able to:

a. Speak with authority and confidence to individuals and group about problems in resource conservation.
b. Organize and run small group meetings at village level.
c. Design and prepare an appropriate range of visual display material.
d. Lay out simple demonstration areas and use them for instructional purposes.

Course Syllabus

Principles of communication and motivation. Effective speaking - preparation of material, approach and delivery. Matching material to audience - age, sex and size of group. Group activity - responding to questions. Use of telephone, conducting interviews, giving orders, organizing and chairing meetings. Preparation and use of visual teaching aids - diagramatic and graphical presentation. Design and preparation of simple disply material - wall-charts, posters, leaflets and booklets. Development and use of demonstration areas in the field.

110 Work Practice, Hand Tool Development, Efficiency, Maintenance

1st & 2nd semester
2 credit hours
(1+1)

Learning objectives

At the completion of the course the student will be able to:

a. Use the appropriate procedure for each practical task, to optimize, work effciency.
b. Ensure that practical tasks are carried out as safely as possible.
c. Describe the basic features and mode of action of the range of hand tools available in Nepal for resource conservation work.
d. Select the appropriate tool for the task, use it in the correct manner and carry out necessary maintenance.

Course syllabus

Simple method study - correct and incorrect procedures in basic work tools. Correct and incorrect body positions in working situations, particularly lifting and carrying. Safe work practice, especially for potentially dangerous tasks. Causes of accidents and their prevention. Hand tools used in renewable natural resource conservation - their development, efficiency and maintenance. Designs and constructions of spades, picks, mattocks, rakes, slashes, machetes, fencing tools, crosscut saws, bandsaws, pruning saws, axes, files. Correct ways of using these tools; carrying them and storage. Routine maintenance procedures, sharpening, setting and oiling. Reshafting and rehandling wooden handled tools.

111 First Aid, Health and Hygiene

2nd semester
1 credit hour

Learning objectives

At the completion of the course the students will be able to:

a. Describe the fundamental aspects of human anatomy and physiology.
b. Carry out correct first aid procedures in cases of illness or accident.
c. Describe the basic principles to ensure the maintenance of good health and hygiene in rural areas.

Course syllabus

Basic human anatomy and physiology. First aid - current procedure in the

emergency treatment of casualties. Minor wounds, bites and stings, bleeding, fractures and dislocations, burns, poisoning. Treatment of shock. Methods of resuscitation. Use of common medicines for preventive and remedial measures.

Basic hygiene in food preparation and disposal of waste. Principles of good building construction, damp proofing, ventilation, fireplaces.

Health of rural workers - need for balanced diet, rest periods, particular occupational health hazards.

YEAR TWO

201 Field Experience Period — Whole of 3rd semester, 23 credit hours

Pairs of students to be allocated to specific villages, living and working in the community under the immediate control of the Pradhan Panch with guidance from DFO or DCO and their staffs. One visit to be paid by a tutor from the Institute. The aims of the attachment will be:

1. To emphasize the need to work with and through the local community in all development projects and that to achieve this, a knowledge of their total pattern of life is essential.
2. To learn from the community what their felt needs are to begin to identify some ways in which these might be met.
3. To assist the community in small development projects by physically working with them in the establishment and maintenance of forest nurseries, tree planting, erosion control, water supply schemes, etc.
4. By undertaking a small, regular teaching commitment in the local school, to encourage the young to develop a more positive attitude toward the conservation of resources.
5. To consider the most appropriate extension technique that might be used in the Panchayat and the ways in which cooperation can be fostered between officials of different HMG Departments.
6. To develop powers of observation and analysis of the total natural resources of the panchayat and to identify likely trends in the use of these resources, e.g. further deforestation, soil erosion, etc.

202 Evaluation of Field Experience period — 4th semester, 3 credit hours

The objective of this unit is to give the student the opportunity to evaluate the field experience period, just completed, and from discussion and analysis to derive maximum benefit from this experience.

204 Soil and Water Conservation — 4th semester, 3 credit hours (2+1)

Learning objectives

At the completion of the course the student will be able to:

a. State the basic elements of climate and weather and their interaction.
b. Describe the causes of water surpluses and deficits.
c. Measure and record the basic physical properties of soils in the field and laboratory.
d. Outline the effect of different land use practices on soil and water conservation.
e. Design and construct simple structures for the control of soil erosion in localized areas.

Course syllabus

Basic meteorology - elements of climate and weather - temperature, rainfall, pressure, humidity. Operation of a simple weather recording station (see also 101) (Revision and extension). Introduction to hydrology - precipitation, evapo-transpiration, water surpluses and deficits, soil moisture and its measurement. Other physical properties of soils. Water catchment areas, run-off and stream flow - basic concepts, relationship to physiography and vegetation, estimation and measurement of stream flow and flood levels.

Causes of soil erosion - predisposing factors, types of erosion, wind, water - rill, gully, sheet.

Control of soil erosion, role of vegetative cover, shrubs and trees in controlling erosion. Farming and silvicultural systems in relation to soil conservation.

Soil conservation engineering - simple structures and their construction - terraces, culverts, check dams, river training methods.

205 Wildlife Conservation in Nepal

4th semester
2 credit hours
(1+1)

Learning objectives

At the completion of the course the student will be able to:

a. Recognize and name with accuracy the major species of wildlife in Nepal.
b. Describe their habits and preferred habitats.
c. Carry out simple conservation practices where appropriate.
d. State the main laws related to wildlife in Nepal and assist in their enforcement as necessary.

Course syllabus

Wildlife in Nepal - mammals, birds, reptiles and lower animals - general features, habits, and habitats.

Populaton and distribution of wildlife by main geographical regions.

Wildlife conservation practice - methods of survey, habitat protection and development, breeding and control. Wildlife reserves and Natural Parks of Nepal - general survey and role of reserves to the nation.

The law related to wildlife.

206 Simple Accounts, Recording and Stocktaking

4th semester
2 (1+1) credit hours

Learning objectives

At the completion of the course the student will be able to:

a. Prepare and keep a simple accounting system for a natural resources enterprise at local level.
b. Make correct payments as required to subordinant staff and contractors.
c. Keep records of work done and plan future work programs.
d. Maintain accurate inventories of tools, equipment and consumable stock, updated as necessary.

Course syllabus

Principles of keeping accounts. Working to a budget, accounting sections, simple operational costing. Payment of accounts, invoicing, preparation of

simple ledger. Payment of wages, other payments to employees and contractors.

Forest recording - flow of materials in and out, operational recording by compartments. Records of work done and forecasts of future work.

Stocktaking - tool and equipment stores, nurseries. Methods of stock control, recording and updating.

207 Timber Utilization and Intermediate Technology — 4th semester, 2 cedit hours (1+1)

Learning objectives

At the completion of the course the student will be able to:

a. Describe the main features of hardwood and softwood timber, and the important properties of the commercial timber of Nepal.
b. Identify with accuracy hand samples of the main commercial timbers.
c. Select appropriate wood for different end-uses and carry out simple seasoning and preservation practice.
d. Outline methods of conversion of round timber in sawmills.
e. Operate simple wood conversion equipment.

Course syllabus

Wood as a material - advantages and disadvantages.

Wood structure - gross features, and major structural features of hardwoods and softwoods*. Moisture content and density, strength properities. Use as fuel-energy values. Wood destorying agencies and natural durability. Preservative treatment and seasoning. Conversion of wood into sawn timber and other products. Main uses for wood. Simple sawmill types, appropriate methods of preservation and seasoning for Nepalese conditions.

* Identification of land samples of main commercial timbers in Nepal.

208 Basic Forest Protection — 4th semester, 3 credit hours (2+1)

Learning objectives

At the completion of the course the student will be able to:

a. Recognize damage to trees and conservation plants by insects, fungi, man, mammals, and other agencies.

b. Describe the mode of action and life cycle of the important biotic agents.

c. Take appropriate remedial and control action where possible and be aware of situations where additional help should be sought.

d. Carry out basic fire protection measures in forest areas and in cases of fire apply appropriate techniques of fire control if possible.

Course syllabus

Abiotic factors causing damage to trees and plants - soil conditions, temperature effects - frost and sun scorch, precipitation, storms, and wind effects.

Biotic factors - bacteria, fungi, harmful plants, insects, birds and mammals. Detailed study of major biotic agents of importance in Nepal in nurseries and forest areas.

Control measures - silvicultural, physical and mechanical control, biological and chemical control. Damage by man and domestic animals and methods of reducing and avoiding such damage.

Forest fire - predisposing of burnt-over areas. Controlled burning and beneficial effects of fire.

209 Techniques of Supervision — 4th semester, 3 credit hours

Learning objectives

At the completion of the course the student will be able to:

a. Describe the role of the supervisor at different levels in the organization.

b. Control work programs, and delegate tasks as necessary.

c. Resolve everyday problems in labor relations.

d. Select subordinate staff, and contract labor, and give basic instruction in working techniques.

Course syllabus

Responsibilities of the supervisor, basic elements of supervision - maintenance of efficiency in the organization and the workers. Controlling the work delegation of responsibilty. Qualities of a good supervisor. Basic human relations - understanding people, their behavior and motivation. Art of giving

orders, maintenance of discipline, causes of misunderstanding, handling grievances. Incentives to work - financial and other. Selection and training of subordinate staff - training methods and evaluation of suceesss. Organization of contract labor.

210 Individual Project Work — 4th semester, 3 credit hours (0+3)

This unit gives the student the opportunity to carry out, under guidance, a limited piece of original investigation on a subject of his own choice. The project must be such that it can reasonably be completed in the limited time available. It should normally consist of the basic elements of observation, recording, analysis, presentation of results and conclusions drawn. It will usually be in written format.

RIBHUVAN UNIVERSITY.

. Nepali Staff

Title[1/]	1979	1980	1981	1982	1983	1984
i. Dean						
ii. Diploma lecturers						
a. Silviculturist (R)						
b. Sivilculturist						
c. Utilization						
d. Economist						
e. SW Engineer						
f. Wildlife						
g. Engineer						
h. Ecologist						
i. Hydrologist						
j. Soil Scientist						
k. Range Management						
l. Agronomist						
iii. Certificate lecturers, Pokhara						
a. Maths, Accounts, Records and Survey						
b. Biology, Wildlife, Protection, etc.						
c. " " " "						
d. RNR Management						
e. Siviculturist						
f. Soil and Water Engineer						
g. Utilization and Forest Products (& Survey)						
h. English/Nepali						
i. Law and Administration						
j. Rural Sociology, Village Systems and Agriculture						
k. Work Study Practice & Supervision						
l. Silviculturist (Agro-forestry systems)						

1/ See also Annex 2, Appendix 4

IN COUNTRY STAFF REQUIREMENTS FOR TRAINING IN RENEWABLE NATURAL RESOURCES

TRIBHUVAN UNIVERSITY.

B. Expatriates[1/]

Title[1/]	1979	1980	1981	1982	1983	1984
Coordinator		———	———	———	———	———
Curriculum Asst.		———	———	———		
Silviculturist			———	———	———	
Economist (soil conservation & forestry)			———	———	———	
Soil & hydraulics engineer			———	———	———	———
Soil scientist			———	———	———	———

1/ Terms of reference for expatriates must await definition of gaps in teaching ability in the university. The aim is to provide Nepali staff as soon as possible. A wide variety of abilities in expatriates is possible, and although the period for each expatriate is shown as being continuous, the period could be shorter, and the personnel changed as required.

Recommended Overseas Training - Existing University Staff at Hetauda

Title	Details	Period
Dean	1 month USA, 1 month UK. Suggest Michigan State and SESIG Universities (USA). Universities covering forestry, Silsoe (for SWC) and Newton Rigg. Also visit to Forestry Commission	1 month (USA) 1 month (UK)
Lecturer (Botany)	Wolverhampton trainer's course plus 3 months at university doing forest botany	6 months (UK)
Lecturer (Botany)	Wolverhampton trainer's course plus 3 months attached to Silsoe.	6 months (UK)

Note

The desire for serving staff to obtain an extra degree is understandable, but it is understood that most of the permanent staff at Hetauda already possess an MS or equivalent. The above recommendations assume that two lecturers can be spared every year, these two being the first. Subsequent years programs should be worked out on the basis of staff availability and requirements.

If the university authorities wish to enter staff for further degrees overseas, great care will be necessary to ensure that teaching capability is not impaired. Although movement of staff between campuses is normal, the absence of staff overseas for long periods will make the scheduling of teaching staff for the new courses very difficult.

Recommended Overseas Training - New Graduates for Diploma Teaching

Title	Details	Period
Forest Engineering (Graduate Engineer required)	MS (Forest Engineering) Oregon State University	2-3 years (1980?)
Forest Botany (Botany or Science graduate)	M.Sc. or attachment with no degree, in Forest Botany Oxford or other U.K. University)	2 years (1980?)
Forest Hydrology (Agriculture or Science graduate)	MS (Forest hydrology) Georgia	2-3 years (1980?)
Forest Soils (Agriculture or Science graduate)	MS (Forest soils) N.C. State University	2-3 years (1980?)
Range Management (Agriculture or Botany graduate)	MS (Range Management) Colorado State University	2 years (1980?)
Agronomy and Land Use (Agriculture)	MS (Agricultural Education) Tuskegee University	2 years (1980?)

Notes:

These scholarships are intended for young persons holding a first B.Sc. (iploma) only. If active-duty staff of the university are young and wish to apply it is very strongly advised that they be considered with applicants resulting from country-wide advertisement. Entry requirements are high, and only entrants who are likely to complete their courses within the time stipulated should be accepted, as it is extremely important that they should be back in time to start the new courses, especially the Diploma Course in 1981/82.

All these people will require specialized training in teaching methods; it is anticipated that special in-country courses will achieve this.

Recommended Overseas Training - Active Duty Officers in the Ministry of Forests for Recruitment to Tribhuvan University

Title	Details	Period 2/
Silviculture, Planning, Biometrics, Genetics, Forest Research Upper 2nd class degree	A. 1/ M.Sc. (Oxford or Bangor) plus Oxford Forest Research Course (1981 June-Oct.)	12 + 3 months (Oct. 1980)
	B. Attachment at Oxford plus Forest Research Course	6 + 3 months (Jan-Oct. 1981)
Management of Forests; Natural Forest Silviculture; Arboriculture Upper 2nd class degree	A. M.Sc./MS in Silviculture and Management e.g. Oxford/Aberdeen/USA	2 years (1980?)
	B. 4 months attachment Aberdeen; 2 months Dehra Dun; 2 months USA	8 months (1979-80?)
Harvesting and Forest Utilization Upper 2nd class degree	A. M.Sc. UK (High Wycombe or New Zealand)	2 years (1980?)
	B. Visits UK/N. Zealand/Australia	8 months
Economics, Business Management, Finance	A. MBA (USA) plus Oxford Management Course (1980 or 1982) or M.Sc. (Bradford)	2 years (1980?) +
	B. Attachment to suitable institute USA or UK	4 months (1980?)
Applied SWC Engineering Irrigation and Drainage Upper 2nd class degree	A. MS/M.Sc. USA or UK	(2-3 years) (1980?)
	B. Visits to UK and India	4 months (1979-80?)
Wildlife Biology, Zookogy, Entomology, Ecology, Management & Research Upper 2nd class degree	A. M.Sc. at Edinburgh, USA or New Zealand	2 years (1980?)
	B. Visits to UK, USA, New Zealand, East Africa	6 months (1980?)

Notes:

1/ Most active-duty officers in the Ministry of Forests, like the active-duty lecturers in the Institute of Forestry, Hetauda, already hold two qualifications; a B.Sc. and a Diploma from Dehra Dun, India. They are also experienced. Two possible programs for frurther training are given above; (a) If possible, given suitable entry qualifications and acceptance for an overseas university, (b) recommended by the mission to give a suitable background to enable effective courses to be run. In both cases, in-country courses in training methods are expected to be run before courses start.

2/ The starting date demanded by HMF(N) for Diploma courses is extremely tight if staff are to be recruited and sent overseas in time to commence teaching in 1981-82. For this reason, an urgent task for the Dean and expatriate training assistant will be to examine the programs arranged for each of the six above

and make requests for expatriate assistance, should they not return in time.

3/ It is understood that several wildlife biologists with MS degrees exist in the National Park and Wildlife office. One could well be spared to run courses at the University; if so this place could well be filled by a person studuing Sociology or Developmental Studies.

Recommended Training - Active-Duty Officers/Lecturers for Certificate Course at Pokhara

As indicated in Chapter 4, further training is expected for eight officers.

Four officers should be sent as soon as possible on the nine-month course for training officers run by FAO in the Philippines. One or two places per year might be attainable by Nepal.

(a)	1980 - 1 and 1981 - 2 -2 officers @ 9 months each	36 months
(b)	1980 - 1 and 1981 - 2 -2 officers to UK/USA on attachment @ 6 months each	24 months

These attachments are the same as those referred to in Appendix 4 - 1 for the lecturers from Hetauda.

IN COUNTRY STAFF REQUIREMENTS FOR TRAINING IN RENEWABLE NATURAL RESOURCES

TRIBHUVAN UNIVERSITY.	1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
A. Nepali Staff:						
Dean Overseas						
5 MS students to U.S.						
1 M.Sc. student to U.K.						
Officers for overseas training[1/]						
a. Silvic to U.K.						
b. Silvic to USA, UK, India						
c. Utilization UK, Australia, N. Zealand						
d. Economics USA and UK						
e. Soil & water India, USA and UK						
f. Wildlife NZ, USA, UK, E. Africa						
Overseas training for existing lecturers (2 at a time) See Appendix 4-4						
Officers for FAO Phillippines Course						
B. Course Development:						
New style certificate at Hetauda starts						
New certificate at Pokhara start						
Diploma course starts (science)						
Diploma course 2nd year in RNR starts[2/]						
C. Buildings:						
Amendments & improvements Hetauda						
Building Diploma Institute, Pokhara		Design & Construction		Occupation		
Build Certificate buildings, Pokhara		Design & Construction		Occupation		

1/ The actual length of time which these officers will be required to spend overseas depends on the types of training that can be arranged. Of course, if they can obtain entry for MS/M.Sc. study this is highly desirable. However some may not be able to do so, and the prescribed courses of study have been drawn up specifically to enable them to teach the subject effectively.

2/ By this time most of the Nepali officers should have returned from overseas.

INSTITUTE OF RENEWABLE NATURAL RESOURCES:

EXPECTED STUDENT NUMBERS

	1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
CERTIFICATE COURSES						
a. HETAUDA						
1st Year	133	150	125	110	110	110
2nd Year	98	133	135	100	100	100
Sub-Total	231	283	260	210	210	210
b. POKHARA						
1st Year	-	-	40	75	110	110
2nd Year	-	-	-	35	70	100
Sub-Total	-	-	40	110	180	210
Total 1st Year	133	150	165	185	220	220
Total 2nd Year	98	133	135	135	170	200
Grand Total	231	283	300	320	390	420
DIPLOMA COURSE						
1st Year (Prep)	-	-	10	10	10	10
1st Year (Science)	-	-	30	30	30	30
2nd Year	-	-	-	35	35	35
3rd Year (SWC)	-	-	-		17	17
3rd Year (For)	-	-	-		17	17
4th Year (Hons)	-	-	-		-	7
Total Diploma	0	0	40	75	109	116

ESTIMATED TRAINING COSTS

(For Nepali Staff Overseas)

These costs are based on the shorter of the two periods metioned in Appendix 4-3.

Costs are calculated as follows:

One academic year's course		$
Tution		5,000
Stipend at $450/month		5,400
Medical and contigencies		1,480
Books		180
		12,060
Air fares, per course (not including family)		2,500
Total for a two-year course		$26,620
	Say	$27,000

Short-term attachments (one month)	
Per diem at $50	1,500
Local travel	100
	1,600
Air fare, per visit	2,500
	$4,100

		$
(From Appendix 4-1)		
Dean 2 months	3,200 + 2,500	5,700
2 Hetauda lecturers	(2 x 6 months per year) 6,030 + 2,500 each for 3 years	51,000
(From Appendix 4-2) (young graduates)		
6 MS degrees @ 2 1/2 years each = $32,650 each		196,000
(From Appendix 4-3 serving officers)		
6 attachments. Say 60 months @ $1,600 = 96,000		
6 air fares @ 2,500	+ 15,000	
		111,000
(From Appendix 4-4 - Certificate lecturer, Pokhara)		
2 Hetauda lecturers (2 x 6 months/year) for 2 years		34,000
4 lecturers to FAO course, Philippines		
9 months @ 1,600 = 14,400		
Air fare	= 1,000	
	15,400	61,600
		459,300
	Say	$460,000

OVERSEAS TRAINING COSTS AND STIPEND/SCHORLARSHIPS FOR

CERTIFICATE COURSE

Foreign Exchange	Overseas Training ($ 000¢)	TOTAL	1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
	Dean	5.7	5.7	-	-	-	-	-
	Hetauda Lecturers	51.0	-	17	17	17	-	-
	Young graduates	196.3	-	87.4	72.6	36.3	-	-
	Serving officers	111	-	63	48	-	-	-
	Pokhara certificate staff	34	-	17	17	-	-	-
	FAO training course	61.6	-	30.8	30.8	-	-	-
		459.6	5.7	215.2	185.4	53.3	-	-
100%	Estimate: $460,000							
	IN-COUNTRY STIPENDS & SCHOLARSHIPS			NR 000'				
	Total no. of students		231	283	300	320	360	420
	No. of 'scholars' (50%),		116	142	150	160	195	210
	Stipends @ NR 1440/yr		332	408	432	461	562	605
	Schorlarships @ NR 960/yr		112	137	144	307	375	403
	Totals (NR 000') = 4.3 million	4278	444	545	576	768	937	1008
	Totals ($ 000') = $356,500	356.5	37	45.4	48	64	78.1	84

STAFF AND SALARIES AT IRNR, POKHARA

oreign Exchange		Salary/yr	1979-80 Cert.	1979-80 Dip.	1980-1 Cert.	1980-1 Dip.	1981-2 Cert.	1981-2 Dip.	1982-3 Cert.	1982-3 Dip.	1983-4 Cert.	1983-4 Dip.	1984-5 Cert.	1984-5 Dip.
	Number of:	18000	-	-	-	-	-	-	-	-	-	-	-	-
	Lecturers	-	-	-	-	-	4	7	10	13	17	13	17	13
	Admin. Officer	-	-	-	1	-	1	-	1	-	1	-	1	-
0%	Bursar	-	-	-	1	-	1	-	1	-	1	-	1	-
	Matron	-	-	-	-	-	1	-	1	1	2	1	2	1
	Total numbers		-	-	2	-	7	7	13	14	21	14	21	14
	Total of grade		-	-	2	-	14	-	27	-	35	0	35	-
	Cost, NR 000'		-	-	36	-	252		486		630		630	
	Number of:													
	Clerks	9000	-	-	1	-	1	-	1	1	2	1	2	1
	Typists	"	-	-	1	-	2	-	3	-	4	-	4	-
	Librarian	"	-	-	-	-	1	-	1	-	1	-	1	-
0%		"	-	-	-	-	1	-	1	-	1	-	1	-
		-	-	-	-	-	1	-	1	-	2	-	2	-
	Total numbers	-	-	-	2	-	5	-	6	2	9	2	9	2
	Total of grade	-	-	-	2	-	5	-	8	-	11	-	11	-
	Cost. NR 000'				18		45		72		99		99	
	Number of:													
	Cooks	3600	-	-	-	-	1	-	2	1	3	2	5	3
	Cleaners	-	-	-	-	-	1	-	3	-	5	-	8	-
	Watchmen	-	-	-	-	-	1	-	1	-	2	-	3	-
0%	Gardners	-	-	-	-	-	1	-	1	-	1	-	2	-
	Drivers	-	-	-	2	-	2	3	2	3	2	3	2	3
	Peons	-	-	-	-	-	1	-	1	-	2	-	2	-
	Total numbers				2	-	7	3	10	4	15	5	22	6
	Total of grade				2	-	10	-	14	-	20		28	
	Cost NR 000'				8		36		51		72		101	
	OVERALL TOTALS NR 000'	(2635)			62		333		609		801		830	
	OVERALL TOTALS $ 000'	(219.8)			5.2		27.8		50.8		66.8		69.2	

EXPATRIATE STAFF REQUIREMENTS AND COSTS, IRNR

Foreign Exchange Component	Description	1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
			MAN MONTHS				
	Coordinator	6	12	6			
	Curriculum Asst.		12	12			
	Silviculturist		6	12	6		
	Economist		6	12	6		
	Hydr. Engineer			12	12		
	Soils Specialist			12	12		
	Total long term	6	36	66	36		
	Consultancies @ 2 months each		10	10	10	10	10
	Total expatriate (man months)	6	46	76	46	10	10
			ESTIMATED COSTS, $ 000 1/				
100%	Long term (total $720,000)	30	180	330	180		
	Consultants (Total $250,000)	-	50	50	50	50	50
	Totals ($970,000)	30	230	380	230	50	50

1/ Consultancies estimated at $5000/month, inclusive of air travel and subsistence.

Long term expatriates estimated at $60,000/year, inclusive of travel, housing, leave, and family costs.

Building Requirements IRNR, Tribhuvan University (POKHARA)

Building space required (assuming that basic sciences would not be included) (for 35-40 students/class)

Number	Type of Room	Space/room	Total room
4	Lecture rooms	56 m^2	216 m^2
1	Lecture room with tables	120 m^2	120 m^2
1	Lecture room with tables	56 m^2	56 m^2
1	Wet laboratory (wet benches)	100 m^2	100 m^2
1	Storeroom adjacent to wet laboratory	20 m^2	20 m^2
1	Dry laboratory - tables - 2 wash stations	100 m^2	100 m^2
1	Herbarium/storeroom adjacent to the dry laboratory	35 m^2	35 m^2
1	Seminar/committee room	24 m^2	24 m^2
1	Auditorium	221 m^2	221 m^2
1	Library - including studyroom and book storage room with checkout desk	200 m^2	200 m^2
1	General equipment storeroom	56 m^2	56 m^2
1	Office - Dean	20 m^2	20 m^2
2	Administrative offices	30 m^2	60 m^2
1	Printing and duplicating room	15 m^2	15 m^2
1	Garage/maintenance area with small storeroom	70 m^2	70 m^2
8	Offices for lecturers (2/room)	20 m^2	160 m^2
1	Chemistry laboratory and store	120 m^2	120 m^2
			1593 m^2
		Say	1600 m^2

Certificate course (100 students/class)

2	Lecture rooms	84 m^2	168 m^2
4	Lecture rooms	56 m^2	216 m^2
1	Committee room	50 m^2	50 m^2
1	Auditorium	450 m^2	450 m^2
1	Wet Lab. (Wet Benches)	100 m^2	100 m^2
1	Storeroom adjacent to the wet laboratory	20 m^2	20 m^2
1	Dry lab. (tables - 2 wash stations)	100 m^2	100 m^2
1	Storeroom adjacent to the dry lab.	20 m^2	20 m^2
12	Offices for lecturers (2/room)	20 m^2	240 m^2
2	Equipment Storerooms	30 m^2	60 m^2
	Plus covered work area and workshop area; concrete floor, CI roof on wood or other supports	100 m^2	100 m^2
			1532 m^2
		Say	1550 m^2

GRAND TOTAL 3150 m^2

Add 25% for corridors, toilets, etc. 3950 m^2

PHYSICAL FACILITIES REQUIRED FOR IRNR

(HETAUDA AND POKHARA)

Foreign Exchange Component		No. of Units	Area m	Rate NR 000'	Cost NR 000'
	HETAUDA				
	Auditorium	1	450	1.5	675
	Hostels for 100 students	1	1000	1.5	1500
50%	Senior staff housing	10	-	88	880
	Bachelor single rooms	10	-	2	20
	Total Hetauda				3075
	POKHARA				
	A. Site development				
	Water supply	-	-	50	50
40%	Electricity	-	-	340	340
	Roads, km	2.1	-	50	105
	Nursery, Sports, Amenity	-	-	10	10
	Sub total, site development				505
	B. Staff quarters				
	Senior staff housing	38	-	88	3344
50%	Junior staff housing	11	-	20	220
	Bachelor single rooms	10	-	2	20
	Sub total, staff housing				3584
	C. Teaching and student accommodation				
50%	Teaching building	-	3950	1.5	5925
	Hostels for 330 @ [illegible] m	330	3300	1.5	4950
	Sub total, teaching and students				10875

SUMMARY OF SITE DEVELOPMENT AND BUILDING COSTS IRNR

Foreign Exchange Component		Total	1980-1	1981-2	1982-3	1983-4	1984-5
			NR	'000			
50%	Hetauda buildings	3075	1500	1575	-	-	-
40%	Pokhara site development	505	505	-	-	-	-
50%	Pokhara staff	3584	1000	2000	584	-	-
50%	Pokhara teach/students	10875	2000	5000	3875		
	Add 8% for soil test supervision etc. to building cost only						
50%		1406	360	686	360	-	-
	Total (NR 000')	19445	5365	9261	4819		
	Total ($ 000')	1620.5	447.1	771.8	401.6	-	-
	Estimated at $1.62 million						

EQUIPMENT LIST

Note: Prices quoted in pounds sterling. For $ U.S. divide by 2

Certificate Course Equipment Requirements (110 students: 5 groups of 24)

Met. Equipment	No. Required	Unit Cost (f)	Total Cost (f)	
Rainguage	5	20	100	
Wet/dry bulb	5	5	25	
Sling psychrometer	5	15	75	
Max-min therometer	5	5	25	
Anemometer	1	100	100	325
Field Equipment				
Mattocks, spades, rakes	25 ea		500	
Knapsack sprayers	5	35	175	
Fence strainers	10	23	230	
Crowbars	25	3	75	
Mells	25	7	175	
Pliers	25	4	100	
Nursery equipment	-	-	600	
Refrigerator 10 ft.^{3}	1	130	130	
Secateurs	10	8	80	
Long handled pruners	5	15	75	
Machetes	25	4	100	
Slashers	25	8	200	
Ladders	5	40	200	
Cross cut saws	15	5	75	
Bowsaws	15	10	150	
Wedges felling	30	2	60	
Axes 3-4 lb.	15	6	90	
Files flat	30	2	60	
Saw sets	15	2	30	
Clamps for saws	1	5	5	
Chainsaws (homelite)	4	150	600	
(and spares)	-	-	-	
First aid eqpt.	25	5	125	3765
Glassware				
Miscellaneous			600	
(Replacement 1/3 in 4 years)			300	900
Botanical				
Craft knives	25	1	25	
Lenses	25	0.50	13	38

Survey	No.	Rate	Total	
Tapes 20 and 3 m	30	13.5	405	
Diameter tapes 2 m	30	1	30	
Metric chains	25	25	625	
Prismatic compass	25	30	750	
Opitcal squares	10	5	50	
Ranging rods	60	5	300	
Clinometer, Suunto	25	25	625	
Tally counters	25	5	125	
Chain relascopes	25	0.5	13	
Abney level (India)	25	10	250	
Hectare grids	50	1.25	63	
Dumpy levels	2	540	1080	
Drawing boards and T squares	25	10	250	
Drawing instruments and scales	25	20	500	5066
Soil Equipment				
Oven	1	500	500	
Balance torsion 1200 g	1	525	525	
Balance beam (12.5 kg)	2	15	30	
Soil tensiometer	3	25	75	
Volumetric samplers	5	10	50	
Soil augers tubs	5	20	100	1280
Visual Aids Equipment				
Camera 35 mm SLR & lenses	1	450	450	
Projector 35 mm Slide	1	250	250	
OHP	2	150	300	
Thermofax	1	250	250	1250
Miscellaneous				
Offset litho printer (small)	1	2900	2900	
Photocopier	1	1500	1500	
Planning charts, magnetic	1 set	75	75	
Maintenance equipment for campus		0	2000	
Basic carpentry kit	1	300	300	6775
				£ 19399

£19,399 + 50% carriage etc. @ £1-NR 24 = NR 700,000

Estimated at $58,350

DIPLOMA COURSE: EQUIPMENT REQUIRED

Description	No. Required	Unit Cost (£)	Total Cost (£)
Meteorology			
Complete Weather Station including:			
Mechanical Chart Hydro-Thermograph	1	100	100
Evaporation Pan	1	5	5
Standard Rain Guage	1	20	20
Insulation Instrument	1	250	250
Barometer	1	150	150
Anemometer	1	100	100
Accessories including Stands/Papers, etc.	-	-	75
Simple Weather Measurement Equipment			
Max-min Thermometer	12	5	60
Sling Psychrometer	12	10	120
Rain Gauge	12	20	240
			1120
Hydrology			
Water Level Records with Machanical			
Chart Drive for Hydr. Stations	3	600	1800
Water Velocity Instruments	12	30	360
Sediment Samplers	12	10	120
Plastic Water Sample Bottles	200	0.5	100
			2380

Description	No. Required	Unit Cost (£)	Total Cost (£)
Hydrology and Soils - Wet Laboratory			
Drying Oven, Forced Draft, Large	1	-	440
pH Meters	3	170	510
Colorimeters	3	70	210
Volumetric Cylinder and Hydrometer for Soil Texture - 1 litre	12	12	144
Timbers	12	10	120
Cans with Lids for Bulk Density, Soil Moisture and Porosity	200	0.5	100
Glassware and Accessories, Chemicals	-	-	300
Still - For Production of Distilled Water	1	-	120
Triple Beam Balances	5	90	450
Top Loading Balance (1 cg)	5	500	2500
			4894
Soils Field Equipment			
Soil Samplers with Tub and Auger	12	19	228
Bucket Augers	12	20	240
Volumetric Samplers	12	10	120
Porous Cup Tensiometers	24	30	720
Soil Colour Books	12	20	240
			1548

Description	No. Required	Unit Cost (£)	Total Cost (£)
Year 1			
General, Systematic Botany, Plant Physiology Item			
Microscope (Students, Mirror Type) 10x Eye Piece; 4x, 10x 40x objectives	25	110	2750
Resin Column Deionisers	2	100	200
Oven	1	-	150
Glassware: Petri-Dishes, Beakers, Measuring Cylinders, Slides, Coverslips	-	-	300
Razor Blades, Needles, Scissors, Tweezers Brushes, etc.	-	-	50
Chemicals, Stains, etc.	-	-	150
Prepared deomstration Slides	-	-	50
Visual Aids - Simple Wall Charts, Botanical Models, etc.	-	-	100
Plant Physiology Equipment. viz. Photosynthesis; Osmosis; Transpiration; Plant Hormones; Tropisms; Germination (detailed advice required)	-	-	300
Balances - Top Braking, Capacity 350g	4	360	1440
Miscroscopes - Staff & 4th year students; inbuilt light source & with microprojector attachment	2	425	850
Hand Lenses - (10x)	25	2	50
			6390

Description	No. Required	Unit Cost (£)	Total Cost (£)
Year 2			
Statistics			
Calculators - Simple 4 Function	25	6	150
Calculators - Statistical (For Staff/4th year students)	3	-	250
			400
Surveying, Mapping and Draftsmanship			
Metric Chains	5	25	125
Compass - Prismatic	5	32	160
Compass - 'Suunto'	10	25	250
Clinometer - 'Suunto'	10	25	250
Levels, Staffs & Ranging Rods (24)	2	575	1150
Hectare Grids	30	1.5	45
Drawing Board	60	10	600
Drawing Instrument Sets	24	10	240
Field Books (included under stationery)	-	-	-
			2820

Description	No. Required	Unit Cost (£)	Total Cost (£)
Year 3 (40 Students to 3 Groups)			
A. Mensuration 1			
Tapes - 30 m Fibreglass	15	15	225
Tapes - 2 m Diameter	15	1	15
Tapes - 1 m Diameter	15	0.75	12
Hysometer - 'Suunto' Direct Read	15	25	375
Abney Levels	10	40	400
Steel Calipers - 1m	10	15	150
Bark Gauges - Swedish	15	10	150
Clipboards	15	3	45
Relascope (Deomstration)	1	25	25
Tally Counter	10	5	50
Scribes	10	1.5	15
Relascope (Simple Chain)	15	2	30
Relascope (Wedge Prism)	4	10	40
Plastic Tape (For Flagging)	-	-	50
			1582
B. Silviculture			
Refrigerator	1	-	130
Seed Germination Cabinet	1	-	250
Freezer (small)	1	-	100
Knapsack Sprayers and Chemicals	6	30	180
Spring Balance (simple)	1	-	15
Nursery (For Demonstration Purposes)	-	-	-
Classhouse	1	-	200
			875

	No. Required	Unit Cost (£)	Total Cost (£)
Miscellaneous			
Basic workshop - for repair and maintenance of hand tools and equipment. to include carpentry tools, band saw, drill press, rip saw, jointer-shaper	-	-	6100
Basic Vehicles Maintenance Equipment	-	-	2000
Grounds & Building Maintenance Equipment (under certificate course)			
Storeroom with basic forest hand tools	-	-	1000
			9100
£39,971 + 50% for carriage/duty etc			39,980

at 1 + NR 24 + 1,439,000

estimated at $119,920 ---> $120,000

SUMMARY OF FURNITURE, EQUIPMENT & VEHICLES REQUIRED, IRNR

Foreign Exchange Component		Total	1980-1	1981-2	1982-3	1983-4	1984-5
	HETAUDA						
%	Furniture (hostels)	34	-	34	-	-	-
40%	Furniture (teaching)	20	-	20	-	-	-
95%	Equipment	350	100	200	50	-	-
90%	Trucks, 7T (2) @ 190,000	380	190	190	-	-	-
	Total, Hetauda	784	290	444	50	-	-
	POKHARA	NR'000					
40%	Furniture (teaching)	296	-	196	100	-	-
0%	Furniture (hostels)	50	-	50	-	-	-
96%	Equipment (Cert.)	7 0	-	400	300	-	-
	" (Dip.)	1439	-	1000	439		
	Trucks 7t (2)	380	190	190	-	-	-
	Cars at 100 (1)	100	100	-	-	-	-
90%	4WD vehicles @ 250 (2)	500	-	500	-	-	-
	M/cycles 125 cc @ 16 (2)	32	-	32	-	-	-
	Minitractors @ 8 (2)	16	-	16	-	-	-
	Total Pokhara	3513	290	2384	839		
	Total IRNR (NR '000)	4297	580	2828	889	-	-
	($ '000)	358.1	48.3	235.7	74.1	-	-

Recurrent Costs and Maintenance

Foreign Exchange Component		Total (Project)	80/81	81/82	82/83	83/84	84/85
0%	Maintenance of buildings Water & electricity	800		50	150	300	300
0%	Stationery, telephone Teaching materials	400	10	40	80	120	150
	Total maintenance/ year	12000	10	90	230	420	450
75%	Vehicles '000 km. per year Trucks (km)		52000				
	4WD (km)		25000				
	Car (km)		15000				
	m/c (km)		9000				
	3/-Trucks		160	160	160	160	160
	Costs) 4/-WD		100	100	100	100	100
	per) 2/-Car		30	30	30	30	30
	km) 1/-m/c		9	9	9	9	9
	Total, vehicles/year . . .		299	299	299	299	299
	Total, vehicles/ project . . .	1495					
	TOTAL RECURRENT (NR '000) . . .	2695	309	389	529	719	749
	$	224.6	25.8	32.4	44.1	59.9	62.4

= NR 2.695 million

Estimated at: $224,600

Notes on Selection of Campus Sites at Pokhara

1. A visit-was made on 9-10 May 1979 by two members of the joint USAID/ODM forestry training mission (Dr. A. Henry and D.H. Wallace) with Mr. M. Haque (Dean of Forestry at Tribhuvan University, Hetauda). During the visit, the group was accompanied by Mr. L.R. Shakya (D.F.O.), whose local knowlege was most valuable.

2. The purpose of the visit was to look at possible sites for the location of the proposed new Forestry Diploma/Certificate Course Campus and select the most appropriate one.

3. During the visit the group also discussed possibilities with:

   Mr. R. Singh - Zonal Commissioner
   Mr. S.M. Sriwastav - Chief District Officer
   Mr. P.B. Chhetri - Town Planning Dev. Officer
   Mr. G. John - Asst. Dean, Tribhuvan University, Pokhara

4. Nine possible sites were looked at. Details of the one recommended are given below (paras 5 and 6) followed by comments on those rejected (para 7).

5. DUNGESANGU SITE. This is the site recommended for consideration by all three members of the visiting group. It lies approximately 5 km by road SE of Pokhara town. Access by tarred road is available as far as the small village of Rembassar. From there, for approximately 1 km, there is a metalled road to the Leper Hospital and after that a level track easily negotiable by Jeep. The site was estimated to extend to approximately 12 acres of firm level land adjoining a wooded hill, all belonging to the Forest Department. It was said further ground to the north could be purchased if required. Apart from a small primary school on top of the hill there are no existing buildings. Land to the south of the hill borders the river SETI gorge and would be unsuitable for building on due to erosion by the river. It could however, be useful for nursery site, trial plots, etc. Services are available nearby. An exiting H.T. electricity line runs near the area and, subject to installation of a transformer, could supply power to the campus. The existing town generated supply is expected to be linked to a national "grid" system in about 2 years. For water a 3" main is to be installed into the area immediately north of the site appears suitable and should certainly be further investigated to establish outline plans and costs.

6. Information on water and electricity services was obtained from the local offices of these utilities. The proposed locations were also discussed briefly with the Zonal Commissioner and Chief District Commissioner both of whom favoured the KHAIRENITAR area from a zonal planning view. They felt it was desirable to spread developments elsewhere within the region but accepted that the mission would have to recommend what it considered best in its view. The Khairenitar site could however be used by the Forestry Institute as an experimental area for afforestation and species trials.

7. The other sites seen and rejected were:

a. MALE PATAN area to west of town - rejected as being intensively farmed with frequent houses and in several ownerships.

b. LAMACHAUR area to N.W. of town - rejected for same reasons.

c. BHALAN area to north of town - rejected because of lack of access. The area lies across a major river gorge which would be difficult and extremely costly to bridge.

d. PRITHVI NARAYAN CAMPUS - although there is some land adjoining the existing campus this is already allocated for extension of other University departments. Some land closer to the river SETI is much too unstable for any building development. There is, therefore, no site available here.

e. PHULWARI GAON - this lies across the river to the east of the present campus; again the land near the river is fissured and unstable. Land further back from the river is privately owned and would involve problems of purchase and resettlement of existing people who farm part of the area. Bridging the river would be extremely expensive other than by suspension foot bridge and there would also be problems with a public road through the area. Because of all those complexities, the area was rejected.

f. RANGHAT - a bare land site lying either side of the very deep and narrow river SETI gorge immediately east of the town. The area nearest the town has been enclosed by stone wall and fence and is being developed as the town park. There might also be problems with land stability. Because of these two factors, the site was rejected.

g. CHHORE PATAN - an area about 4 km south of the town centre near the Tibetan Refugee Camp. Because of insufficient area of clear firm site land, the area was rejected.

h. BIRAUTA BAZAR - approximately 3 km south of the town. The area would be suitable as a possible campus site because of extensive firm and reasonably level land, easy access and close proximity of mains water and electricity. However, the area is scheduled under the town development plan for tourist development and it appears the Town Planning Department would not favour University development. There could also be problems in acquiring the land which is in private ownership. Although the site rejected, it might be reconsidered if problems arise with the one recommended.

Details of Proposals for Ministry of Forests Training Wing (MFTW)

Contents

Appendix 1 Summary of responsibilities and activities of the Ministry of Forests Training Wing

2 Outline of Ministry of Forests Training Wing Courses
- 1 Reorientation Course of DFOs
- 2 Community Forestry Course for Rangers and Foresters
- 3 Reorientation Course for Rangers/J.T.s/Overseers in SWC
- 4 Panchayat Forest Foreman Course
- 5 Soil and Water Conservation Assistant's Course
- 6 Soil and Water Conservation Officers Updating Course
- 7 Foresters Course
- 8 Course for Forest Guards

3-1 Staffing requirements and Costs MFTW

3-2 Recommended overseas scholarships - MFTW staff

3-3 Activity schedule for overseas training, in country courses and buildings

3-4 Expatriate staff requirements and costs, MFTW

3-5 Numbers expected on MFTW courses (man weeks)

3-6 Details of buildings required, MFTW

3-7 Ministry of Forests Training Wing - Equipment list

3-8 Capital requirements and costs, MFTW

3-9 Summary of recurrent costs, MFTW

3-10 Critical path analysis, MFTW

A separate contents list is given here to facilitate the use of the Annex for planning within the MFTW.

Summary of Responsibilities and Activities of the Ministry of Forest Training Wing

The functions of the Training Wing within the Ministry of Forests would be:

Develop and co-ordinate training programs, including the specification of overseas training for all staff.

provide training services and facilities for the running of short in-service, job-related courses.

advise, monitor and evaluate training.

To meet these objectives the following staff and facilities would be needed.

Staff

Initally three professional officers would be required. These would be the Chief Training Officer (CTO) who would have overall responsibility for training to Secretary. Under the CTO would be two training officers, one responsible for Forestry, the other for SWC. For the first two years, two expatriate officers with training expertise would be attached to the MFTW to help develop training programs and course syllabi. In addition two technical staff (Ranger grade) would be required (one based at Chautara) to assist in organizing and running the course at central or regional bases. Support staff needed would be a clerk, a typist, a printing technician, a storekeeper, three drivers and a peon. In addition, two expatriates would be required for two years. Estimated staff costs (excluding expatriates) are NR 659,000 over five years.

Accommodation

As the Ministry of Forests is to remain in its existing office, no accommodation is available for the Training Wing there or in the new SWC Centre to be built alongside. It is therefore proposed a purpose-built MFTW unit be constructed on an available site behind the present Minfor offices and adjoining the SWC Centre. The same architect would be employed as for the latter to give a unified scheme.

In addition, an area for demonstration and field training is required for Centre based courses. For this, the Chautara area 87 km NE of Kathmandu would be well suited because of the community forestry development that has already taken place there. To organize and run the field based part of courses there, it is proposed one technical training staff be based there. The required floor area is

520 m^2 (Kathmandu); 300 m^2 (Chautara). Total estimated cost for buildings and furniture is NR 1,753,000.

Vehicles

Centre based training staff would have to be mobile to enable them to help organize and run regional courses. They also have to assess training needs and evaluate results in the field. This would require appreciable travelling for which the following vehicles are proposed:

2 Four-wheel drive vehicles (one at Chautara)

2 Small Cars

1 Lorry

The estimated cost for vehicles is NR 780,000.

Equipment

Visual aids, printing equipment, office equipment and tools will be required for both the Kathmandu and Chautara centres. They are listed in Appendix 3-7, and are required for preparation of teaching class notes, manuals, aids and materials for both centrally-run courses and those carried out in rural centres. This is especially important for the latter. Equipment costs are estimated at NR 405,000.

Phasing and Cost of In-Service Training

Selection of the Chief Training Officer has been completed and he should undertake training abroad by December 1980. The two expatriate staff should take up post in January 1980 and the two Minfor Training Officers should also take up their posts then, followed in February by the two technical trainers. This will enable CTO and expatriates to train the trainers. This should be completed by the end of March 1980, enabling MFTW based courses to start in April 1980. Temporary office and training facilities would be needed in Kathmandu, but it is hoped the Chautara facilities would be available by then.

The reorientation courses for Foresters and Rangers are of prime importance and it will take 20 courses (20 participants/course) to cover existing and proposed additional staff in the project. A six week course is proposed, but some staff may be identified whose existing technical knowledge in nursery, afforestation and protection work is sufficient to make the second half of the course unnecessary for them. However, assuming the initial courses are all based on

six weeks, this would enable three courses to be run April-June 1980 and eight in the full year following. It would also be essential to run at least one 2 week course for DFOs at an early stage. Any earlier start then this would require staff and resources for another sources.

Recurrent costs

Recurrent costs are estimated as shown in Appendix 3-9, broken down under the following heads:

Training Officers Allowances

Vehicle Costs

Building Maintenance

Furniture and Equipment Replacement

Electricity and Water

Telephones, Stationery and Teaching Materials

The annual cost is estimated at NR 700,000/.

Description	No. Required	Unit Cost (£)	Total Cost (£)
C. Management & Evaluation			
Nil			
D. Harvesting, Conversion and Utilization			
Visual Aids - T.R.A.D.A. Wall Charts, Timber Samples, etc.	-	-	200
			200
Administrative Equipment			
Typewriters	2	-	1050
Offset Litho Printer	1	-	2900
Photocopier	1	-	1500
Camera-35mm + Lesnes & accessories	1	-	500
Slide Projector-35mm + Lenses	2	300	600
Overhead Projector	2	150	300
Chart Holders & Paper	-	-	300
Adding Machine with Printer	1	160	160
Chalk Boards (each classroom)	3	100	300
Thermofax (for making transparencies)	1	250	250
Projector (16mm Cine)	1	-	800
			8600

The following sections outline the major training needs with which the MFTW would be involved, primarily in helping develop the training courses necessary to meet needs and in producing course syllabi and training materials. There would also be a need to monitor the effectiveness of the courses and assess progress with the training program.

Outline of Ministry of Forests Training Wing Courses

1. Title : Reorientation Course for DFOs

Participants : DFOs in C.F.D.P. area

Numbers : 20

Duration : 2 weeks

Location : Kathmandu and Chautara (MFTW)

Objectives : On completion of courses participants will be able to:

a. Describe HMG policy on rural development.

b. Demonstrate detailed knowledge of current panchayat forest legislation and the aid available under this.

c. Detail the potential benefits of CDF schemes to local staff or community representatives.

d. Speak effectively to groups using simple teaching aids.

e. Initiate, develop and monitor CFD schemes within their division in cooperation with other agencies.

Syllabus:

Current status in hill areas; HMG policy on rural development; existing forest legislation and aid schemes	2 days
Identification, planning and development of local schemes and the benefits arising	2 days
Integrated land use and coordination with other agencies	1 day
Basic teaching methods and aids	1 day
Field visit to identif' development, methods and problems on community schemes (Chautara)	3 days
Problem identification and analysis	1 day
Exercise on presentation of development scheme to a group	2 days

2. Title : Community Forestry Course for Rangers and Foresters

Participants : Rangers and Foresters in CFDP areas with responsibilities for implementation of the project schemes

Numbers : 20 approximately

Duration : Up to 6 weeks in two 3 week modules

Location : MFTW at Kathmandu and Chautara

Objectives : On completion of the course participants will be able to:

a. Outline current policy on rural development.

b. Explain the provisions of current panchayat forest leglislation and the aid available through this.

c. Speak to small groups of people effectively using simple visual aids.

d. Plan, organize, and run simple training sessions on technical forestry subjects.

e. Carry out detail planning and organization of local C.F.D. schemes on consultation with local panchayat.

f. Monitor such schemes and take action to correct any deficiencies.

g. Provide basic technical help for local forestry schemes.

Syllabus:

(Note: It is proposed this course be run in two 3 week modules. The first would be for all relevant participants; the second, covering technical aspects, for those lacking the necessary knowledge of nursery work, afforestation and protection operations.)

Week 1 - Current policy and legislation. Aid and benefits of C.F.D. schemes erosion control and integrated land use. Problems arising where this is absent. Speaking to small groups and handling discussion sessions. (P.I.).

Week 2 - Field visit - Identification of problem areas, preparing action plans, nursery siting and planning, species for afforestation; demarcation and protection methods; management plans (field work), local consultation methods.

Week 3 - Public relations; planning and running of sample training sessions; coordination with other agencies and staff. Public speaking (P.II.). Preparation of a simple management plan and its control.

Week 4-6 - (Field based) - Nursery siting and preparation; identification of suitable species; seed collection and storage; seed sowing and raising of seedlings in nursery; afforestation methods; sample surveying and demarcation; protection methods; sample erosion control in the field; management methods for production of fodder, fuelwood and timber.

3. Title : Reorientation Course for Rangers/J.T.s/Overseers in S.W.C. Department

Participants : Members of above grades during first year of service with SWC Department

Numbers : 20 approximately

Duration : 5 weeks

Location : MFTW Kathmandu (2 weeks) + field (3 weeks)

Objectives : On completion of the course participants will be able to:

a. Outline current policy and legislation on rural development particularly in field of SWC.
b. Identify the courses and symptoms of erosion
c. Specify methods of controlling these.
d. Plan, organize and implement preventive and control measures
e. Participate in the development and implementation of schemes involving local panchayats.
f. Plan and carry out simple training sessions.

Syllabus:

Weeks 1-2 - Existing policy and legislation; aid available for local schemes; speaking to small groups; planning and running sample training session; basic concepts of the courses, effects and control of erosion.

Weeks 3-5 - (Field) - Basic types of erosion, major preventive measures; simple control measures including their design and implementation (seeding, planting, mulching, checkdams, sediment trabs, drainage systems, etc.).

4. Title : Panchayat Forest Foreman Course

Participants : Individuals selected from local panchayats for the post

Numbers : 20 approximately

Duration : Two periods of 3 weeks each plus 1 month attachment with skilled nurseryman

Location : Divisionally based at suitable local centres

Objectives : On completion of the course, participants will be able to:

a. Identify suitable species for raising and planting in their locality
b. Select, collect and safely store seed from such species
c. Sow and raise planting stock in a nursery
d. Lift and transport planting stock by best methods
e. Plant and tend trees till established
f. Establish and manage forest grasses and legumes

Syllabus:

Weeks 1-3 - Species identification; recommended species, selection of seed courses; seed collection by safe and effective methods; seed storage and inspection, nursery siting, layout and protection. Plantation maintenance (weed control, etc.), protection and management.

Weeks 4-6 - Seed sowing, (methods, materials and equipment); seedling and transport; tending (protection, weeding, watering); lifting and transport nursery stock to planting site; man-power requirements. Planting methods (including equipment, labour requirements and scheduling). Establishment and management of forest grasses and legumes.

5. Title : Soil and Water Conservation Assistant's Course

Participants : SWC Assistants selected by their department

Number : Approximately 20

Duration : 8 weeks in two 4 week modules at approximately 12 months intervals

Location : Suitable local centre in the Pokhara/Dungesangu area in view of existing SWC projects there

Objectives : On completion of the courses, participants will be able to:

First module:

a. Identify the more important tree and grass species relevant to SWC work
b. Select, collect, store seeds from appropriate sources
c. Carry out basic nursery operations of preparing seed beds, sowing, tending, potting and preparing stock for dispatch.

Second module:

d. Plant and tend trees till established, including those in trial planting
e. Carry out simple measurement and survey techniques in the field
f. Establish boundary fences or demarcation lines using the appropriate materials
g. Carry out emergency maintenance on small SW structures

Syllabus:

First module:

SWC Department's objectives; community participation. Identification on main tree and grass species relevant to SWC work. Selection of seed sources; seed collection methods and timing; correct seed storage techniques.

Preparation of seed beds, seed sowing, preparation and use of plastic pots, protection and tending of nursery stock. Preparation of planting stock for dispatch to planting.

Second module:

Preparation of planting site, transport and care of planting stock; planting techniques, protection and establishment operation. Special aspects of trial plots.

Simple field measurement and surveying.

Types and methods of establishing boundary fences, markers, live fences etc. Materials required.

Outline of materials and methods used in small scale SWC works.

Maintenance of these and methods of emergency repair.

6. Title : Soil and Water Conservation Officers Updating Course

Participants : SWC Officers and other associated professional officers

Number : 20-25

Duration : One week (normally annually in October)

Location : MFTW Kathmandu

Objectives : On completion of the course, participants will be able to:

a. Define new techniques or methods for soil and water conservation

b. Decide on their relevance within their own area of responsibility and implement those that are agreed as relevant

Syllabus:

This will be nonstandard and may involve field visits. The course will be arranged each year by the Training Officer (SWC) in conjunction with the Department of SWC.

7. Title : Foresters Course

Participants : Existing Foresters selected as having potential for promotion to Ranger

Numbers : One course per annum for approximately 20 people

Duration : 6 months - 3 months centrally based and 3 months on-the-job training

Location : Initial 3 months at Pokhara Forestry Institue followed by 3 months at home or other suitable station.

Objectives : The purpose of the training will be to give participants a basic course in forest technology, supervisory skills and job-related management techniques. This will give them the opportunity to compete more effectively for promotion to Ranger.

Syllabus:

Months 1-3 - Basic sylviculture; nursery and establishment operation. Protection (main pests/diseases and protection against influence of man and animals); simple survey techniques and mapping; soil conservation; wildlife. Extension work; current policy and legislation. Development of surpervisory skills; communication; simple forest management and accounting.

Months 4-6 - These would be in the field, working to a training plan agreed upon by tutor, field supervisor and trainee. This plan would identify specific areas which the trainee needs to cover and the time to be spent on these. It would also include a simple project on a local problem.

8. Title : Course for Forest Guards

Participants : Forest Guards (priority being given to those in CFD areas)

Numbers : 20 (maximum)

Duration : 8 weeks, field course

Location : Suitable local centres

Objectives : On completion of the course, participants will be able to:

a. Outline aid available to local panchayats for community forestry development schemes

b. Identify potential C.F.D. areas in their locality

c. Advise local people on how to participate on developing agreed areas and the benefits to be obtained

d. Offer basic technical help with local schemes through participation and demonstration

Syllabus:

Week 1 - Introduction; problems with current land use; existing policy and legislation for forestry; aid available to local communities for development schemes and contribution expected of them. How to approach local people and discuss participative schemes. Visits to successful schemes and problem areas and identification of major factors in these.

Week 2 - Forest legislation, its purpose and implementation. Influence of man, fire and grazing on forests and benefits to be obtained when people cooperate to control these. Prevention and control of erosion by good land use.

Week 3 - Basic silviculture - species identification, tree growth; establishment and maintenance operations; characteristics and uses of main species (fodder, fuelwood, timber, erosion control, etc.).

Week 4 - Nursery work - seed collection and storage (requirements of different species), extraction, sowing, (soil requirements, seed bed preparation) use of plastic pot containers, protection and watering. Lifting and preparation of plants for dispatch.

Week 5 - Demarcation - simple survey techniques, methods of demarcation and choice of method.

Week 6 - Afforestation methods; site preparation; planting methods and tools, protection and weed control. Man power requirements and organization of the job.

Week 7-8 - Management of community forests, production of fodder, fuelwood and timber and how to sustain yields selection felling, conversion and removal of timber. Timber measurement, construction of access paths, test and conclusion.

STAFF REQUIREMENTS AND COSTS MFTW

Foreign Exchange Component		Total	1980-1	1981-2	1982-3	1983-4	1984-5
	Professional staff (18000)		3	3	3	3	3
	Technical staff (9000)		2	2	2	2	2
	Office staff (9000)		2	4	4	4	4
	Others: Watchmen (3600)		-	2	2	2	2
	Cleaners (3600)		-	2	2	2	2
	Drivers (3600)		2	5	5	5	5
	Costs Professional		54	54	54	54	54
	(NR '000) Technical, etc.		36	54	54	54	54
	Other		7.2	32.4	32.4	32.4	32.4
0%	Total costs (NR '000)	659	97.2	104.4	104.4	104.4	104.4
	Total costs ($ '000)	54.9	8.1	11.7	11.7	11.7	11.7

Estimated at $54,000

1/ Senior clerk, typist, printer, storekeeper.

RECOMMENDED OVERSEAS SCHOLARSHIPS - MFTW STAFF

Title	Details	Date
Planning Cell Chief	1 month USA, 1 month UK (to accompany Dean	
Chief Training Officer	1 month USA (as for Dean and PCC), then Huddersfield Course for Course Organizers and visits to UK institutions. Practical: draw up materials for in-service courses	1.9.79 Huddersfield Course starts 2.10.79
Training Officer	3 month training officer course plus attachment	1980?
Training Officer	3 month training officer course plus attachment	1980?

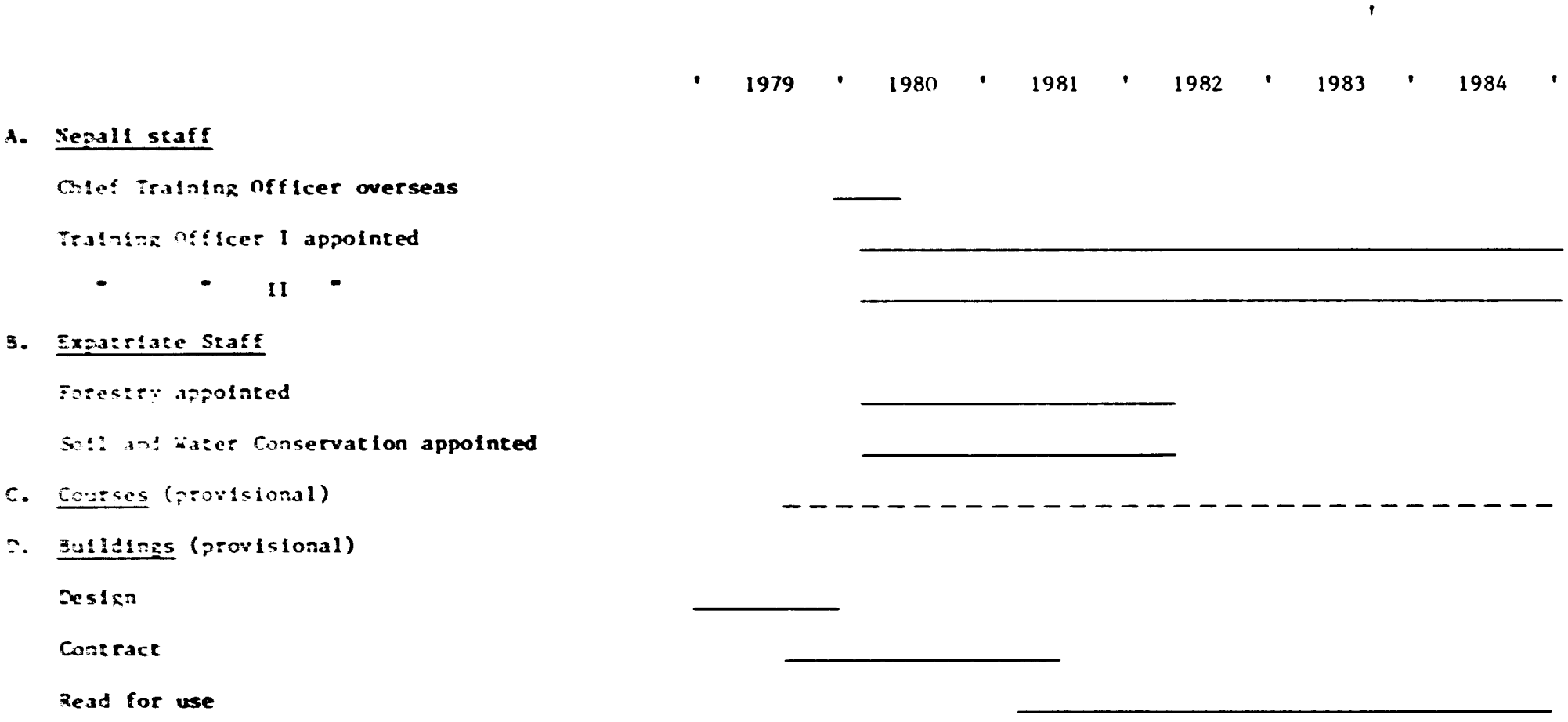
Costs of overseas training ($)

(Note: costs based on estimates in Annex 2 Appendix 5-2)

Foreign Exchange Component	Title	Year 1980-1
	Planning Cell Chief	4100
100%	Chief Training Officer	4100
	Training Officers	17060
	TOTAL	25260

Estimated at $25,300

MINISTRY OF FORESTS TRAINING WING. ACTIVITY SCHEDULE FOR OVERSEAS TRAINING, IN-COUNTRY COURSES AND BUILDINGS



EXPATRIATE STAFF REQUIREMENTS AND COSTS, MFTW

Foreign Exchange Component		1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
	(a) Periods needed in Nepal: Man months						
	Forestry advisor	3	12	9	-	-	-
	SWC Advisor	3	12	9	-	-	-
	Total long term (48)	6	24	18	-	-	-
	Consultancies (14) (2 months each)	-	4	4	2	2	2
	Total expatriates	6	28	22	2	2	2
	(b) Estimated costs $ '000						
	Long term (240)	30	120	90	-	-	-
	Consultants (70)	-	20	20	10	10	10
	Totals ($ '000)	30	140	110	10	10	10
100%	Project Total $310,000						

1/ Long term expatriates estimated at $60,000 per year, including air fares, family costs, and leave periods.

Consultants estimated at $5000 per month, inclusinve of fares, fees and subsistence.

EXPATRIATE STAFF REQUIREMENTS AND COSTS, MFTW

Foreign Exchange Component		1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
	(a) Periods needed in Nepal: Man months						
	Forestry advisor	3	12	9	-	-	-
	SWC Advisor	3	12	9	-	-	-
	Total long term (48)	6	24	18	-	-	-
	Consultancies (14) (2 months each)	-	4	4	2	2	2
	Total expatriates	6	28	22	2	2	2
	(b) Estimated costs $ '000						
	Long term (240)	30	120	90	-	-	-
	Consultants (70)	-	20	20	10	10	10
	Totals ($ '000)	30	140	110	10	10	10
100%	Project Total $310,000						

1/ Long term expatriates estimated at $60,000 per year, including air fares, family costs, and leave periods.

Consultants estimated at $5000 per month, inclusinve of fares, fees and subsistence.

NUMBERS EXPECTED ON MFTW COURSES (MAN WEEKS)

Man wks.	No. on Ea. Crs	Description	1979-80 1/	1979-80 2/	1980-1 1/	1980-1 2/	1981-2 1/	1981-2 2/	1982-3 1/	1982-3 2/	1983-4 1/	1983-4 2/	1984-5 1/	1984-5 2/
100	20	SWC Workshops	-	-	20	(1)	20	(1)	20	(1)	20	(1)	20	(1)
190	15	Forest/Wildlife Workshops			30	(2)	40	(2)	40	(2)	40	(2)	40	(2)
60	20	DFO Orientation	40	(1)	80	(2)	-	-	-	-	-	-	-	-
	-	Total, Officers	40	(1)	130	(5)	60	(3)	60	(3)	60	(3)	60	(3)
440	20	Foresters	360	(3)	960	(8)	480	(4)	360	(3)	240	(2)	240	(2)
100	20	SWC Technicians	-	-	100	(1)	100	(1)	100	(1)	100	(1)	100	(1)
	-	Total Technicians	360	(3)	1060	(9)	580	(5)	460	(4)	340	(3)	340	(3)
860	20	Panchayat F.F.	-	-	600	(5)	960	(8)	1200	(10)	1200	(10)	1200	(10)
320	10	Nurserymen	-	-	60	(2)	120	(6)	240	(8)	240	( )	240	(8)
80	20	SWC Assistants	-	-	80	(1)	160	(1)	160	(1)	160	(1)	160	(1)
	-	Total, Others	-	-	740	(8)	1240	(15)	1600	(19)	1600	(19)	1600	(19)

Notes

1/ Number of trainee - weeks/year.

2/ Number of courses/year.

3/ Total number of persons trained over 5 years on each course.

Details of Buildings Required, MFTW

The following facilities would be required:

a. Kathmandu

No.	Description	No. of people	Net area (m^2)
1	Lecture theatre	50	70
1	Common room (with basic catering facilities)	50	70
3	Lecture/seminar rooms	10/room	60
1	Visual aids room (adjoinging main lecture theatre)	-	30
1	Main office and store	3	30
6	Offices for staff (4 x 10 m^2 and 2 x 20 m^2)	6	80
1	Print room and store		20
			360
b.	Chautara	Add 4%	504
1	Classroom	25	50
1	Hostel (including toilets and catering facilities and accomodation for 2 instructors)	22	250
			300

Costs

Foreign Exchange Component		NR '000
50%	MFTW, Kathmandu. The estimate of Mr. & Mrs. Kayastha, architects is considered too high. 504 m^2 @ 1760	890
50%	Chautara, teaching and student facilities 300 m^2 @ 1500	450
50%	Staff houses, Chautara @ NR 50,000 each	100
		1440
	TOTAL, NR 000	1605
	$120,000	

MINISTRY OF FORESTS TRAINING WING - EQUIPMENT LIST

Description	No. Required	Unit Cost (£)	Total Cost (£)
Visual aids:			
Overhead projector	2	170	340
Slide projector (including lenses)	3	250	750
Projector 16 mm, sound cine	1	800	800
Synchronise/Dissolve control unit	1	150	150
Camera 33 mm SLR (including 35, 50, 100/200, close-up and copier lenses)	1	450	450
Tape deck and amplifier	1	300	300
Screens (O.H.P. and cine)	3	30	90
Table/stands	3	45	140
Microphone and stand	1	40	40
Chalkboard/pegboard	4	50	200
Film and slide storage unit, etc.	2	75	150
Graphics materials, instruments, drawing table, chart-stand	-	-	170
Light table	1	40	40
Screen board unit for lecture room	1	500	500
			4120

£4120 + 50% carriage etc. x 24.4 = 24.4 = NRs 151,000 + 3% duty = NRs 155,000

Printing office:			
Desk-top offest litho printer or duplicator	1	-	2900
Photocopier	1	-	1500
Thermofax	1	-	250
Typewriter	2	-	1050
Office equipment (miscellaneous)	-	-	250
			£ 5950

£5950 + 50% carriage + 3% duty x 24.4 = NRs 225,000

TOTAL FOR VISUAL AIDS PLUS PRINTING/OFFICE . . . . . NRs 380,000

Estimated @ $ 31,700

CAPITAL REQUIREMENTS & COSTS, MFTW

Foreign Exchange Component		Total	1980-1	1981-2	1982-3	1983-4	1984-5
				NR'000			
	Building Kathmandu	890	400	490	-	-	-
	Building Chautara	550	400	150	-	-	-
50%	Building sub-total	1440	800	640	-	-	-
	Furniture, Kathmandu	106	-	36	70	-	-
	Furniture, Chautara	25	-	25	-	-	-
0%	Furniture sub-total	131	-	61	70	-	-
	(1) Trucks 7T	190	190	-	-	-	-
	(2) 4WD Vehicle	500	250	250	-	-	-
	(3) Car, 1100cc	200	100	100	-	-	-
95%	Vehicle sub-total	890	540	350	-	-	-
	Equipment, Kathmandu	380	200	180	-	-	-
	Equipment, Chautara	25	25	-	-	-	-
95%	Equipment sub-total	405	225	180	-	-	-
	Total NR '000	2866	1565	1231	70	-	-
	Total $ '000	238.8	130.4	102.6	5.8		

CAPITAL REQUIREMENTS & COSTS, MFTW

	Total	1980-1	1981-2	1982-3	1983-4	1984-5
			NR'000			
Furniture, MFTW Kathmandu	106					
Furniture, Chautara	25					
Equipment, Kathmandu	380					
Equipment, Chautara	25					
(1) Trucks 7T	180					
(2) 4 WD Vehicle	400					
(3) Car, 1100 cc	200					

CAPITAL REQUIREMENTS & COSTS, MFTW

Foreign Exchange Component		Total	1980-1	1981-2	1982-3	1983-4	1984-5
				NR'000			
	Trucks, 5000 km @ 3/-	75	15	15	15	15	15
	4 WD, 24000 km @ 4/-	480	96	96	96	96	96
	Cars, 20,000 km @ 2/-	200	40	40	40	40	40
	Vehicles total	755	151	151	151	151	151
				NR'000			
	Building Maintenance	243	-	-	81	81	81
	Electricity & Water	320	-	80	80	80	80
	Telephone, Stationery & teaching materials	250	50	50	50	50	50
	Teaching equipment replacement	42			14	14	14
	Maintenance etc. Total	855	50	130	225	225	225
	Daily allowance, teaching staff	60	12	12	12	12	12
	Daily allowance Trainees (from page 2)	1667	340 78 1/	301	330	309	309
	Total, allowances	1727	352 78 1/	313	342	321	321
	Total NR '000	3337	553 78 1/	594	718	697	697
	Total $ '000	278.1	46.1 6.5 1/	49.5	59.8	58.1	58.1

1/ NR 78,000 from 1979-80

SUMMARY OF TRAINING COURSE COSTS, MFTW (DAILY ALLOWANCES)

Foreign Exchange	Rank Being Trained	TOTAL	1979-80	1980-1	1981-2	1982-3	1983-4	1984-5
	(From Attachment 3-5)		NUMBER OF MAN WEEKS					
	Professionals (Officers)	410	40	130	60	60	60	60
	Technicians	3140	360	1060	580	460	340	340
	Other	6780	-	740	1240	1600	1600	1600
	Total man-weeks	10330	400	1930	1800	2120	2000	2000
	Number of courses held	125	4	22	23	26	25	25
	(Rate per week)		NR'000 COST					
	Professionals (350/-)	144	14	46	21	21	21	21
	Technicians (175/-)	552	63	186	102	81	60	60
	Others (140/-)	950	-	104	174	224	224	224
0%	Total Daily Allowances	1646	77	336	297	326	305	305
20%	Transport costs	21	1	4	4	4	4	4
	TOTAL NR '000	1667	78	340	301	330	309	309
	TOTAL $ '000	138.9	6.5	28.3	25.1	27.5	25.8	25.8