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**SOCIOECONOMIC FACTORS LEADING TO  
DEFORESTATION IN NEPAL**

Ramrajya L. Shrestha

HMG-USAID-GTZ-IDRC-WINROCK PROJECT  
STRENGTHENING INSTITUTIONAL CAPACITY IN THE  
FOOD AND AGRICULTURAL SECTOR IN NEPAL

## FOREWORD

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Michael B. Wallace  
Series Editor

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# SOCIOECONOMIC FACTORS LEADING TO

## DEFORESTATION IN NEPAL

Ramrajya L. Shrestha\*

### ABSTRACT

This research explores various socioeconomic factors which contribute to deforestation in Nepal. Based on a survey of one Tarai and two hill panchayats, the study explores forest dependency, evidence of deforestation, as well as attitudes of farmers, local leaders, and foresters. Finding correlation between ownership of trees with land and family size, the paper concludes with suggestions for improving cooperation between government and communities toward combatting deforestation.

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## INTRODUCTION

### Overview

Not long ago the wealth of Nepal was considered to be the dense forest covering the Tarai, hill, and mountain regions. The forest protected the soil from rainfall during the monsoons and reduced sheet erosion (Rieger, 1976 as mentioned in Martens, 1983). Recently, though, the ecological balance has rapidly deteriorated. On the basis of land use data available for 1980, it is estimated that present forest area ranges from 4.1-4.9 million ha, or 30 percent of Nepal's area--a 25 percent reduction from a decade earlier. However, a more recent estimate is far below this figure (ADB et al., 1982). While forests are converted into brush land in the hills, they are cleared for agricultural land in the Tarai. Because of unorganized encroachment into Tarai forest areas by hill migrants, over 100,000 hectares of prime forest have been recently converted to agricultural land (ADB et al., 1982). According to a 1974/75 survey, the area of Tarai forests was at 1.6 million ha. According to the Land Resource Mapping Project, estimated forest area is 1.4 million ha. in Tarai districts. This shows that 0.2 million ha. of forest were lost within a decade. Projections indicate that with the increased demand by a growing population, accessible forests in the hills will disappear within 14 years and those in the Tarai within 25 years (FAO/World Bank, Cooperative Program, 1979).

Despite this reliance on the forest, afforestation programs are limited. During the Fifth Plan (1975-1980) less than 10,000 ha. was afforested under government programs. A greater effort must be made to meet the demand for fuelwood and industrial wood by the turn of the century, estimated at (1.6 to 1.8 million ha.).

### Objectives of the Study

The broad objective of this study is to develop a framework to guide future detailed data collection and analysis related to the following specific objectives:

- (1) To highlight the problem of deforestation in Nepal;
- (2) To determine the magnitude of dependency on forest in three panchayats, for fuelwood, timber, fodder, and land;
- (3) To examine government policies regarding forestry.

### Problems of Deforestation

Nepal has a total land area of about 14 million hectares (DFAMS, 1977) and a population of about 15 million (National Population Census Commission, 1981). Nepal's person-land ratio of 1.06 and person-cultivated land ratio of 6.5 are high compared to other countries (Shrestha, 1982), indicating that Nepal is a land-scarce agricultural country.

Distribution of forest damage varies depending on the local population density (Legar, 1976; Martens, 1983). The population density per square kilometer is 113 in the western region, 51 in the mid-western

region, and 66 in the far-western region, while it is 132 and 177 in the eastern and central regions, (ADB et al., 1982). Central Nepal has suffered a large amount of damage because of deforestation and soil destruction. The damage in eastern Nepal is equally serious. Vegetation exists only in steep and inaccessible places (Martens, 1983).

The most serious damage resulting from the destruction of forest areas is the loss of cultivable soil--the most obvious effect being erosion. Much natural erosion occurs in Nepal because of heavy monsoons and steep terrain, yet perhaps half of the erosion is caused by humans. (Field and Pandey, 1969). Part of this is due to the high rate of population growth, causing cultivation of marginal land, much of which is on steep slopes. Erosion is also due to overgrazing and excessive use of the forest for fodder, fuelwood, timber and resettlement.

As forests are cleared in the hills, the quantity of debris transported by the rivers increases and as the rivers emerge into the plains and flow more slowly, the material begins to settle. As a result, the rivers change course and inundate valuable farm land. It is estimated that the third largest river in the Himalaya, the Kosi, which drains eastern Nepal has shifted about 112 km to the west in the last 150 years (Donnier, 1972 quoted in Martens, 1983).

Besides soil erosion, deforestation is causing a growing contrast between winter drought and summer floods, indirectly affecting crop productivity.

#### Main Factors Leading to Deforestation

In Nepal, dependency on forest for essential commodities is high with few or no substitutes. The traditional attitude of people towards the forest is that the forest is common free property. They think they are entitled to benefits from the forest but they do not realize the importance of sustaining the forest. When the population was limited people could afford to use the forest without paying attention to forest protection. There was enough time for regeneration. These days the population has increased enormously along with the rate of dependency on forests. On the other hand, the rate of afforestation is extremely low. The main factors leading to deforestation are described below.

Fodder Collection. In Nepal, only rough estimates of the livestock population are available. The 1977 population of cattle, buffalo, sheep, goats, and pigs was estimated at 15.6 million (World Bank, 1979). The average number of bovine animals per family has been estimated at 4.4 and 6.2 in the hills and the Tarai (World Bank, 1974).

The limited amount of grazing land in the hills provides enough feed for animals only during the monsoon season, between June and September. Private fodder trees and crop residues provide some feed during other months but this is insufficient as land holdings are small. Families rely on the forest to make up the difference, estimated to be about 23 percent of total consumption (Rajbhandary and Shah, 1981).

This proportion varies between farms of different sizes. The dependence on forest for fodder is inversely related to farm size (Wyatt-Smith, 1982). Small farmers are less willing to plant fodder trees as they fear trees would hamper their crops. Households in the eastern hills own fewer fodder trees than those in the western hills. Thus, the former group probably relies more on the forest.

At present, it is estimated that animals on an average obtain only half of the recommended ration. Given this low consumption, Wyatt-Smith estimated that the average family would require 3.5 ha. of forest to support its livestock. One cannot calculate the area of the forest currently available to each family. However, the natural area of forested land divided by the number of households gives an area of about 1.7 ha. per family (Shrestha, 1982). Given the number of animals and their present consumption patterns, this is only half the area required to allow the agricultural system and the forest to maintain themselves. If fodder is collected carefully, trees can tolerate cutting over long periods of time. More often, the damage is so great that regeneration is impossible. Similarly, livestock are driven into the forest for grazing, which destroys the shrubs and bush layer of the forest.

Fuelwood. In Nepal, about 87 percent of the country's total energy need is derived from wood (World Bank, 1978). The average per capita consumption is increasing and is estimated at one cubic meter (cu. m.) per year (ADB et al., 1982). LRMP has estimated the per capita need at 556 kg (0.8 cu. m.) for the hills and 439 kg (0.6 cu. m.) for the Tarai of the Far-Western Region.

About 90 percent of the wood taken from the forest is used as fuelwood (Mauch, 1974, as cited in Martens, 1983). Aside from home heating and cooking, large quantities of wood are consumed in the Kathmandu Valley to heat brick kilns. The LRMP estimate shows that the demand supply ratio of fuelwood and timber is 2.3:1 in the mid-hills of the Western and Far-Western Regions, while in the Tarai and the high hills it is 1.7:1 and 0.4:1.

The World Bank (1978) forecast that over 80,000 ha per year needs to be afforested to meet the projected rural energy demands up to the year 2000. The current rate of afforestation is only 5000 ha per year.

Because of the scarcity of fuelwood, families are increasingly burning dung or plants which could be used for fodder. At the present rate of forest destruction, the World Bank (1978) estimated that between 1985 and 1995, the quantity of dung and fodder used for fuel would rise to over 8 million tons annually.

Timber. The timber requirement per household depends on altitude and ethnic group (Martens, 1983). In Eastern Nepal about 70 cu. m. of wood is required per house. However, about 20 cum. would be sufficient if the stems were more economical (Mauch, 1974 cited in Martens, 1983). Improved equipment is used in the Tarai and the Valley, while in the hills, long axes are available.

Per capita consumption of industrial timber in Nepal is about 0.02 cu. m., while demand was calculated at 292,800 cu. m. for 1980--the projected demand for the year 2000 is 700,000 cu. m.. (ADB et al.,

1982). It is estimated that existing saw mills lacking raw materials, are operating at 60 percent capacity due to poor coordination between the licensing authority and the forest department responsible for the supply of raw materials (ADB et al., 1982).

Land Clearing. In the hills, as the need for cultivable land increases, people clear steeper slopes, intensifying erosion. Fertile land, easy communication and transport, and the eradication of malaria, have attracted hill people to the Tarai. Migration is estimated to be 0.7 percent annually. The composition of the population was 62.4 percent in the hills and 37.6 percent in the Tarai in 1971. By 1981, it had changed to 56.3 percent in the hills and 43.7 percent in the Tarai (ADB et al., 1982).

However, this migration was unplanned. Legal and illegal encroachments have had devastating effects on the Tarai forest lands. More than 7000 sq km of forest land have been converted into cultivable land during 1975-1980 (National Planning Commission, 1981).

There has been a lack of coordination between forestry development programs and resettlement programs. Realizing this, His Majesty's Government (HMG) decided in 1982 that no more forest will be cleared for agricultural purposes or resettlement. Because of migration, however, the Tarai forests were badly damaged and heavily deforested.

#### METHODOLOGY

Available secondary data regarding forest development and the problem of deforestation were collected but were only generally useful. Because of the lack of detailed studies in this area, primary data from two hill panchayats and one Tarai panchayat were collected.

##### Survey Technique and Sample Size

The two hill panchayats are the Sarangkot panchayat of Kaski district and Dhanubase tvey Technique and Sample Size

The two hill panchayats are the Sarangkot panchayat of Kaski district and Dhanubase the panchayat of Syangja district. The Tarai panchayat is the Bayarban panchayat of Morang district. Districts where community forestry programs are already implemented or are in the process of implementation were selected. In the two hill districts community forestry programs have already been started and in the Tarai district one will start in the near future. Beyond this, there was no particular reason for choosing these districts which were selected randomly from the suitable options. Given time and budget constraints, it was not possible to conduct the survey in more than three panchayats.

One panchayat was selected from each district. Panchayats near the forested or deforested areas were randomly selected. From each hill panchayat 45 households and from the Tarai panchayat 48 households were selected.

Three levels of questionnaires were designed. The farmers' questionnaire was given to 138 farmers in three panchayats, while the local leaders' and panchas' questionnaire was administered to eight people.

Three district forest officers answered the third questionnaire.

### Description of the Panchayats Surveyed

Dhanubase. This panchayat is in Syangja district with a population of 5000. The panchayat has 400 ha. of cultivated land, 100 ha. of fallow land and 125 ha. of forest and bush land (local panchayat office). The average family size is five, seven, and nine for small, medium and large farmers, respectively. About 85 percent of the male and 43 percent of the female household members are literate.

In the sample area the present average land holding of small farmers is 0.3 ha. The holding has decreased by eight percent compared to five years ago and by 23 percent compared to ten years ago. The decline in cultivated land is evident. In the last five years pakho bari has declined even more intensively, as the average land holding of medium farmers is 0.7 ha. The present holding has decreased by 36 percent in the last five years and by 40 percent in the last 10 years. The decline in cultivated land is around 40 percent in khet land and more than 50 percent in pakho land. A certain decline is observed in house yards, private forests and gardens as well. The average land holding of large farmers is 2.1 ha. which is seven percent less than five years ago and nine percent less than ten years ago.

About 12 percent of the trees are owned by small farmers, 18 percent by medium farmers, and 70 percent by large farmers. Small and medium farmers have more fodder and firewood trees than timber trees while large farmers own more timber. Large farmers own a higher percentage of all types of trees than medium and small farmers. Farm size and number of trees are directly correlated (Table 1).

The average number of livestock owned by small farmers is 3.7 which is 10 percent higher than last year and 16 percent lower than five years ago. Medium farmers own 3.6 an average of livestock which is 34 percent higher than last year and 36 percent less than five years ago. The average number of livestock owned by large farmers is 7.6 which is three percent higher compared than last year and 39 percent higher than five years ago. The large farmers own more livestock than medium and small farmers. However, there are not many differences in the ownership by medium and small farmers.

Sarangkot. This panchayat is in Kaski District in western Nepal with a population of 7677. According to the local panchayat office, it has 750 ha. of cultivated land, 500 ha. of fallow land and 250 ha. of forest and bush land. In the sample households the average family size is five, five, and eight, respectively. About 66 percent of the males and 56 percent of the females are literate.

The average land holding of small farmers is 0.3 ha. which is 39 percent less compared to the area five years back and 50 percent less compared to the area 10 years back. The medium farmers average land holding is 0.7 ha. which is 15 percent less compared to five years ago and 18 percent less than 10 years ago. The average land holding of large farmers is 2.1 ha. which is six percent less than five years back and eight percent less compare to 10 years back.

Large farmers own 84 percent of the trees, while medium and small farmers own 13 and three percent. Although small farmers own the highest percentage of fodder trees, medium farmers and large farmers own the highest percentage of firewood trees. In this panchayat also, the higher the average land holding, the higher the number of trees.

The average number of livestock owned by small farmers is 2.3 which is about two percent higher than last year and about 24 percent lower than five years ago. The average number owned by medium farmers is 3.1 which is about nine percent less compared to last year and 37 percent less compared to five years ago.

Bayarban. This panchayat lies in Morang District in the eastern Tarai. In the current sample, the average land holding of small farmers is 1.1 ha. which is 13 percent less compared to five years ago. However, compared to a decade ago, this is an increase of 24 percent. The medium farmers' average land holding is 3.5 ha. which is 19 percent less compared to five years ago and nine percent less than ten years ago. The average land holding of the large farmers is 12.7 ha. which is 10 percent less compared to five years ago and nine percent less compared to ten years ago.

Among all three groups the average land area increased five years back compared to 10 years ago, while land area is currently decreasing. The change is mainly in cultivated land. The increase of land may be from destruction of forests for cultivation five years back and the decrease might have been caused by land fragmentation and sale.

Small farmers own 87 percent of the trees, medium and large farmers own 18 and 75 percent of the trees respectively. Unlike the hill panchayats, small and medium farmers own the highest percentage of fruit trees compared to other types of trees. Large farmers own the highest percentage of timber trees. In this panchayat, like the others, land holding and number of trees are directly correlated (Table 1).

The average number of livestock owned by small farmers is 5.5 which is 15 percent higher compared to last year and 28 percent higher compared to five years ago. The average number of livestock owned by medium farmers is 11.3 which is nine percent higher compared to last year and 50 percent higher than five years ago. Large farmers own an average of 30 livestock, which is eight percent higher compared to last year and three percent lower than five years ago.

Summary. The number of trees owned by farmers are correlated with land and family size. In all three panchayats small farmers have small families compared to large farmers. In all three panchayats the literacy rate is higher among males than females.

In the Tarai panchayats, large and medium farmers seem to own a substantially higher number of livestock than in the hill panchayats. In all panchayats for all economic strata, the livestock number appears slightly higher than last year and lower than five years ago.

There are several reasons for the reduction in the number of livestock including change in forest resources, pasture, income, family

members buying and selling, transferal as families separate, and death and slaughter of livestock (Table 2).

Table 1. Average Number of Trees Owned by Households

Type of Trees	Farmer Type	Dhanubase		Sarangkot		Bayarban	
		Ave.No.	Percent	Ave.No.	Percent	Ave.No.	Percent
Fruit Trees	Small	8.8	2.5	4.05	0.8	4.5	2.3
	Medium	9.3	2.7	7.4	1.5	12.9	6.5
	Large	45.8	13.3	11.8	2.4	47.8	24.1
Fodder Trees	Small	7.9	2.3	4.8	0.9	0.5	0.3
	Medium	15.7	4.6	7.6	1.5	1.1	0.05
	Large	51.8	15.0	34.1	6.8	1.0	0.5
Firewood Trees	Small	0.3	0.09	1.9	0.4	-	-
	Medium	6.4	1.9	40.6	8.2	0.3	0.2
	Large	40.0	11.6	216.3	43.5	2.4	1.2
Fodder & Firewood	Small	22.7	6.6	1.7	0.3	0.4	0.2
	Medium	24.1	7.0	5.6	1.1	-	-
	Large	45.9	13.3	126.1	25.4	-	-
Timber Trees	Small	2.8	0.8	1.9	0.4	0.7	0.3
	Medium	6.3	1.8	2.6	0.5	1.8	0.9
	Large	56.3	16.3	50.6	6.2	12.6	63.5
Total	Small	42.6		14.4		6.1	
	Medium	61.8		83.8		15.1	
	Large	239.8		418.9		63.8	
Total		344.2	100.00	497.1	100.00	85.0	100.00

Table 2. Reasons for Decrease in Livestock Population (in %)

		Forest	Pasture	Income	Family Member	Other*
Dhanubase	Small Farmer	16.7	25.0	8.3	33.3	41.7
	Medium Farmer	11.1	22.2	16.7	22.2	33.3
	Large Farmer	6.7	13.3	33.3	26.7	53.3
Bayarban	Small Farmer	-	-	28.0	12.0	60.0
	Medium Farmer	5.5	33.3	5.5	11.1	44.5
	Large Farmer	40.0	60.0	-	-	-
Sarangkot	Small Farmer	31.0	5.0	11.0	21.0	32.0
	Medium Farmer	29.0	-	-	36.0	35.0
	Large Farmer	17.0	17.0	-	17.0	49.0

\*Other: Dead, sold and divided while separating family members. Killed by tiger.

## FOREST DEPENDENCY AND EVIDENCE OF DEFORESTATION

### Animal Feed

Animals are grazed all year but private grazing is scarce except in Sarangkot. Average private grazing land in Sarangkot is 0.3 ha. by large farmers, 0.1 ha. by medium farmers, and 0.05 ha. small farmers. In Dhanubase, average area is only 0.01 ha. and owned only by large and medium farmers. In Bayarban there is no separate grazing land.

In all the panchayats, farmers rely more on private land and trees for fodder than on the forest. Fine green grass is given to the animals mainly from June to November. Tree fodder is used mainly from October to March. Besides this, they give paddy, straw, and maize stalks to the animals throughout the year. Livestock are grazed in cultivated land after the harvest when the land is left fallow, especially in winter, from November to March.

Farmers usually stall feed buffalo year-round. Occasionally they stall feed cows in the rainy season. In the hill panchayats, 58 percent of the farmers report the main reason for stall feeding buffalo is they are unable to walk on the steep slopes. In the Tarai the main reason is that livestock are not allowed to graze in the protected forests.

In all three panchayats, all farmers collect more fodder in summer than winter. In Dhanubase panchayat and Bayarban panchayat, farmers collect more fodder from private cultivated land than from forest both in summer and winter. In Sarangkot panchayat more fodder is collected from forest than from private cultivated land in both summer and winter.

There is not much variation in the daily labor used to collect fodder in winter and summer. Large farmers in all panchayats use more labor per day than medium and small farmers, but it is correlated with the amount of fodder collection. In all three panchayats, large farmers collected more fodder than medium and small farmers; large farmers collected from 81 to 133 kg per day, medium farmers collected 48 to 67 kg per day and small farmer collected 37 to 64 kg per day.

The average time taken to collect a load of fodder is higher at present in Sarangkot and Bayarban than five and ten years ago. This might be due to the reduced availability of fodder from the forest. However, the time involved is less or almost the same at present in Dhanubase as five and ten years ago (Table 3).

The sample results show that about five to ten years ago, some farmers depended on the forest alone. This has declined, especially among large farmers. The percentage of people depending on communal pasture and forested areas has fallen. On the other hand, the percentage depending on cultivated land, forest and cultivated land, and communal pasture and cultivated land has increased. However, in Sarangkot the percentage depending on cultivated land alone has declined.

A high percentage of farmers indicated deforestation and lack of forest protection as the main reasons for the declining dependency on forest (Table 4). In Bayarban panchayat, all farmers indicated deforestation as the only reason for reducing dependency on forest for fod-

der. In Dhanubase panchayat, 42 percent of the small farmers and 47 percent of the large farmers considered deforestation and protection as the only reasons. An equal percentage (36 percent) of medium farmers considered deforestation and protection as the only reasons. An equal percentage (36 percent) of medium farmers considered deforestation and protection as the main reasons.

Table 3. Average Time Taken to Collect One Load of Fodder

		Average time taken per day in hours					
		This Year		5 Years Back		10 Years Back	
		Summer	Winter	Summer	Winter	Summer	Winter
Dhanubase	Small Farmer	1.0	1.4	1.1	1.5	1.1	1.5
	Medium Farmer	1.1	0.9	1.4	1.2	1.4	1.2
	Large Farmer	1.7	1.2	1.7	1.3	1.7	1.2
Sarangkot	Small Farmer	2.6	3.9	2.7	3.3	1.8	2.4
	Medium Farmer	2.6	3.1	2.0	2.6	1.3	1.6
	Large Farmer	3.0	3.3	2.3	2.6	1.7	1.9
Bayarban	Small Farmer	2.4	1.8	2.7	1.7	2.2	1.2
	Medium Farmer	2.5	2.0	2.1	2.5	2.2	1.8
	Large Farmer	5.0	3.0	4.8	2.8	2.4	1.5

Table 4. Reasons for Reduction in Dependency on Forest (in %)

	Defor- esta- tion (1)		Forest Pro- tected (2)		Enough Pasture & Trees (3)		Reasons (1)&(2) &(3)		(1)&(2)		(2)&(3)	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	Dhanubase											
Small Farmer	5	(42)	3	(25)	2	(17)	-	-	-	-	2	(17)
Medium Farmer	5	(36)	5	(36)	2	(14)	1	(7)	3	(21)	2	(14)
Large Farmer	5	(33)	7	(47)	3	(20)	-	-	-	-	2	(14)
Sarangkot												
Small Farmer	7	(37)	3	(16)	-	-	-	-	7	(37)	2	(11)
Medium Farmer	4	(25)	3	(36)	2	(14)	-	-	3	(21)	-	-
Large Farmer	3	(25)	5	(42)	-	-	1	(8)	3	(25)	-	-
Bayarban												
Small Farmer	25	(100)	-	-	-	-	-	-	-	-	-	-
Medium Farmer	18	(100)	-	-	-	-	-	-	-	-	-	-
Large Farmer	5	(100)	-	-	-	-	-	-	-	-	-	-

Farmers in the sample do not plant fodder grass which could have reduced dependency on the forest, especially as population is increasing and forests and forest products are disappearing rapidly. In each panchayat, more than 79 percent of all the farmers have not planted fodder grass. Main reasons for not planting grass are lack of knowledge, fear that it might hamper land productivity, and the idea that growing grass is not necessary.

## Fuelwood

The average monthly fuelwood requirement per household varies between 391 to 477 kg for small farmers, 336 to 575 kg for medium farmers, and 365 to 516 kg for large farmers. There is no indication of correlation between farm size and fuelwood requirement. The requirement was lowest in Sarangkot and highest in Bayarban. As fuelwood has become scarce, the opinion of the villagers is that it takes more time to cook a meal now than five years ago. The sample data supports this in all three panchayats and strata (Table 5).

Farmers' dependency on different sources for fuelwood seems to be changing. Dependency on forest alone declined in all three panchayats in the last decade. Similarly, dependency on private land alone has declined, except in Dhanubase. However, people have started depending more on private land and forest and have started supplementing their need from purchase, in Sarangkot. In Dhanubase people started depending more on their own land and purchase. In Bayarban people are depending more on purchase of fuelwood.

One person per household is involved in collecting fuelwood, except for the large farmers of Bayarban, where two persons per household per day are involved. In Dhanubase and Sarangkot the average time taken to collect a load of fuelwood per person is about three hours. This indicates that fuelwood is not easily available. The situation is worse in Bayarban where it takes five to eight hours (Table 6).

In rural areas a higher percentage of people depend on fuelwood for cooking. The sample data shows that in Sarangkot panchayat none of the farmers and less than 10 percent in Dhanubase use kerosene for cooking. In Bayarban the percentage of people using kerosene is slightly higher. About 20 percent of the farmers pointed out that kerosene was expensive and the rest said they could still manage to get fuelwood.

In several rural areas it has been observed that people burn dung cakes instead of fuelwood. This practice is not seen among sample farmers of Sarangkot, but it was started in Dhanubase and Bayarban in the last five years. Fewer than eight percent of the sample farmers in Dhanubase follow this practice and fewer than 20 percent in Bayarban.

## Timber

Average timber required last year per household ranged from 34 to 50 cubic feet (cu. ft.) in Dhanubase panchayat. The requirement is lowest in Sarangkot, ranging from 7 to 14 cu. ft. In Dhanubase a higher percentage of small farmers and large farmers get their timber from their own land while medium farmers purchase timber. In Sarangkot a higher percentage of all farmers get their timber from their own land and forest. In Bayarban, a large percentage of farmers purchase timber.

## Settlement and Encroachment

Seven percent of the large farmers of Dhanubase and seven percent of the medium farmers of Sarangkot have cleared forest. The remaining hill farmers said they had not done so. In Bayarban, 20 percent of small farmers and 6 percent of medium farmers have cleared the forest.

Table 5. Average Fuelwood Requirement and Time to Cook One Meal

Panchayat strata		Average fuelwood required per month (kg)	Average time to cook one meal (hours)	
			5 years ago	present
Dhanubase	Small Farmer	418.5	1.0	2.0
	Medium Farmer	402.0	1.0	2.0
	Large Farmer	477.0	1.3	2.0
Sarangkot	Small Farmer	391.0	2.5	3.0
	Medium Farmer	336.0	1.8	2.1
	Large Farmer	365.0	2.0	2.5
Bayarban	Small Farmer	477.2	1.3	1.3
	Medium Farmer	575.0	1.0	1.3
	Large Farmer	516.0	1.0	2.0

Table 6. Labor Involvement in Fuelwood Collection

		Average number of people collecting fuelwood/household/day	Average time to collect load of fuelwood (hours)
Dhanubase	Small Farmer	0.7	2.0
	Medium Farmer	1.1	3.0
	Large Farmer	0.8	3.0
Sarangkot	Small Farmer	0.8	3.3
	Medium Farmer	0.8	2.9
	Large Farmer	1.0	3.2
Bayarban	Small Farmer	1.2	5.0
	Medium Farmer	1.2	8.0
	Large Farmer	2.0	7.0

#### ATTITUDES OF FARMERS, LOCAL LEADERS AND FORESTERS

##### Attitudes of Farmers Towards Deforestation Problem and Afforestation Activities

The main reasons for deforestation are careless tree felling by villagers, carelessness of the Forest Division, and the low rate of reforestation activities. In Dhanubase, most small farmers (58 percent) and large farmers (53 percent) think that careless tree felling by villagers is the main reason for deforestation, while medium farmers (44 percent) think the low rate of reforestation is the main reason.

In Sarangkot, 42 percent of small farmers and 33 percent of large farmers think all three reasons have a combined effect on deforestation. However, medium farmers (36 percent) think careless tree felling by villagers is the main reason. In Bayarban, most small (80 percent), medium (83 percent) and large (80 percent) farmers think carelessness of the Forest Division is the main reason for deforestation (Table 7).

Table 7. Reasons for Deforestation Given by Villagers

	Careless Tree Felling by Villagers		Careless-ness of Forest Division		Low Reforestation & High Deforestation		(1&2)		(1&3)		(2&3)		(1&2&3)	
	(1)		(2)		(3)									
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Dhanubase														
Small Farmer	7	58	-	-	2	17	1	8	2	17	-	-	-	-
Medium Farmer	4	22	1	6	8	44	1	6	4	22	-	-	-	-
Large Farmer	8	53	-	-	4	27	2	13	1	7	-	-	-	-
Sarangkot														
Small Farmer	5	26	1	5	1	8	-	-	4	21	-	-	8	42
Medium Farmer	5	36	2	14	2	14	1	7	-	-	-	-	4	29
Large Farmer	3	25	1	8	2	17	-	-	2	16	-	-	4	33
Bayarban														
Small Farmer	1	4	20	80	-	-	1	4	-	-	2	8	1	4
Medium Farmer	-	-	15	83	1	6	-	-	-	-	-	-	1	11
Large Farmer	-	-	4	80	-	-	1	20	-	-	-	-	-	-

In Dhanubase and Sarangkot, the hill panchayats, more than 73 percent of the farmers have knowledge about reforestation activities. Surprisingly, in Bayarban, the Tarai panchayat, very few (less than 22 percent) farmers have such knowledge.

Though the Community Forestry Development Program is a new approach to afforestation, most rural people seem to be aware of it. Almost 73 to 94 percent of sample farmers are aware of it in Dhanubase. In Sarangkot, all sample farmers are aware of it. In Bayarban, 56 percent of the small, 78 percent of medium and 100 percent of the large farmers are aware of it. Few small farmers have knowledge about the program in Bayarban, perhaps because the program has not yet begun there.

In Dhanubase most small and large farmers (67 percent) were made aware of the program through radio or newspaper while 57 percent of the medium farmers were informed by the Forest Division. In Sarangkot, 75 percent of the small farmers, 79 percent of the medium farmers, and 81 percent of the large farmers became aware of this program both from the Forest Division and the radio/newspaper. In Bayarban panchayat, 71 percent of small, 57 percent of medium, and 80 percent of large farmers became aware of this program from the radio and newspaper.

All sample farmers think reforestation activities are beneficial. Most farmers say that the main benefits from the forest are firewood, fodder and litter. The majority of farmers in Dhanubase and Sarangkot expressed that the government and the villagers are both beneficiaries of reforestation. In Bayarban panchayat, a majority of the small and large farmers shared this view, though a high percentage of medium farmers think the main beneficiary of reforestation is the government.

In Dhanubase, 67 percent of the small and large farmers and 83 percent of the medium farmers would like to increase their livestock

number after the reforestation, assuming fodder would be plentiful. The remaining farmers would not like to change anything. In Sarangkot, 79 percent of small and medium farmers, and 92 percent of large farmers would like to increase their livestock number. Sixteen percent of the small farmers would like to reduce their livestock number and raise only the improved breed of livestock. In Bayarban, 59 percent of the small farmers, 67 percent of the medium farmers, and 60 percent of the large farmers would like to reduce the livestock number and raise only a limited number of improved breed. The remaining farmers want to increase the livestock number. In Dhanubase and Sarangkot, most farmers would like to increase the livestock number but in Bayarban the majority only want to raise the improved breed (Table 8).

Farmers attitudes toward planning are an important factor in making the afforestation program successful. In all of the panchayats more than 89 percent of the farmers think they should plant trees. In Dhanubase, 83 percent of small, 61 percent of medium, and 80 percent of large farmers have already planted trees. In Sarangkot, 94 percent of small, 71 percent of medium and 83 percent of large farmers and, in Bayarban, 32 percent of small, 56 percent of medium, and 80 percent of large farmers have planted trees.

The majority of farmers in all three panchayats have planted trees on their own land. More than 70 percent of the farmers in each panchayat were interested in planting more trees on private land. The main reason for farmers not being interested in planting trees is the lack of land. Some of the farmers who have shown an interest but have not planted trees cite the lack of seedlings, irrigation, land, manpower, and other resources. Some are not planting because they lack appropriate knowledge (Table 9).

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Table 8. Farmers' Attitude Toward Livestock, If Grass and Fodder Are Plentiful in Future as a Result of Reforestation Activities

	If grass and fodder are plentiful farmer would		
	Increase Livestock (%)	Reduce Number But Improve the Breed (%)	No Change (%)
Dhanubase			
Small Farmer	67	-	33
Medium Farmer	83	-	17
Large Farmer	67	-	33
Sarangkot			
Small Farmer	79	16	5
Medium Farmer	79	-	21
Large Farmer	92	-	8
Bayarban			
Small Farmer	41	19	-
Medium Farmer	33	67	-
Large Farmer	40	60	-

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Table 9. Farmers' Attitude Toward Plantations

	Farmers who think they should plant trees (%)	Farmers who have done plantation (%)	Place of Plantation			Interested to plant more (%)
			Forest (%)	Communal Land (%)	Own Land (%)	
<b>Dhanubase</b>						
Small Farmer	100	83	-	-	100	82
Medium Farmer	94	61	-	14	86	78
Large Farmer	100	80	8	8	83	79
<b>Sarangkot</b>						
Small Farmer	89	74	-	-	100	79
Medium Farmer	93	71	-	-	100	64
Large Farmer	100	83	-	10	90	75
<b>Bayarban</b>						
Small Farmer	96	32	-	-	100	79
Medium Farmer	89	56	-	22	78	94
Large Farmer	100	80	-	-	100	100

#### Attitudes of Local Leaders

Sarangkot. In Sarangkot, the Community Forestry Development Program was implemented in 1979. Local leaders have been quite aware of the program since its inception and according to them, they were involved in the forest development program from the beginning and out of their own interest. They think the main benefits of forest protection would be easy availability of fuelwood, fodder and timber, protection from soil erosion, soil fertility, and the enhancement of natural beauty. Certain areas of the panchayat are heavily deforested and villagers suffer from occasional flood and soil erosion.

Local leaders think that local panchayat leaders could protect the forest if they are given responsibility. Panchayat leaders have proven this by protecting the newly planted area which now looks like dense forest. Forests are protected by fencing and forest guards. Fencing materials are financed by the government. The planting would be carried out by the panchayat with the help of voluntary labor.

Once the trees have matured, farmers who participated in the planting and conservation are eligible to get about 200 kg. of fuelwood a month. They will be permitted to use only branches without damaging the main trees. They will be charged a moderate tax which will go to the panchayat office. Farmers will be allowed to cut green grass under the trees but will not be allowed to fell trees for fodder. However, with the permission of the panchayat and forest offices, villagers could fell trees for timber. Livestock will not be allowed in the forest to graze.

Leaders guess about 75 percent of the people in the panchayat are willing to protect and develop the forest, five percent are not cooperative and the remainder is indifferent. In their opinion the main reasons for deforestation in the area are forest clearing by local

people and inefficiency of the Forest Division. Careless tree felling for timber, fodder, and fuelwood are also responsible to some extent.

Dhanubase. The community forestry development program was implemented in 1979/80 in the Dhanubase panchayat. Local leaders have participated in the program from the beginning.

Besides the lack of fodder, fuelwood, and regular water sources, the destruction of cultivated lands by floods and the disappearance of wild animals are major problems faced by the people because of deforestation. In this area, forest protection is not yet properly carried out. The planting area is protected by forest guards. Seedlings are provided by the government and voluntary labor is provided by villagers. Once the trees mature, leaders think income from forest products will be kept in the panchayat, and branches of the trees will be distributed to villagers without harming the trees themselves.

Livestock are allowed to graze in the forest, but the panchayat does not allow people to collect fuelwood or fodder. From time to time, the Panchayat gives permission to collect fuelwood and fodder when it is appropriate. More than 90 percent of the people are cooperative toward forest protection and development.

Local leaders think the main reasons for deforestation are clearing by local people, landless people, and the government, careless tree felling for timber, fodder and fuelwood, and inefficiency of the Forest Division in forest protection.

Bayarban. The community forestry development program is not implemented in the Tarai districts yet, but will be implemented in Morang district as of 1984. Local leaders became aware of this program recently through radio and newspapers. Local leaders have been involved in the afforestation program since last year.

In this area, the problems faced by people due to deforestation are the drying up of water sources and declining soil fertility along with changes in climatic pattern.

In the opinion of local leaders, panchayats would be able to protect the forest only if there is full support from the villagers. The planting area would be protected by forest guards. Forest guards and planting costs would be financed by the panchayat and voluntary labor would be used. It has not yet been decided how the income from the forest would be distributed. Most likely it would go to the panchayat.

Strict rules and regulations about fodder and fuelwood collection are nonexistent. Occasionally, the Forest Division issues permission slips to collect fuelwood.

In the opinion of local leaders, the main reasons for deforestation in this area are forest clearing by landless people and migrants from the hills, the rehabilitation program of the government, the inefficiency of the Forest Division in forest protection.

## Attitudes of Forest Officers

Kaski (Sarangkot). In Kaski District, the forest area was 98,641 ha. in 1977. According to forest officials the present area is approximately 30 percent less. The existing forest is not in good condition, more than 50 percent is deforested.

In the opinion of forest officials, the main reasons for deforestation are the inefficient Fuelwood Corporation, expansion of agricultural land, and lack of authority given to the Forest Division to take action against encroachers.

About 25 percent of the forest area is encroached for cultivation by local villagers. The average land area per household acquired through encroachment is about 0.02 ha. From 1979/80 to 1982/83, 2736 hectares were planted and 16,000 seedlings/hectare were planted annually. The survival rate is only 60 percent.

The Forest Officer thinks the present rate of reforestation is very low because the Forest Division does not have sufficient funds or manpower for that purpose. The approximate rate of tree felling for the last ten years is 12,000 cu. ft. per year for timber and 12,000 cu. ft. per year for fuelwood. No figure for illegal tree felling was given.

In this area, timber and fuelwood species are planted by the Forest Division. However, fodder species are distributed to individuals to plant on private land.

Syangja (Dhanubase). The forest area of Syangja district was 22,424 ha. in 1977 (Remote Sensing Centre). According to forest officers, the present area is approximately 10 percent less. The existing forest is 50 percent deforested. The main reasons for deforestation are increased population and dependency on forest for timber, fuelwood and fodder.

There is also encroachment of the forest by local people. The approximate land area thus acquired is 0.01 ha. per family of encroachers. Since 1979/80, 50 ha. per year is being reforested. Forest officers think that the emphasis on reforestation is low because the local people and leaders are not conscious of the problem. The rate of tree felling for timber has been about 3000 cu. ft. each year for the last ten years. Both timber and fodder species are planted in this district.

Morang (Bayarban). The present forest area of the Morang district is 30,321 ha. which is about 21 percent of the gross area of the district (Land Resource Mapping Project). According to forest officers, the present forest area is approximately ten percent less than a decade ago and the remaining forest is roughly 25 percent deforested.

According to forest officers, the main reasons for deforestation are forest encroachment for cultivation, resettlement, and illegal tree felling for timber, fuelwood and fodder (Table 10). About 75 percent of the encroachers come from hill districts of eastern Nepal and 25 percent are from other Tarai districts. Approximately two ha. of land is cleared by one family of encroachers.

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 Table 10. Number of Trees Felled in Morang District

Year	No. of Trees	Timber (cu. ft.)	Wood for Fuelwood and Other Purposes (cu. ft.)
1977/78*	132,569	3,403,704	226,270
1978/79*	78,797	1,994,240	106,352
1979/80	70,713	1,385,038	16,945
1980/81	1730	60,755	895
1981/82	36,488	639,388	-
1982/83	255	16,951	-

\* In these two years only 50 percent of this data is for Morang.  
 Source: District Forest Office, Morang.

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 In this district, the reforestation activities started in 1982 when 31 ha. were planted. Fifteen ha. were planted in 1983. The survival rate of the seedlings is 50 to 60 percent. Recently the emphasis on reforestation is higher than at the beginning of this decade, but it is not enough to cope with the present rate of deforestation.

The above data records only legal tree felling. Records on illegal tree felling are unavailable. One assumes the extent would be significant because people highly depend on the forest for fuelwood, timber, and fodder, and because of the open border with India, illegal export of timber and fuelwood is common.

In this district the areas cleared for resettlement from 1976 to 1979 totalled 5908 ha., in the Bayarban panchayat alone it totalled 1414 ha. There has not been any land clearing since 1979. In this district, only timber species and not fodder and fuelwood species have been planted. Branches of trees are used as fuelwood.

#### GOVERNMENT POLICY

In most of the villages few traditional rules existed for forest protection and management. After the government took ownership of all the forests in 1957, existing traditional rules faded away and local people did not feel any responsibility toward the forests. Peoples' attitudes are important factors responsible for indiscriminate use of forests.

The government only took responsibility for selling and exporting forest products. The other side of the forest management, reforestation and regeneration of the forest, was neglected. The high rate of forest destruction and negligible rate of afforestation made the government realize the need for forest development, better management and community participation. Therefore, in 1979, the 1957 Act was amended and a new concept of panchayat forest and panchayat-protected forest was introduced. The main aim was to involve local panchayats and communities in forest development and to make villagers aware of their responsibility.

The National Forestry Plan of 1976 was the first attempt to initiate comprehensive forest development in Nepal. The aims of the

national forestry policy are as follows (ADB et al., 1982):

- (a) to obtain maximum contribution from forests to make Nepal self-sufficient in basic industrial forest products, fuelwood, and tree fodder,
- (b) to reserve and maintain forests in the Tarai in coordination with agriculture, pasture, and other land uses;
- (c) to systematically increase forest consciousness among the hill communities by encouraging formation of panchayat and private forests as well as leased forests;
- (d) to increase nonagricultural employment in the hills by diversifying forestry activities, particularly the collection of resin, medicinal plants and herbs and their local processing;
- (e) to increase the gene pool of flora and fauna by creating National Forests and ensuring their adequate protection through cooperation by the people.

According to the panchayat forest rules, 1978 panchayat forests were established in the following way (LRMP, 1982):

"For the purpose of developing forests through reforestation on any government forest or part thereof which has been rendered waste, or in which only stray trees are left, a maximum of 20 bighas (13.4 ha) in the Tarai region and 2500 ropanis (125 ha) elsewhere in one village panchayat area shall be allotted as panchayat forest. Explanation: Str y trees mean a maximum of six trees with a diameter of less than 16 inches (49 cm) each in an area of one ropani (0.05 ha).

Panchayat Protected Forests are defined as follows (LRMP, 1982):

- (a) For the purpose of protecting and properly managing any government forest or part thereof, a maximum of 400 bighas (268 ha) in the Tarai and 5000 ropanis (250 ha) elsewhere shall be determined as Panchayat protected forest for every village panchayat.
- (b) Panchayat protected forests may be handed over to the local panchayat in one lot or in different lots within the limits prescribed in Sub-Rule (1), provided that such local panchayat shall not be given additional lots unless it has made arrangements for the proper protection and management of the previous lots.

The development plan did not emphasize afforestation or reforestation. In 15 years of development planning only about 20,000 ha. have been afforested in Nepal while during the same period more than 2 million ha. of forest have disappeared. In the Tarai, 393,645 ha. were deforested between 1955 and 1977, between 1977 to 1981, 63,230 ha. were deforested (Table 11). The expenditure on afforestation during the Fifth Plan was only 4.6 percent of the total outlay for forestry. However, the emphasis on afforestation for fuelwood in the hills has in-

creased in the Sixth Plan. Afforestation is mainly done with the help of a community forestry project. Under the Sixth Plan an area of 71,427 ha. is targeted to be afforested.

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 Table 11. Forest and Deforested Area in Tarai (ha)

1955(1)	Forest Area		Deforested Area	
	1977(2)	1981(3)	1955-1977	1977-1981
1140755	517703	454473	393645	63230

1 = U.S. Army

2 = Landsat Imagery, March 1977

3 = Landsat Imagery, March 1977

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### CONCLUSION

The problem of deforestation is realized throughout Nepal. However, few studies precisely quantify the effects or identify the causes of deforestation. This short research study only aims to broadly indicate the problem, to make a basis for further detailed studies.

The findings of this study reveal that the number of trees owned by farmers is correlated with land and family size. The correlation between land size and number of trees are observed in other studies as well (Shrestha, 1982 and Wyatt-Smith 1982). Land size and livestock number both have declined over the last five years. The decline in forest resources and pasture is one of the reasons for the declining livestock number. In some cases the livestock number has increased compared to last year, but there may be no net increase, as sale and slaughter of livestock takes place toward the middle of the year.

Nepal has a high livestock population that is expected to increase, though in the sample, livestock population has declined. The majority of hill farmers sampled would like to increase their livestock number once fodder becomes more available after afforestation, whereas the majority of Tarai farmers sampled would like to raise a small number of improved livestock rather than increasing their number of inferior breed. The reason may be that improved breeds are easily available and can easily survive in the Tarai, whereas in the hills improved breeds are difficult to obtain and expensive.

At present, sample farmers are reducing their livestock. This finding could not be generalized without further study. A detailed study of past and present livestock population and people's attitudes toward livestock raising after afforestation would be useful for the success of reforestation projects.

Fodder is not easily available these days compared to five or ten years ago. The percentage of people, especially large farmers, depending on the forest alone for fodder has declined over the past decade. Dependency has been diverted toward private land. This is a clear indication of deforestation. A majority of farmers agree that deforestation is the main reason for diversion from forest to other sources of fodder. Research should be done to indicate the diversion of depen-

dependency, and related causes and effects. Study should also focus on how to make farmers plant fodder grass without hampering their normal crop, so that diversion of dependency would not be a burden to the farmers.

Fuelwood is equally scarce these days and time-consuming to collect. Due to this scarcity, more time is needed to cook a meal than five years ago. As in the case of fodder, dependency on the forest alone for fuelwood has declined and dependency on forest and private land together has increased, compared to a decade ago.

Wide publicity of the concept of fuel-saving stoves is required and studies should be carried out to examine how people benefit from these stoves, to what extent they have lessened the burden on fuelwood collection and saved the time of farmers. Research should be done to find out the ways of diverting the dependency on fuelwood to other fuels.

Most hill people think that careless tree felling by villagers is the main reason for deforestation. The low rate of reforestation and carelessness of the Forest Division are also responsible. However, Tarai farmers emphasized that the carelessness of the Forest Division is the main reason for deforestation.

It is surprising to find that hill people are more aware of reforestation activities than Tarai farmers. The Tarai was once very rich in forest and has recently become a highly deforested area. Farmers are not much aware of reforestation activities, indicating reforestation is still highly neglected in this area.

In the hills, people were made aware of these activities by the Forest Division as well as the radio and newspaper, while in the Tarai a majority of farmers were informed about the community forestry program through the media. It seems that people have less interaction with the Forest Division despite its accessibility in the Tarai.

Farmers in all three panchayats realized afforestation would benefit both government and farmers. A high percentage of farmers would like to plant trees on private land and in the hills they have started to do so.

The local leaders are quite interested in participating in the afforestation program and protecting the afforested areas in their respective panchayats. Certain pockets in the survey area are heavily deforested and according to the leaders, villagers are suffering from occasional floods and soil erosion and in some areas streams have dried up. In the hill panchayats, local leaders think careless tree felling by local people and the government, along with the inefficiency of the Forest Division to protect the forest are the main reasons for deforestation. Similarly, Tarai people observe that forest clearing by local migrants, the rehabilitation program of the government and inefficiency of the Forest Division are the main reasons for deforestation. Local leaders think more than 75 percent of the villagers would be willing to cooperate in the afforestation program.

Forest officers think careless tree felling for fodder, fuelwood and timber, forest encroachment for cultivation, the government's resettlement program, the inefficiency of the fuel corporation, and inade-

quate authority given to the Forest Division to take action against encroachers are the main reasons for deforestation.

According to the rough guesses made by forest officers, about 10 to 30 percent of the forest area has been deforested within a decade in these districts. The existing forest is also in bad condition, between 25 to 50 percent having been deforested.

Government targets for forest development may be impressive, but the emphasis on afforestation is extremely low compared to the rate of deforestation. Local people think the Forest Division is as responsible for deforestation as other factors. On the other hand, foresters think that they do not have enough authority to control deforestation. Forest is taken as everybody's property, and everybody, including the government, is careless in using the forest and its products.

Therefore, it is important that related government departments take the responsibility in leading people toward forest development. Cooperation of both the government and communities could make the development of forest successful. The government should try to mobilize more resources in afforestation activities and also encourage the private sector in agroforestry. The government could even develop the policy of leasing land for such purposes.

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