CHAPTER IV

AGROFORESTRY SYSTEMS AND THE ROLE OF GENDER
IN THE STUDY AREA

From the knowledge of socio-economic and demographic profile presented in the previous chapter, one can see that Salle area is endowed with the diversified social strata of different ethnic group where Magar is the dominant. Like in other parts of mid hills of Nepal, Salle also comprises of distinct components of the agroforestry systems. The transect of the village (Figure 7) shows different components of agroforestry system and their locations.

4.1 Agroforestry systems

The definition of agroforestry i.e., intentional manipulation of land unit to satisfy subsistence needs for food, fodder, fuelwood, timber and soil protection through the practice of cultivating crops and trees is applicable also to the eastern hills situation of Nepal. In the Salle village of eastern hills, agroforestry system has evolved over a much longer time historically where most commonly encountered agroforestry system is combination of annual crops and multipurpose trees, or in other words, it is the crop/ tree/ livestock mix typically found around homesteads.

ALTITUDE	2200 MSL	—	—	—	450 MSL
LAND TYPE	NAGI LAND (Tree plantation area! and grass land)	UPLAND (Homestead Area)	UPLAND (Bari land)	PRIVATE FOREST	LOW LAND (Irrigated field)
CROPS	—	Vegetables, (Kitchen garden)	Maize Potato Millet Soybean Wheat	—	Rice Wheat Maize
CROPPING PATTERNS	—	—	Potato+Maize Maize/Millet Maize+Soybean Maize-Wheat	—	Rice-Rice-Fallow Rice-Wheat-Fallow Maize-Rice-Fallow
LIVESTOCK	—	Ox Cows Buffaloes Sheep Goats Pigs Poultry	—	—	—
TREES	Salla Utis Nevaro Masala Palant	—	Nevaro, Bains Dudhilo, , Dhupi Gogan, Bans Painyu, Khanyu, Ghurmiso Utis	Nevaro Dudhilo Utish' Khanyu, Ghurmiso	—
ACCESS AND CONTROL BY GENDER	Access by both Control by male	—	Access and Control by both	Access by both, control by male	Access by both Control by male

Figure 7   Transect of the Salle village
Source: PRA, RRA and Survey, 1992

4.1.1 Components of agroforestry systems

The main components of agroforestry systems can be categorized as crop, tree and livestock relating directly with the farm household. Agroforestry systems comprise of some cereal crops in a complex interaction with tree species like *Nevaro, Duhilo, Utis* etc. These trees are normally grown on the marginal lands, on terrace risers and are also essential components of livestock subsystem in the village.

1) Crop Production

The main field crops grown on the *bariland* are potato, maize and other minor crops are soybean, millet, wheat etc. (Figure 8). Small areas of a limited range of fruit and vegetables are grown around homesteads. A small area of rice is also grown on irrigated lowland fields. Maize and potatoes are staple food crops. Potato and millet are major cash crops. Findings show that the ethnicity and economic status of the farmer has no relation in the selection of these crops. Even though 52 per cent of the households own paddy land, the average size is only 0.52 ha. Thus, paddy land represents a small portion of the land which is generally kept free of trees.
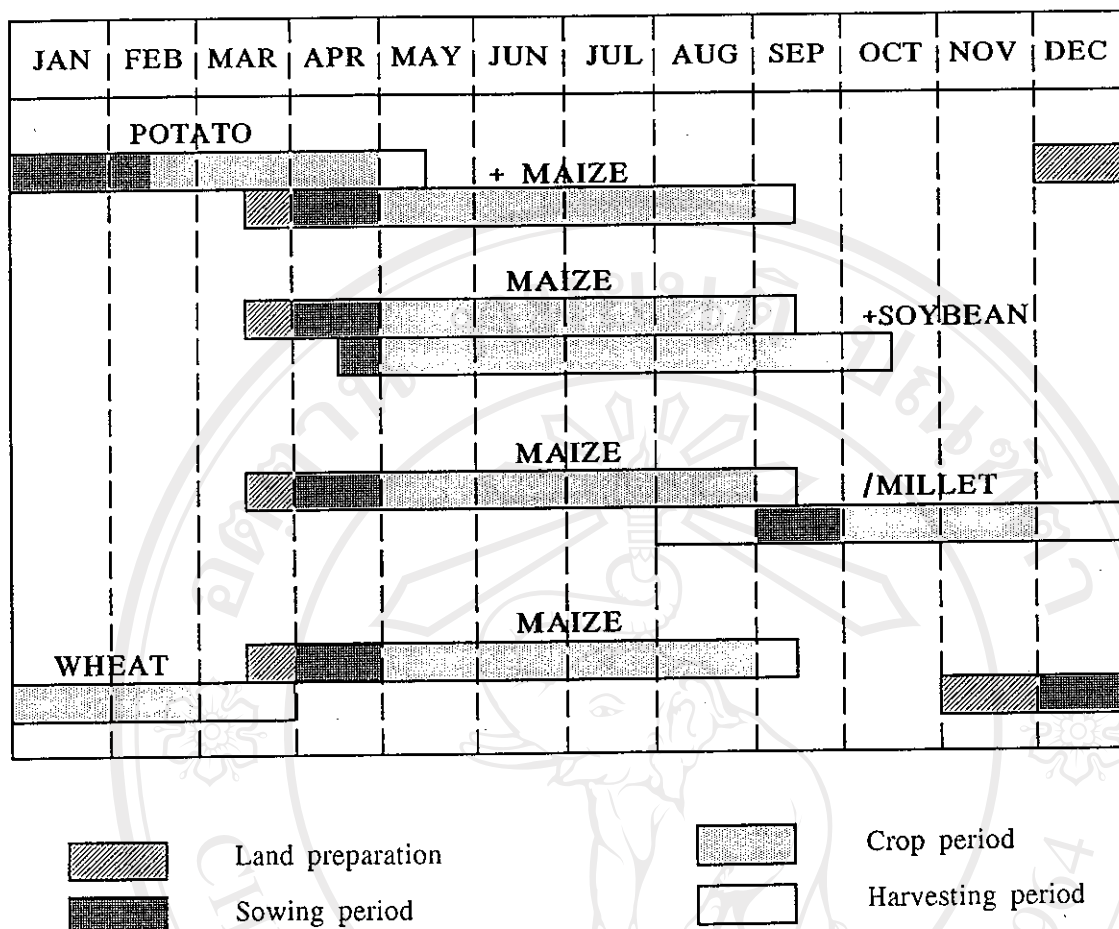
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

POTATO

+ MAIZE

MAIZE

+SOYBEAN

MAIZE

/MILLET

MAIZE

WHEAT

▨ Land preparation   ▦ Crop period

▨ Sowing period   ☐ Harvesting period

Figure 8 Cropping calendar (on *Bari*land)
Source: PRA and RRA, 1992

2) Animal production

Almost every household maintains a range of animals, namely cow, buffalo, sheep, goat, pig and poultry. The average number of which was found as 1.6 cows, 3 she-buffaloes, 1 he-buffalo, 0.2 sheep, 1.9 goats, 1.2 pigs and 16.9 chickens (Table 6). Almost all farmers raise chickens, whereas only 4 per cent farmers own sheep. Similarly, cows, buffaloes and pigs are reared by 57, 95 and 92 per cent farmers respectively.

Different ethnic group have different priority for each species of animal. Brahmin and Chhetri give priority to buffaloes, cows and goats. Traditionally, they do not keep pigs and poultry but some farmers are now beginning to do so as they realize the economic benefits of pigs and chickens. In the other hand, Magar and Gurung are culturally allowed to rear any species. However, they are dependent on pigs and poultry for ritual purposes.

Cows and buffaloes are the most prevalent and economically important livestock and they bear close relationship with the prevailing resource and agricultural features in the village. They are raised as sources of earning and saving and also for manure and draught power. The seasonal feeding patterns for the livestock production depends in general on five major food sources: fodder from farmland and private forestland, fodder and grasses from *nagi*land, crop residues, field crop areas and rice fields. Livestock subsystem is regarded as secondary in priority to crop production despite a comparable economic return and income generation from this subsystem. The animals are always underfed and their feeding type is confined to stall feeding system. There is no more communal grazing land after the *nagi*land has covered with tree plantation.

Table 6 Livestock ownership pattern

Livestock type	Av. holding	Per cent of farmers owning	Uses
Cows	1.6	57	manure, milk, religious need
Oxen	0.8	40	draught and manure
She-buffaloes	3.0	95	milk, manure
He-buffaloes	1.0	85	draught, manure, meat
Sheep	0.2	4	wool, meat, manure
Goats	1.9	42	meat, manure
Pigs	1.2	92	meat, manure
Chickens	16.9	100	meat, eggs, manure

Source: Survey, 1992

3)   Tree growing

Studies in the hill region of Nepal, have shown that a household own an average of 28 trees (Foley and Barnard, 1984) on the farmland, however, its exceptionally high (82) in case of Salle village. But, poor farmers have half of this number (Table 3). An average number of trees available to the households on *nagi*land and private forestland are 1232 and 244 respectively (Table 7). In addition, there is an average 31 tree seedlings under cultivation. Most of these trees are grown by natural seeding or transplanted by farmers from other parts of their land or from the nursery.

Almost all households have *Utis (Alnus nepalensis), Gogan (Saurauia napaulensis), Dudhilo (Ficus nerifolia)* and *Painyu (Prunus cerasoides)*

on their farmland and average number of these trees are 300, 27, 24 and 11 respectively (Table 46). *Utis* is the most common tree for fuelwood and timber but the farmer is not satisfied by quality of timber produced by *Utis*. *Gogan, Nevaro, Dudhilo, Painyu and Bans* are main tree fodder for livestock feed.

New tree planting is generally done on the *nagi*land and cultivated farmland. Mainly fodder trees are planted on cultivated farmland. Rusten (1989) showed that in hills of Nepal, an average of 54 per cent of all trees grown on privateland are potential sources of animal fodder, and 33 per cent are primarily cultivated to supply animal fodder. Tamang (1990) has described the increasing number of trees on private land will transfer the pressure of demand for forest products (fuel, fodder, timber) as an alternative source. The main sites for planting are along the terrace edge, banks, around house and cattle shed and along gullies and streambanks. A few farmers also have underplanted fodder trees in previously established *Utis* blocks and in combination with cardamom plantations. It is interesting that 90 per cent of farmers plan to sell trees for cash in the future. This suggests that access to markets and existence of road network has to some degree influenced tree planting activities in the area.

Table 7 Average number of trees available on *nagi*land/ forestland to the
farmers of different ethnic group

Ethnic group	Hectare/ HH*		Average number of trees/ HH	
	*Nagi*land	Forestland	*Nagi*land	Forestland
Brahmin/Chhetri	NR	0.13	NR	58
Magar/Gurung	0.60	0.49	1232	430
Mean	0.60	0.31	1232	244

Note: * and NR indicate household and No response respectively.
Source: Survey, 1992

Decreasing of fodder trees in forest and marginal areas increase
the pressure towards the private land. At the same time, the qualities and quantities
of private fodder trees is decreasing due to the heavy lopping. Therefore, planting
of multipurpose tree species in and around the farmland is realized to be crucial for
sustaining the hill farming system.

4.1.2 Inter-relationships existing among components of agroforestry systems

For the purpose of analyzing the interrelationships, the components
of agroforestry system have been identified as crops, livestock, trees, pasture and
farming household (Figures 9 and 10). There exists a complementary relationships
between crops and livestock and also between livestock and tree.

Crops provide feed and sometimes bedding materials as well to livestock and in return, receive draft power and manure from livestock. The range of manure application rates in the sample is 6- 30 tones/ ha with an average of 9 tones/ ha. This is very low compared to average of 31 tones/ ha FYM (Farm Yard Manure) applied to potato in the maize/ potato system, calculated from field measurement by Gurung and Neupane (1992). Conlin and Falk (1979) noted that smaller farms use higher application rates.
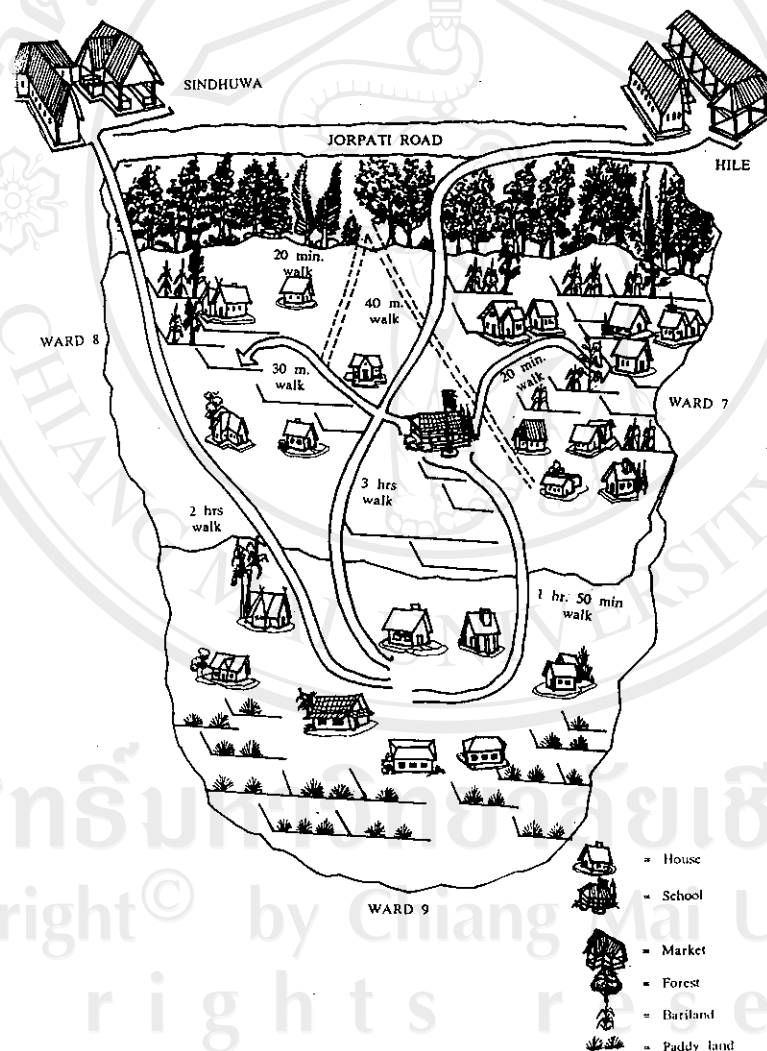

Figure 9 Location of different components of agroforestry system
Source: PRA and RRA, 1992

Manure is also expressed as an important product of all ruminants by respondents in a survey on the benefits of animal keeping in the Koshi hills (Gatenby *et al.*, 1990) and this is true for the case of Salle village too. Higher production levels of manure by buffalo and cow compared to other ruminants by respondents in a survey are indicated by Campbell *et al.*, (1990). Even though pig manure is assessed as best in terms of increasing crop production, the preference of farmer is on the quantity but not the quality of manure produced.

Livestock feed supplied by crops, mostly consists of roughage such as crop by-products (straw and stover) and some concentrates such as cereal grains, maize. The crop by-product (mainly rice straw) is used as livestock feed due to reduction in feed supply from nonfarm sources, particularly forests and pastures. Regarding livestock feed from crop by products, 80, 90, 50, and 10 per cent of total by-product are used as fodder in case of maize, millet, rice and wheat respectively (Pandey, 1982).

The contribution of oxen and he-buffalo to farming, especially in providing the draft power, is enormous. Roughly, 75 per cent of the cultivated land is ploughed by these animals, and 90 per cent of the work is done by pair of oxen (*ek hall goru*). Campbell *et al.*, (1990) reported that only 52 per cent of farmers have a pair of working oxen. However, those not owning any stated that timely unavailability of those oxen was a constraint to crop production, although a loan system operates for using other farmers' oxen.

Trees on farmland directly influence crop production by supplying compost materials, in addition, trees plantation on grassland (*nagi*land) that located on upper slopes, provide protection to cropland against landslides and erosion. Forest is the principle source of fallen, dry leaf litter and lopped green foliage of trees and herbaceous species which are used for animal feed, bedding and composting. Forest biomass when mixed with animal excreta, yields organic compost manure which forms the principal source of soil nutrients for hill agricultural land. It is worth noting that crop- forestry linkages are one way at all the sites i.e., only crops benefitting from the forests and not vice versa (Yadav, 1990). Khadka *et al.*, (1984) have estimated that about 50 per cent of litter production is removed annually from the same forests in Nepalese midhills. This seriously interrupts nutrient cycling within the forest.

In general, forest and pasture are more closely linked with livestock than with any other component. In the hills, the number of livestock kept per household is mainly determined by the available forests. More land holding group has strong relationship between fodder trees and large/ small animal holding (Chapter III). This relationship seems weak in case of poor Magar/ Gurung, medium Brahmin/ Chhetri and poor Brahmin/ Chhetri group. Their grazing management might be therefore, more related to the forestry component, rather than indigenous fodder trees planted on farmland. The quantity of feed supplied by forests is not only determined by the area of available forest lands but also by the availability of fodder trees in the forest; as the green grasses and tree fodder from forests are usually collected and stall fed to livestock. But as the farm animals are prohibited

in grazing, there is no provision of manure to forest. Fodder is required for domestic animals. A large animal consume about 2 metric tons of fodder annually. The animals obtain an estimated 35 per cent of their feed from trees (Pandey, 1982).

The linkages of three production sectors (e.g. crop, tree and livestock) with the household sector is the main actor as it plays a key role in overall operation of the agroforestry system (Figure 10). To seek and sustain the contribution of three sectors, the household sector has to manage activities through labor and other inputs.

The households obtain food, fuel and cash from crop, livestock and tree components of agroforestry system. Leutel (1991) in his study indicated that in middle hills of Nepal, the amount of firewood consumption for a household is 581 kg per year. It is generally mentioned that farming households maintain two-way direct linkages with crops and livestock but their direct linkages with trees/ forests are rather one way (Yadav, 1990).

However, in Salle village, direct linkages of households with trees tend to be two ways as the farmers are much interested in tree plantation on their *nagi*land privatized later. For the protection of trees, they have made rules and regulations which required each to be watchman for one day on rotational basis. And they have comparatively more trees on their farmland too.
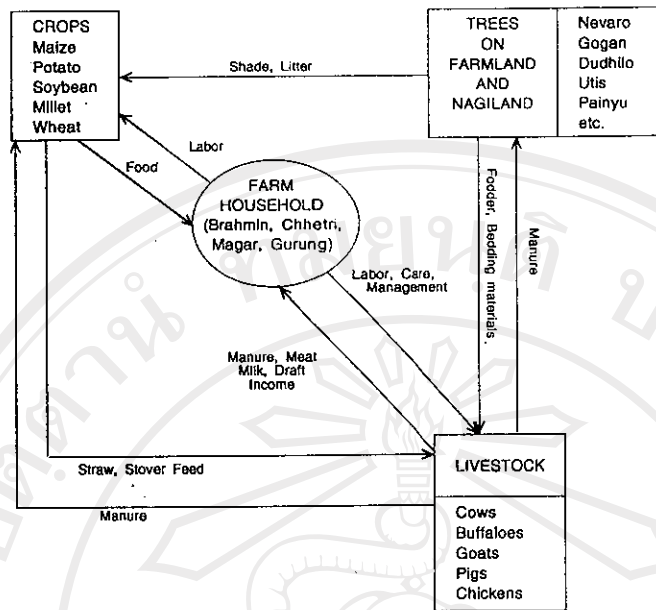
Figure 10 Components of agroforestry system and their inter-relationships
Source: PRA, RRA and Survey, 1992

The farm, tree and livestock linkages is thus strong in Salle village

as there are only few interventions from market forces with negligible transformation

in agriculture. But in order to cope with decreasing availability of trees/ forest, the

farmers change their farming practices by reducing size of livestock holdings,

changing in herd composition, increasing stall feeding practices and increasing use

of crop by products for livestock feed, that also helped reduce dependency on forest

resources. However, these type of activities are directly related to the household

labor dynamics. For some of the items such as stall feeding and making use of crop

by-products required more labor for livestock management. Likewise, due to

reduction in livestock number, a certain part of the labor force are found to change

to other alternative activities.

1) Interaction among crop, tree and livestock components

When a question regarding the tree and crop interaction was posed to the farmers, they responded that there were many effects caused by trees either positive or negative, or a combination of both. Among those, 46 per cent of farmers replied that the tree influenced crops on both ways: positive and negative. However, 31 per cent replied that tree had positive effects. The other 18 per cent reported negative effects of trees on crops (Table 8).

Table 8   The tree and crop interaction

Tree and crop interaction	Farmers' Response	
(positive, negative or both)	No. of respondent	Per cent
Positive effect	45	31
Negative effect	26	18
Both (positive & negative)	66	46
No idea	8	5
Total	145	100

n = 145

Source: Survey, 1992

a) Positive impact of tree and crop interaction

The rural farmers have realized positive impact (advantages) of farm tree growing practices (Table 9). The main advantage is primarily based on fodder production (Leutel, 1991). Twenty nine per cent of farmers responded that as fodder is available nearby house from farmland, they can cut whenever needed

for feeding livestock and 14 per cent respondents indicated saving in time of fodder collection because of their accessibility, namely, nearer to their house and can be cut at any time.

Table 9   Advantages of tree growing on the private land

Advantages (identified by farmers)	Farmers' Response	
	No. of respondent	Per cent
Soil[1]	5	11
Land[2]	1	2
Fodder[3]	2	4
Time[4]	13	29
Soil & Land	4	9
Soil & Fodder	4	9
Soil & Time	4	9
Land & Fodder	4	9
Land & Time	2	4
Fodder & Time	6	14
Total	45	100

n = 45

Note: 1 = Increase organic matter and soil productivity.
2 = Land conservation
3 = Less time for fodder collection
4 = Can be cut at any time

Source: Survey, 1992

The other advantages like increase in organic matter and land productivity and soil conservation are also realized by the sampled farmers. Fonzen and Oberholzer (1984) stated that the farmers of mid hills of Nepal were very aware and appreciative of positive interaction effects of the woody perennial strips so that they reconcile to the negative interaction effects over crops.

b)   Negative effects of farm trees to field crops

The most realized negative effect of the tree to the field crops are shading effect, difficulty in agricultural operations like hoeing, weeding, harrowing, etc. and low yield of crops due to space and nutrient competition (Table 10). Random plantation of trees on the edge of cropping terrace with approximate distance between trees are shown in Figure 11, from which the spacing between crops and trees could also be clear. Fonzen and Oberholzer (1984) also mentioned some of the negative interactions of crops and trees such as shading effect of woody perennial at around the cultivated land, consequently lower yields of crops near the trees, damage to young crops by dripping of large drops of rain from the over storey trees.
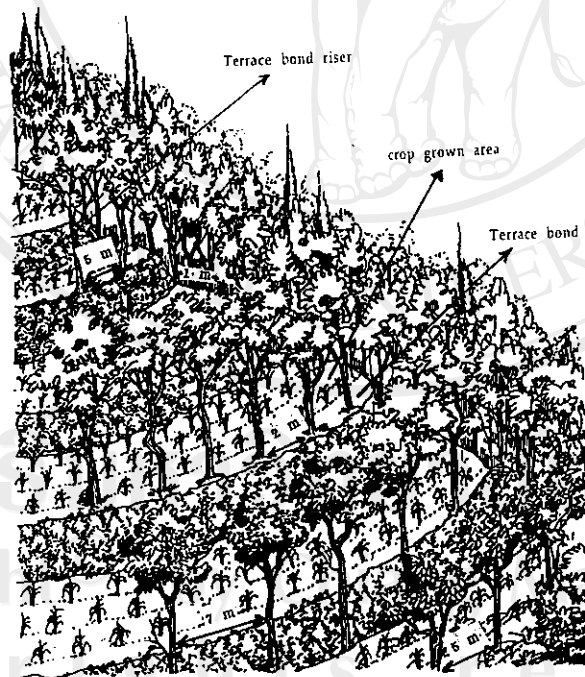

Figure 11   Random plantation of trees on terrace bond, bond riser with
approximate distance between trees
Source: PRA and RRA, 1991

Table 10   The negative effects of tree species to field crops

Disadvantages (identified by farmers)	Farmers' Response	
	No. of respondent	Per cent
Shading effect	13	50
Difficulty in agricultural works	2	8
Shading effect & low yield of crops	7	27
Shading effect & difficulty in agricultural works	4	15
Total	26	100

n = 26

Source: Survey, 1992

The underlying principle in judging crop and tree interaction is based on the crop yield. The RRA (Rapid Rural Appraisal) and PRA (Participatory Rural Appraisal) results revealed farmers' views on this aspect. *Nevaro* and *Utis* are regarded as preferred tree species for agroforestry. Paddy is indicated to be badly affected by tree shade. Trees are as resting place for many birds during day and night causing damage to maize crops. Millet and soybean are also adversely affected through shading effect of companion trees. However, the importance of tree species to the maintenance of livestock components can easily trade off this disadvantage. Fonzen and Oberholzer (1984) also indicated same observation from farmers of western region of Nepal. Livestock is an inseparable component and there is an acute need of tree species around farmland to secure the subsistence of livestock system. Moreover, farmers can minimize the shading effect by adopting a traditional indigenous knowledge of tree management practices by cutting twigs and branches at appropriate time of the year, planting of trees on bunds of terraces to reduce shading effect and maintaining wide spacing of trees (Table 11).

Table 11   Farm tree management

Tree management strategies	Farmers' response	
	No. of respondent	Per cent
Tree[1]	53	38
Bund[2]	23	16
Space[3]	11	9
Tree & Bund	20	14
Tree & Space	19	13
Bund & Space	14	10
Total	145	100

n = 145

Description of strategies
1 = By trimming trees
2 = Planting of trees on bunds of terraces to reduce shading effect
3 = Maintaining wide spacing of trees
Source: Survey, 1992

4.1.3   Importance of tree and its preference

Tree fodder is a primary constituent of all animal feed used. Animal productivity can be improved or sustained by increasing the number of fodder trees (Pandey ,1982). The percentage of tree fodder to total fodder consumed exhibits considerable seasonal, geographic and environmental variation. It is estimated that on an average annually over 50 per cent of all fodder is acquired from tree fodder sources (Pandey, 1982). Other estimates are: 30 per cent (Fonzen and Oberholzer, 1984); 35 per cent (Brewbaker, 1983); and 87 per cent (Singh *et al.*, 1984). Private trees contribute, on average, one fifth of tree fodder demand and in some areas, 50 per cent or more of tree fodder comes from private trees (Wyatt-Smith, 1982 and Mahat, 1985). Fox (1983) determined that in middle hill

community, an annual average 13 per cent of total fodder demand is met from tree

fodder resources, with 72 per cent of this demand being met from private trees.

Number of tree plantation on different types of land has been

presented in Table 12. It is clear from the table that *nagi*land comprises more trees

in terms of number. This statement is true for Magar, Gurung ethnic group. In case

of Brahmin/ Chhetri, as they do not own *nagi*land, concentration of tree plantation

is more on farmland. Accessible forest land is also more in rich Magar/ Gurung

followed by medium Magar/ Gurung and least to the medium Brahmin/ Chhetri.

Table 12   Average tree available per household on various types of land.

Socioeconomic group	Farmland	*Nagi*land	Forestland
Rich Magar/Gurung (E1R)	112	2834	657
Medium Magar/Gurung (E1M)	111	588	203
Poor Magar/Gurung (E1P)	44	273	NR
Medium Brahmin/Chhetri (E2M)	98	NR	55
Poor Brahmin/Chhetri (E2P)	45	None	60
Mean	82	1232	244

Note: NR indicates no response.
Source: Survey, 1992

1)   Status of tree plantation

Nevaro, Dudhilo, Gogan are dominant trees existing on

farmland. This case is true for all types of socioeconomic strata. Besides, *Utis,*

Painyu and Khanyu are equally available to all other except rich Magar, Gurung (Table 13). In case of *nagi*land, *Salla* and *Utis* are predominated to all group owning *nagi*. However, *Masala, Falant and Nevaro* are also existing to rich and medium Magar, Gurung.

Forest land, on the other hand, comprises *Utis* as a dominating tree species. Several other local bushes and shrubs are also prevailing in the forest. The characteristics of tree species are described below.

Utis (*Alnus nepalensis*):

This tree is widely distributed at elevations above 900 msl (metre above sea level). It is liable to damage by browsing animals when young, but seedlings over 50 cm high are relatively immune (Jackson, 1987). It is not a very good fuel from the point of view of kilojoules per cubic metre, though this is compensated for by its high volume increment. It dries rapidly and burns easily. It is not considered to be among the best timbers for construction, but is widely used of this purpose because of the scarcity of better timbers. Despite the shortcomings, it is widely planted mainly because of its rapid growth, good form and the relative ease by which it can be established. It is a useful species for planting in ravines and other small areas near farms where crops cannot be grown. The leaves are used as fodder for sheep and goats.

Nevaro (*Ficus roxburghii*):

It is a medium sized tree which is widely used for fodder. It grows up to about 2000 msl. The leaves are used for fodder during December and March, and again after the flush of new leaves in April, May and June. One vigorous tree will produce 60- 80 kg of fresh leaves each year. It is evergreen tree. It causes dysphagia in case of ruminants (Pandey, 1982).

Dudhilo (*Ficus nerifolia*):

This tree species occurs between 900 msl and 2200 msl. It is a small deciduous tree. It is widely used fodder tree, and popular among farmers. The trees are lopped for fodder from January to February and again from May to June after the flush of new leaves has appeared.

Gogan (*Saurauia napaulensis*):

It is a small tree fairly tolerant to shade and occurs between 750 and 2100 msl. It is mainly valued for its fodder. The trees are lopped from December to early March. The large leaves are used for plates. Despite its being one of the most valued fodder trees, it has only so far been raised on a relatively small scale, perhaps because it has a very small seed and needs quite a lot of care in the nursery.

Ghurmiso (*Leucosceptrum canum*):

This shrub or small tree is said to be good fodder for sheep and goats, some people say that larger animals can also use it. This tree has also been used for roadside slope protection.

Table 13   Dominating tree species grown on various types of land

Socioeconomic group	Farmland	Nagiland	Forestland
Rich Magar/Gurung (E1R)	Nevaro Dudhilo & Gogan	Salla Utis & Masala	Nevaro Dudhilo Utis Painyu Khanyu & Ghurmiso
Medium Magar/Gurung (E1M)	Nevaro Painyu Dudhilo Gogan Utis Khanyu & Ghurmiso	Nevaro Falant Salla Utis & Masala	Utis
Poor Magar/Gurung (E1P)	Nevaro Painyu Dudhilo Gogan Bains Dhupi Utis & Khanyu	Utis & Salla	-
Medium Brahmin/Chhetri (E2M)	Nevaro Painyu Dudhilo Gogan Bains Utis Khanyu & Bans	-	Utis
Poor Brahmin/Chhetri (E2P)	Nevaro Dudhilo Gogan Utis Painyu Bains & Khanyu	-	Utis

Source: Survey, 1992

Painyu (*Prunus cerasoides*) **(Wild cherry):**

It is a medium sized fodder tree occurring from 1300 to 2400 msl. According to Pandey (1982), it is used almost exclusively as fodder for sheep and goats, not cattle, and causes urinary problems and reduced milk yields. The flush of new leaves begins in November or December after flowering, but the trees are lopped in June and July when they are mature and have been washed by rain. According to Pandey (1982), one tree will yield 80 - 120 kg of fresh fodder per year. It has also been planted as an avenue tree. Ill effects of this species on ruminants are urinal problems and milk yield decrease.

Khanyu (*Ficus cunia*)**:**

This species occurs from the terai to 1700 msl. It is a small to medium tree which is deciduous for a short time in the year. It is a light demander and is said to have some tolerance to frost. It is one of the first species to regenerate naturally on eroded sites. It is a useful fodder tree, though not among the most highly regarded. The leaves are lopped from January to April. Yields of fodder are rather low.

Katus (*Castanopsis hystrix*)**:**

This species grows between 1000 msl and 2500 msl. It is a good timber for house buildings, the leaves are used for fodder and nuts are edible. It is excellent for firewood but has slow growth and good reseeding characteristics. It is excellent for fuelwood but has slow growth and good reseeding characteristics.

Okhar (*Juglans regia*):

It is a large deciduous and light demanding tree occurring from 1200 msl to 2500 msl. It is used for firewood and timber purpose and nuts are edible.

Salla (*Pinus wallichiana*):

It is very characteristic of abandoned fields and grazing land. The timber is of better quality and durable and where the tree is plentiful it is widely used for house building. Where it occurs naturally it is highly valued as a firewood. It is regarded as an important species for afforestation at higher altitudes, because it is more cold resistant and produces a better timber.

Falant (*Quercus glauca*) (White Oak):

It is a large evergreen tree over 30 m. Its natural occurrence indicates that it should only be planted in localities with a high annual rainfall. The wood is hard and durable. It is a good firewood and the leaves are a valued fodder. The wood from this is also used to make plows.

Bains (*Salix babylonica*) (Willow):

It is a deciduous tree, used for fodder and also for basket making.

Bans (*Bambusa sp.*) (Bamboo):

It is evergreen tree. All ruminants can be fed on this fodder species, whereas it is used most exclusively as feed for sheep and goats. The mature bamboo

clumps produce new shoots every year throughout rainy season and growth take place rapidly. Bamboo is traditionally propagated by vegetative means (sucker) throughout the middle hills.

Dhupi (*Juniperus spp.*):

It often occurs as prostrate shrub especially at higher altitudes and in dry places. The wood is an excellent fuel and will burn when still green. The timber is of high quality being aromatic, easy to work and very durable. Although it is important source of fuel, its very slow growth reduces its value as plantation species.

2) Tree preference category

In order to understand the preferential category among the available tree species, PRA (Participatory Rural Appraisal) was conducted in the village. Participants were male and female from different social strata of the village, and PRA was done differently among the male group as well as female group. Tree preference by male and female farmers was determined through matrix scoring.

It is found that male group prefer *Bans* the best one considering overall advantage for nutrition, durability, tolerant to pest and diseases and palatability to livestock (Table 14). It is followed by *Khanyu, Nevaro* and *Dudhilo* with the criteria for high milk production in addition to durability and

palatability to livestock. Therefore, their selection criteria of the fodder is found

exclusively related to livestock need and preferences as well as durability.

Table 14   Tree preference by male farmers through matrix scoring

Fodder criteria	Ne	Kh	Go	Du	Pa	Gh	Ba	B
Effect on milk production (farmers' experience)	8	7	2	6	1	3	4	5
Tolerant to pest/disease	1	2	7	6	5	4	3	8
Nutritious	7	6	4	3	1	5	2	8
Prevent shading effect on crop	3	7	4	6	5	1	2	8
Long duration	7	5	4	6	1	3	1	8
Tolerant to snow/hailstone	1	2	5	7	8	6	3	4
Available during dry season	4	3	8	2	6	1	7	5
Fast growing	7	8	5	1	4	2	3	6
High palatability	6	5	4	7	1	2	3	8
Total score	44	45	43	44	32	27	28	60

Note: Score is based on increasing order from 1 to 8.
    1   = least preferred & 8= most preferred.
    Kh :   *Ficus semicordata*   (*Khanyu*)
    Pa :   *Prunus cerasoides*   (*Painyu*)
    Du :   *Ficus nerifolia*   (*Dudhilo*)
    Ne :   *Ficus roxburghii*   (*Nevaro*)
    Go :   *Saurauia napaulensis*   (*Gogan*)
    Gh :   *Leucosceptrum canum* (*Ghurmiso*)
    Ba :   *Salix sp*   (*Bains*)
    B   :   *Bambusa sp*   (*Bans*)
Source: PRA, 1992

Almost similar to male group, female group preferred more for *Nevaro,*

Khanyu and Gogan (Table 15). But their criteria of selecting tree species were high

productivity, palatability and nutritious, related to the livestock component. Besides,

interestingly, their preference of trees showed to be related with some household

activities for e.g., preference of *Nevaro, Gogan and Katheber* necessary to make

local leaves plate.

Table 15   Tree preference by female farmers through matrix scoring

Fodder criteria	Kh	Pa	Du	Ne	Kb	Go	Gh
Household use of leaves	-	-	-	7	5	6	-
High productivity	6	1	4	7	3	5	2
High palatability	6	1	5	7	4	3	2
Available during dry season	5	-	-	6	3	4	7
Nutritious	6	1	4	7	3	5	2
Trees tolerant to pests/diseases	5	4	4	7	3	1	2
Total score	28	7	17	41	21	24	15

Note: Score is based on increasing order from 1 to 7.
    1   =   least preferred & 7 = most preferred
    Kh :   *Ficus semicordata*   *(Khanyu)*
    Pa :   *Prunus cerasoides*   *(Painyu)*
    Du :   *Ficus nerifolia*   *(Dudhilo)*
    Ne :   *Ficus roxburghii*   *(Nevaro)*
    Kb :   *Kathe Ber*
    Go :   *Saurauia napaulensis*   *(Gogan)*
    Gh :   *Leucosceptrum canum*   *(Ghurmiso)*

Source : PRA, 1992

        It was noticed that women had acquired an intimate, practical knowledge of

the suitability of different tree species for cooking. They knew which trees burn

slowly and which fast, which smoke and which kindle easily. These were the main

criteria for preferring the fuelwood/ timber tree species. Timsina and Paudel (1992)

reported that one of the main preference criteria for fuelwood is less smoke when

burnt.

Table 16   Tree species preference by men
        (n = 65)

Tree species (Local names)	Preference categories			Popularity score
	Liked very much	Liked	Liked a little	
Nevaro	65	-	-	100
Khanyu	14	9	-	30.8
Gogan	8	31	16	52.4
Dudhilo	27	26	6	71.4
Painyu	3	6	44	33.1
Ghurmiso	2	9	4	14.4
Bains	1	7	5	11.2
Utis	48	2	-	75.9
Phusre	25	-	-	38.5
Patle	12	-	-	18.5

Mean   = 44.62 and St. Dev.= 28.10
Source: Survey, 1992

Later on these results were verified by conducting a formal survey among male and female of different socioeconomic strata. The farmer preference in trees includes those tree species which are socially adopted, economically viable and producing more yield. Here, the preference of likeness is categorized into the following three group:

Farmers' preference categories	Percent likeness
Liked very much	100
Liked	67
Liked a little	33

Source: Leutel (1991)

The following method is developed and applied to assess farmers' preference, fodder and firewood qualities based on farmers' knowledge or responses.

Popularity Score (PS) for each tree species equals

(No. of farmers in liked very much category * 100/ total
    respondent)
+
(No. of farmers in liked category * 67/ total
    respondent)
+
(No. of farmers in liked a little category * 33/ total
    respondent)

The tree species according to male farmers' preference are listed along with popularity score in Table 16.

Result showed that all respondents are positive to consider *Nevaro* as a very much liked fodder (Table 18). They preferred *Dudhilo* as the second important fodder and *Gogan* as the third (Table 16). The same case is observed in case of women too (Table 17). The difference in popularity scoring for various tree species by gender is shown in figure 12.

Table 17   Tree species preference by women
(n = 80)

Tree species (Local names)	Preference categories			Popularity score
	Liked very much	Liked	Liked a little	
Nevaro	80	-	-	100
Khanyu	21	18	-	41.3
Gogan	16	29	18	51.7
Dudhilo	47	32	3	86.8
Painyu	5	4	56	32.7
Ghurmiso	6	3	6	12.5
Bains	3	6	5	12.5
Utis	78	2	-	99.2
Phusre	26	-	-	32.5
Patle	18	-	-	22.5

Mean   = 49.34 and St. Dev.= 31.90
Source: Survey, 1992

This result of formal survey (Table 18) is not correlated with the PRA result for some cases because *Bans* and *Khanyu* are categorized as most and second most preferred fodder by men and women farmers respectively in PRA procedures (Tables 14 and 15). But these are not mentioned as highly preferred species in formal survey. For fuelwood and timber purpose, only *Utis* is most preferable however, *Phusre* and *Patle* are also preferred by men and women farmers (Table 18).

Table 18   The preferred tree species by gender
(farmers' response, n = 145)

Preference categories	Fodder trees		Fuelwood/timber trees	
	Male	Female	Male	Female
Liked very much	Nevaro Dudhilo	Nevaro	Utis	Utis
Liked	Gogan Dudhilo	Gogan Khanyu	Phusre Patle	Phusre Patle
Liked a little	Painyu	Painyu	-	-

Source: Survey, 1992

Table 19   Ranking of preference criteria for fodder trees by gender
(farmers' response, n= 145)

Preference criteria	Per cent of respondents															
	Nevaro				Dudhilo				Gogan				Khanyu			
	M^1	R^2	F^3	R^2	M^1	R^2	F^3	R^2	M^1	R^2	F^3	R^2	M^1	R^2	F^3	R^2
High milk production	72	1	86	1	46	2	31	2	28	3	40	3	23	1	23	2
Nutritious	28	2	40	2	49	1	53	1	43	2	45	1	12	2	31	1
Available during dry season	12	3	8	3	18	3	5	3	12	1	20	2	6	3	3	-

Note:
    1 = Male farmers; 2 = Rank; 3 = Female farmers
Source: Survey, 1992
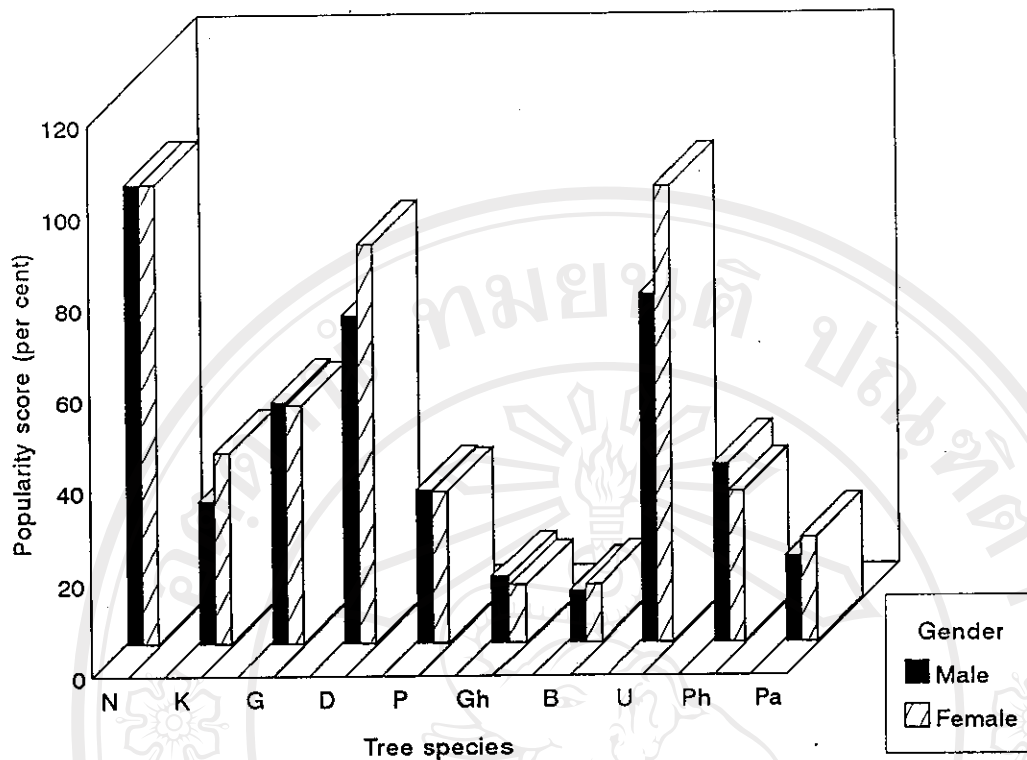
N= Nevaro; K= Khanyu; G= Gogan; D= Dudhilo; P= Painyu; Gh= Ghurmiso; B= Bains; Ph= Phusre; Pa= Patle

Figure 12 The popularity scores for different tree species by gender
Source: Survey, 1992

Regarding farmers' reaction on preference criteria, high milk production is assigned as the main reason for preferring *Nevaro* as the best fodder. *Gogan* and *Dudhilo* are preferred as these are nutritious to livestock (Table 19). *Painyu* is characterized as evergreen tree species. For making household plate from leaves, *Nevaro* is mostly used by female farmers. *Utis* is the preferred fuelwood and timber by both male and female farmers for various reasons e.g. strong timber for house construction, furniture, long durability, giving less smoke, easy to burn, fast growing etc. Furthermore, ranking of these preference criteria by gender are found to be different. The criteria of male by rankwise are fast growing, strong timber for house

construction, agricultural tools and furniture whereas for female, easy to burn, give

less smoke, less quantity enough for cooking and gives tasty food, available for

every season etc are criteria of preferring *Utis* (Table 20).

Table 20　Ranking of preference criteria for fuelwood tree (*Utis*) by gender
(farmers' response, n= 145)

| Preference criteria | Per cent of respondents | | | |
	Male	Rank	Female	Rank
Fast growing	25	1	16	4
Improve soil condition	14	4	8	5
Easy to burn, give less smoke, less quantity enough for cooking and gives tasty food.	31	3	26	1
Available for every season	23	5	25	2
Strong timber for house construction, agricultural tools and furniture.	35	2	28	3
	n = 65		n = 80	

Source: Survey, 1992

3)　Fodder tree cutting and management

Nevaro, Khanyu and Gogan are mostly cut and fed to animals

from November to May, *Dudhilo* and *Painyu* from February to July, *Ghurmiso* from

October to May. *Utis* actually is cut for fuelwood and timber whenever necessary,

but, most of the villagers reported cutting from December to July (Figure 13).

Figure 13   Availability period of different fodder and fuelwood trees

Tree species (local name)	Lopping Months											
	J	F	M	A	M	J	J	A	S	O	N	D
Fodder:												
Nevaro	**************										****	
Khanyu	******************										****	
Gogan	******************										*******	
Dudhilo			*******************									
Painyu			*******************									
Ghurmiso	****************										*******	
Bains			*******************									
Fuelwood:												
Utis	***********************										**	

Source: Survey, 1992

Most of the farmers of all socioeconomic strata indicated January to June as fodder scarcity months however some other also reported nonavailability of fodder until September (Figure 14).   Therefore, there is more deficit of fodder during winter (September to June) than in summer (July to August). Farmers generally feed their livestock with fodder trees, grasses, bushes, weeds, grain feeds along with rice straw or other crop residues.

Figure 14 Fodder scarcity months in Salle

Socioeconomic group	Months
	J F M A M J J A S O N D
Rich Magar/Gurung(E1R)	**************
Medium Magar/Gurung(E1M)	************* ******
Poor Magar/Gurung(E1P)	**************** ******
Medium Brahmin/Chhetri(E2M)	***************
Poor Brahmin/Chhetri(E2M)	*************

Source: Survey, 1992

Table 21 Feeding management practices during dry season

Strategies[1]	Per cent of respondents				
	E1R[2]	E1M[2]	E1P[2]	E2M[2]	E2P[2]
Grass	36	42	24	28	-
Rice	-	16	50	11	78
Stock	50	16	6	11	22
Grass & Rice	-	6	5	50	-
Grass & Stock	14	18	7	-	-
Rice & Stock	-	2	8	-	-
Total	100	100	100	100	100
	n = 14	n = 62	n = 42	n = 18	n = 9

1. Description of strategies
    Grass : Feeding grass from own forestland and *nagi*land
    Rice : Buying rice straw
    Stock : Feeding stock fodder and own rice straw

2. E1R : Rich Magar/Gurung
    E1M : Medium Magar/Gurung
    E1P : Poor Magar/Gurung
    E2M : Medium Brahmin/Chhetri
    E2P : Poor Brahmin/Chhetri
Source: Survey, 1992

But in deficit months, most of the farmers (32 per cent of total respondents)

managed grasses from forest or *nagi*land for feeding livestock, buying and feeding

ricestraw is second alternative (28 per cent of respondents) for them (Figure 15).

The management practices vary among socioeconomic group (Table 21).
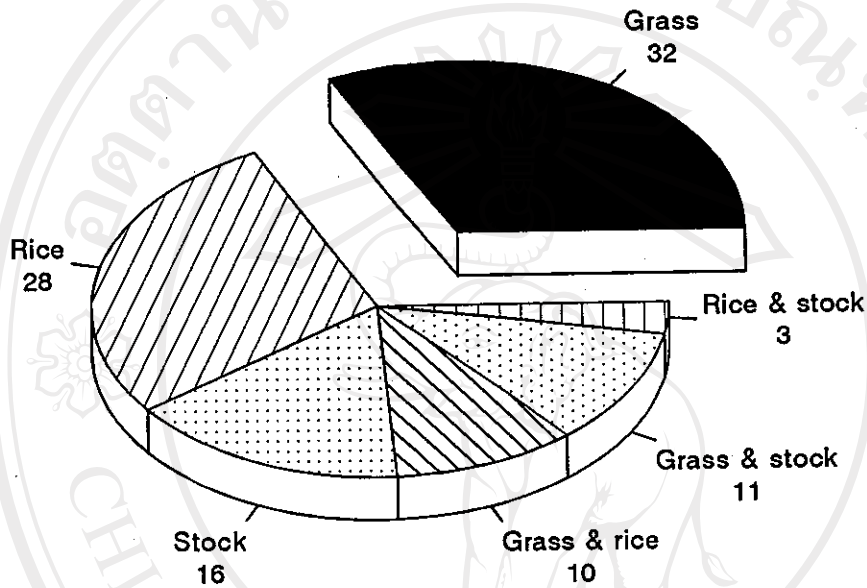
Figure 15 Feeding management practices during dry season
Source: Survey, 1992

4.2   Gender analysis in agroforestry systems

After knowing the components of agroforestry system and inter-relationships among them, it is necessary to reveal the labor involved in different agroforestry activities for sustaining the existing system. It is known that both men and women have been involved in production and management aspect of the agroforestry system. The roles and responsibility of gender in agroforestry in a given society are examined through gender analysis. It helps to visualize the access and control of resources/ activities/ benefits in a given circumstances. It is believed that cross sectional understanding helps better to concurrent the particular situation and thereby contribute to strengthen the household activities.

4.2.1   Gender role in various agroforestry activities

Womens' participation in agroforestry began when mesopotamians first domesticated animals and planted food near home and it is thought that women were the first to do this. In subsistence food production, women's role has always been a central one, and this includes crop production, care and management of livestock and birds and their products for family consumption and use. Women contribute 50 to 80 per cent of total labor in crop farming depending on ecological niches and the ethnic group (Adhikary, 1988). Female labor participation is more than 80 per cent of the total labor required for livestock farming (Mathema and Vanderveen, 1981). Such literatures indicate the important role of women in agroforestry. However, their precise role and contributions should be well

documented in order to know their problems and constraints regarding these aspects. Here gender analysis is employed for noting gender involvement in these sectors. Chi square test is also used to indicate whether there is significant involvement of women in various agroforestry activities. However, this is discussed by categorizing agroforestry into crop, tree and livestock subsystems.

1)   **Crop subsystem**

The results of the observations showed that all members of the farm family (men, women and children) participate actively in crop production. Although, women perform almost at par with men, there are certain operations which are performed exclusively by men and others exclusively by women. For instance, in land preparation the ploughing of fields is exclusively done by men (77 per cent of respondents), so that in the absence of men of the household i.e., mostly in case of female headed household, labor is hired for this operation. Several studies in Nepal (Bajracharya, 1990; Bhattarai *et al.*, 1989; Pradhan, 1983; Timsina *et al.*, 1989; Vaidya *et al.*, 1990) and also in India (Chauhan *et al.*, 1992) indicated the same observation. Actually, ploughing is sometimes assisted by children as it is reported by 13 per cent of respondents.

More than 50 per cent respondents of Magar, Gurung reported clod breaking and digging operations as female activities. However, large proportions of respondents (41 per cent) in Brahmin, Chhetri indicated participation of both sex in these activities (Appendix Table 1). But among different economic

group, medium status women are found highly involved (47 per cent) followed by

poor (36 per cent) while involvement of rich women is the least (22 per cent)
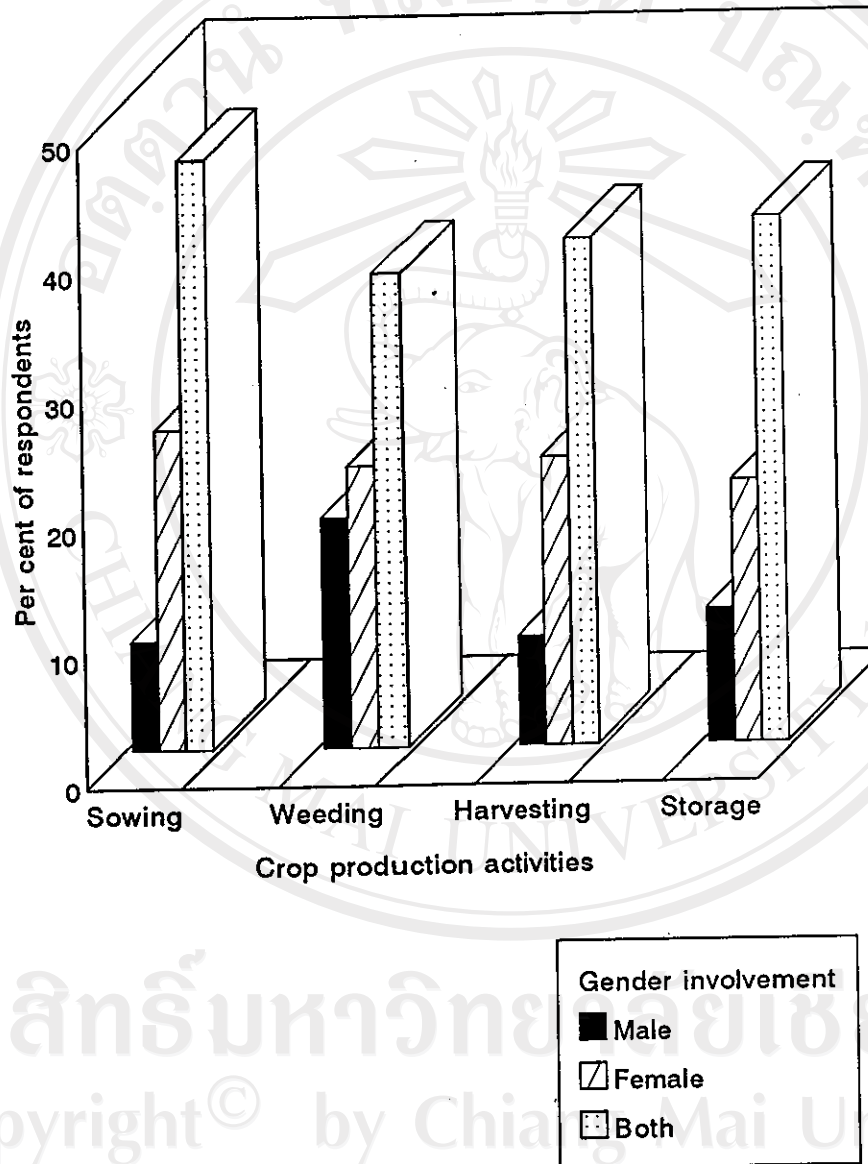
(Appendix Table 2).

Figure 16 Gender participation in crop production activities
Source: Survey, 1992

The reasons for this situation may be larger land holding size of medium than poor and the ability of hiring labor by rich. The involvement of gender in various crop production activities and in cultivation of different crops are shown in figures 16 and 17.
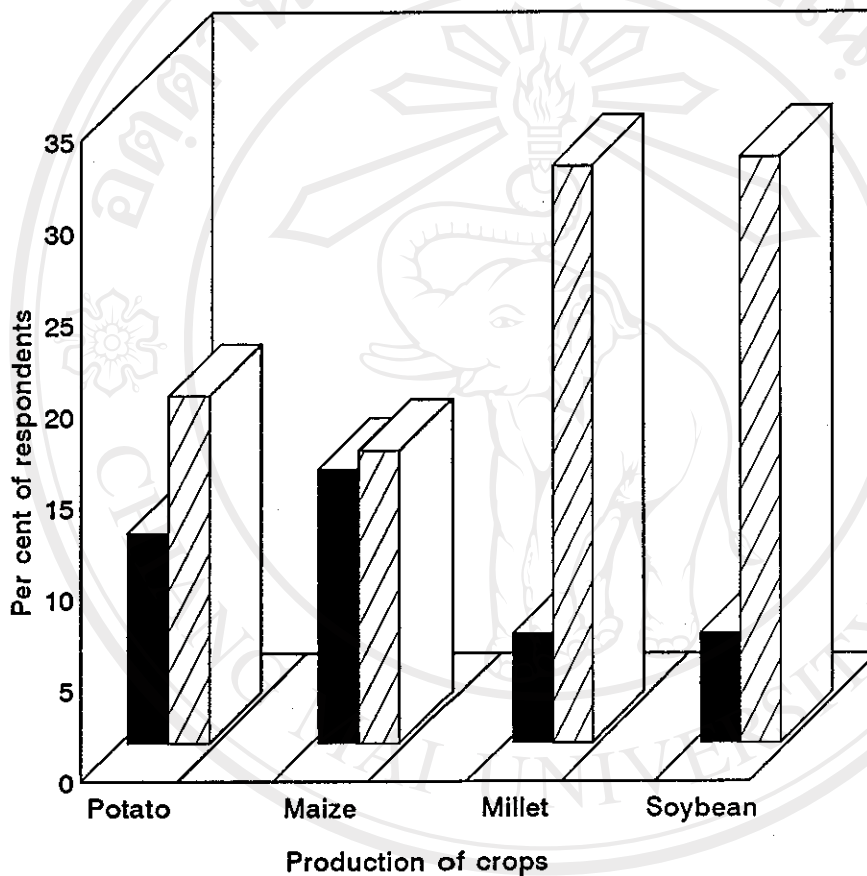
Figure 17 Gender participation in cultivation of different crops
Source: Survey, 1992

Potato and wheat are sown by both male and female, maize is sown by both with assistance of children. Millet and soybean are sown mostly by female in Magar, Gurung whereas these are performed by both sexes in Brahmin, Chhetri (Figures 18 and 19). But equal involvement of male, female and children are found for intercultural operation in all crops. . Pradhan (1981) reported that sowing, transplanting and weeding are mostly done by women and both sexes acknowledge that women are better planters than men.
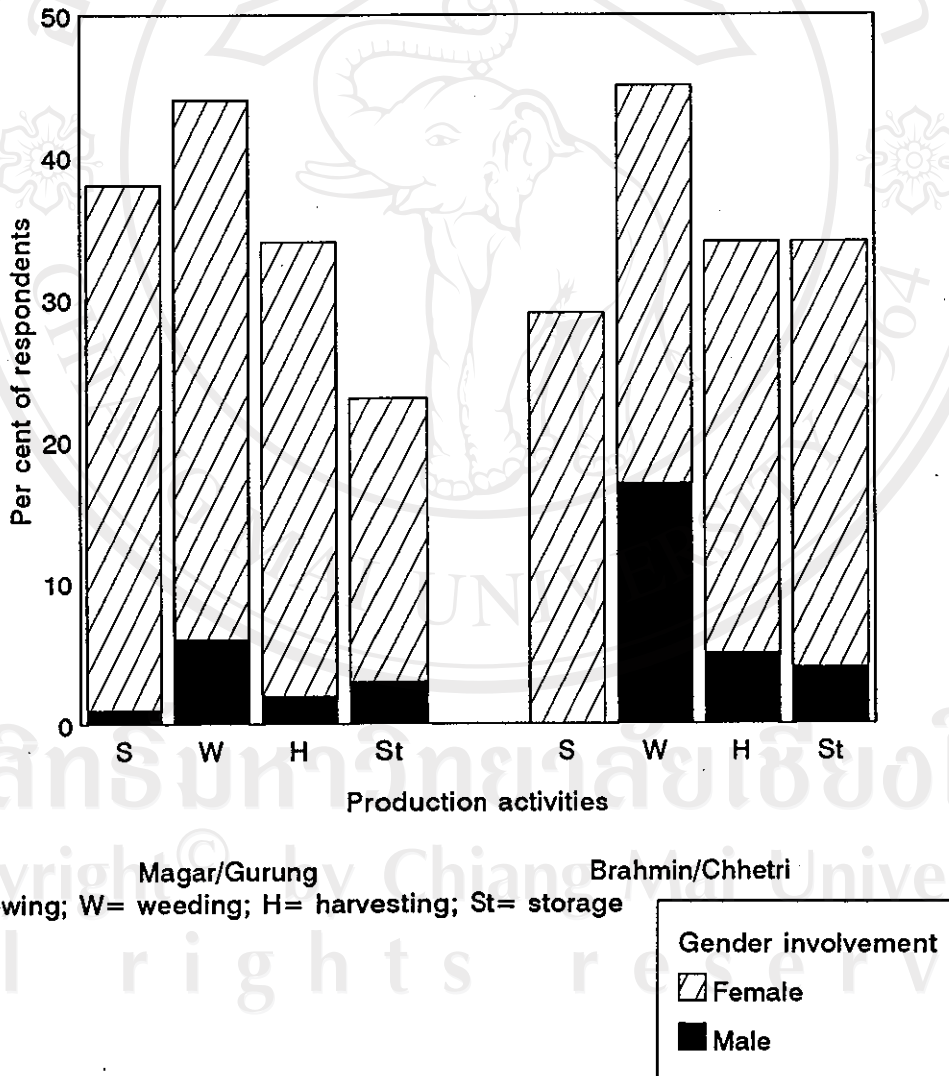
Figure 18 Gender participation in millet production by ethnic group
Source: Survey, 1992

There is a belief that if sowing and transplanting is done by women there will be a better yield (Majupuria, 1989). In harvesting of potato, maize and wheat, both sexes are equally involved. However, 35 per cent of Magar, Gurung respondents reported female involvement in millet and soybean harvesting. Chauhan *et al.*, (1992) observed that in India also, women are solely responsible for weeding, transplanting and harvesting. Regarding post harvest activities, only in millet and soybean, women are mostly engaged but in other crops, participation of both are observed. Women do drying of crop residue, storing or bagging of grains, threshing of wheat and cleaning of grains. All the food processing activities: threshing, drying, husking, roasting and grinding is entirely the responsibility of women (Pradhan, 1981).

S= sowing; W= weeding; H= harvesting; St= storage
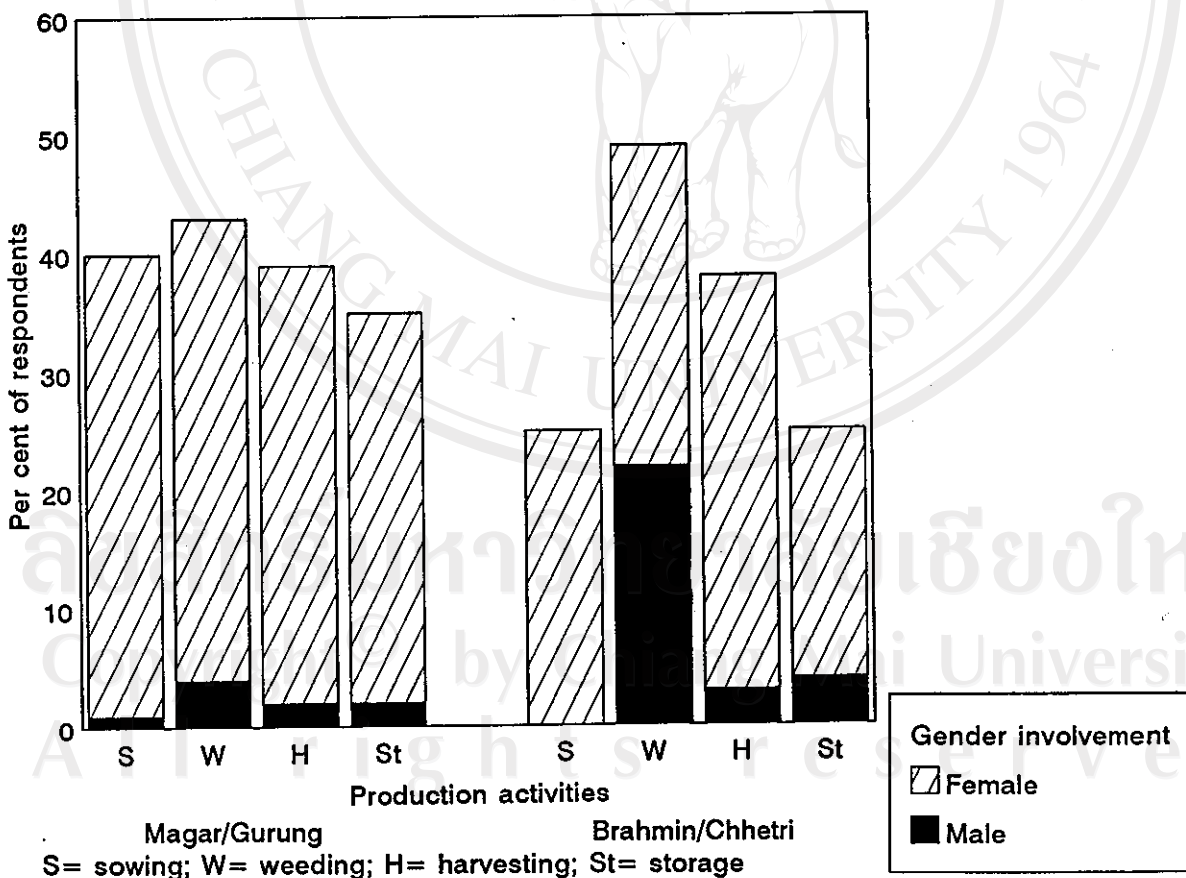
Figure 19 Gender involvement in soybean cultivation by ethnic group
Source: Survey, 1992

Vaidya *et al.*, (1990) reported that womens' participation is higher than men in wheat production in central hill region of Nepal. However, in Salle, this case is opposite. The cause may be that wheat is not staple food in that location and only 67 per cent of households are growing wheat. The farmers are still unaware of best way of its consumption.

Table 22   Gender participation in agroforestry activities by ethnic group

Activities	Per cent of respondents							
	Magar/Gurung				Brahmin/Chhetri			
	M^1	F^2	B^3	A^4	M^1	F^2	B^3	A^4
Crop production:								
Sowing	6	29	40	25	11	21	52	16
Int. operation	12	25	37	26	24	19	37	20
Harvesting	8	24	40	28	9	21	39	31
Post harvest	10	23	38	29	11	18	44	27
Livestock management:	5	28	67	-	15	24	61	-
Tree management:								
Farmland	24	32	28	16	20	30	34	16
*Nagi*land/forestland	10	50	20	20	15	33	31	21
	n = 118				n = 27			

Note: 1: male, 2: female, 3: both, 4: all family members
Source: Survey, 1992

Analyzing the situation with respect to ethnic group reveals more participation of Magar, Gurung women than that of Brahmin, Chhetri in almost all of crop production processes (Table 22 and Figure 20), however, this result is found not significantly different through Chi square test. This fact may also be correlated

with larger landholding, livestock size and more numbers of trees available to the

Magar, Gurung. Acharya and Bennett (1981) reported that womens' participation

is higher in the more disadvantaged ethnic group, which is in conflict with the Salle
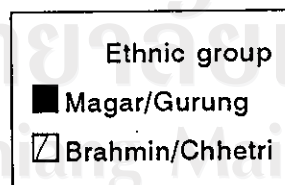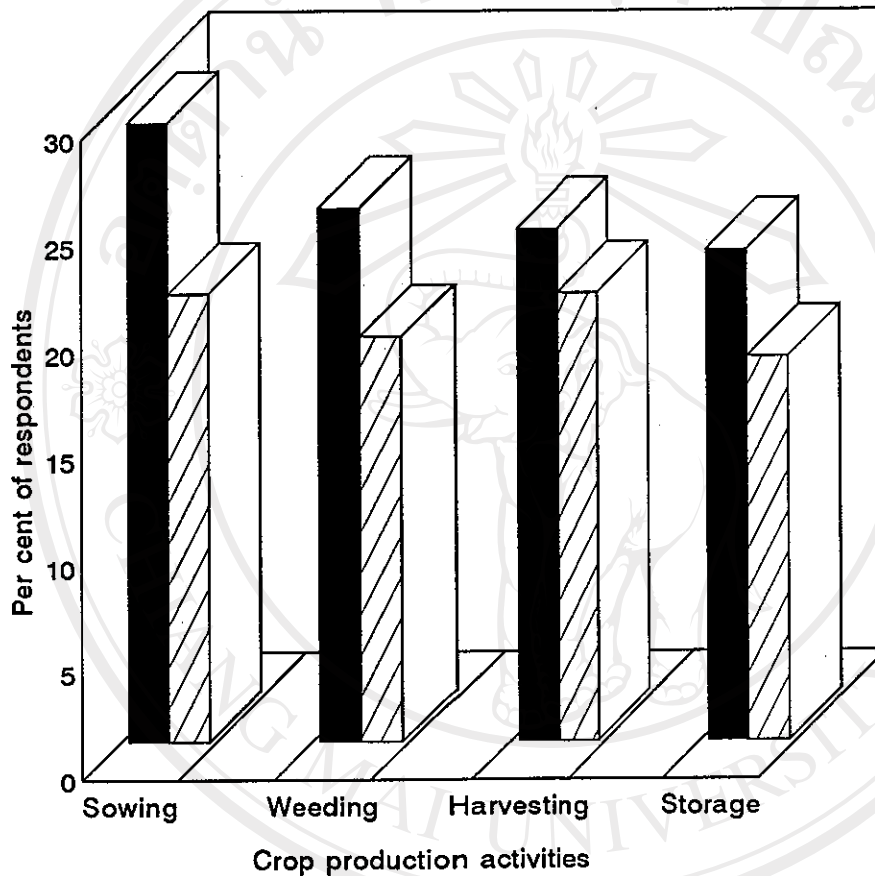
finding.

Figure 20 Womens' participation in crop production activities by ethnicity
Source: Survey, 1992

In this case, Brahmin, Chhetri can be referred as disadvantaged group in terms of low access to resources. But their involvement seems to be less and this may be due to the uncoverage of wage labor. However, Loutfi (1985) also indicated that upward social mobility tends, in India, to lead to women's inactivity and lower relative status within the household.

Little is known about effect of downward mobility, although it is noted that some particular hardships for women as families become landless. Majupuria (1989) highlighted in "Nepalese Women" that Brahmin, Chhetri women as belonging to higher caste, are involved more on household jobs than in crop production.

Table 23   **Gender participation in agroforestry activities by economic group**

| Activities | Per cent of respondents | | | | | | | | | | | |
| | Rich | | | | Medium | | | | Poor | | | |
	M^1	F^2	B^3	A^4	M^1	F^2	B^3	A^4	M^1	F^2	B^3	A^4
Crop production:												
Sowing	8	12	54	26	8	22	29	41	9	17	37	37
Int. operation	8	18	66	8	6	23	25	46	16	18	40	26
Harvesting	7	16	60	17	7	24	27	42	15	19	53	13
Post harvest	8	10	59	23	6	20	32	42	4	20	46	33
Livestock management:	18	7	75	-	4	39	57	-	5	22	73	-
Tree management:												
Farmland	16	16	48	13	13	23	27	37	16	19	43	22
*Nagi*land/forestland	14	54	32	-	14	67	10	9	15	22	38	25
	n = 14				n = 81				n = 50			

Note: 1: male, 2: female, 3: both, 4: all family members
Source: Survey, 1992

Finding shows more involvement of medium and poor economic status women irrespective to ethnic group in crop production than that of rich women (Table 23 and Figure 21). This might be true that the rich households can hire labor for most of the crop activities, which is further supported by the fact that most of the rich farmers get income through remittances (pension/ army service) which enable them to afford in hiring labor.
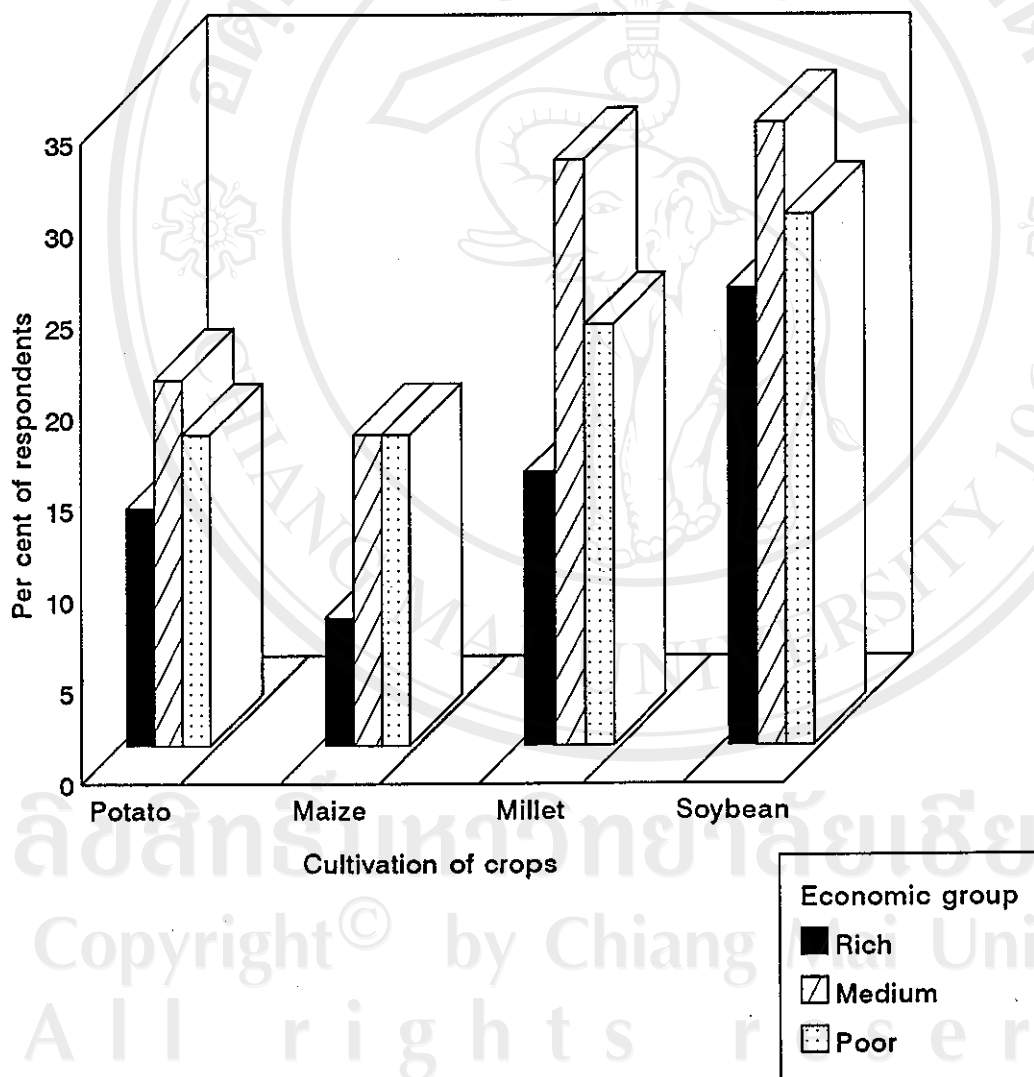

Figure 21 Womens' involvement in cultivation of different crops by economic
status
Source: Survey, 1992

2) Livestock subsystem

Womens' involvement in livestock production is a longstanding tradition in Nepal where animals have been an integral part of farming systems. The livestock production patterns may differ widely in various ecological zones and social systems, but women play a major part in caring for animals in all systems from high hills to *terai*. It is necessary to prepare database on women's role in livestock production so as to assert that their contributions are critical to overall development of the sector. Because, without an adequate database, problems arise in knowing where to direct inputs to help women increase their productivity.

The results represented more female participation compared to male in various day to day livestock activities, i.e., preparing and feeding *khole*, feeding water, feeding thinned maize and rice straw, shed cleaning, compost making and making ghee, curd etc (Figure 22).


Kw= feeding khole and water; Fo= feeding.fodder; Cs= cleaning shed
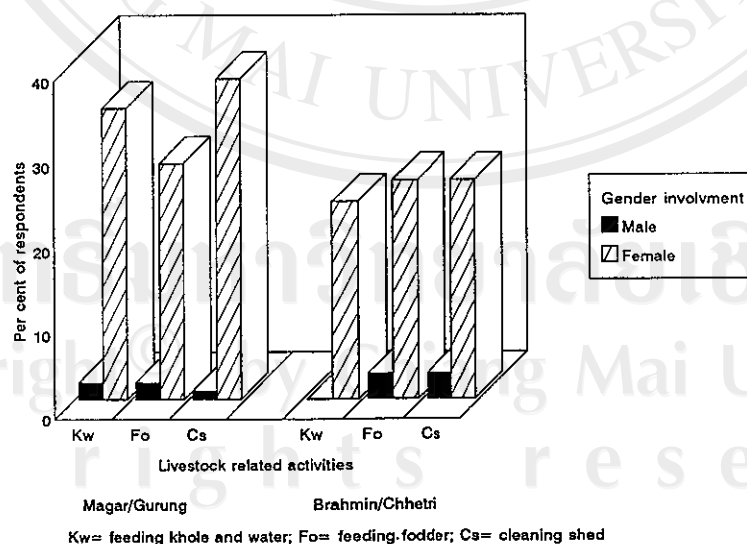
Figure 22 Gender participation in livestock activities by ethnic group
Source: Survey, 1992

The care of livestock is predominantly and sometimes completely womens' responsibility. This is supported by other researchers (Katuwal, 1990; Paris, 1992 and Timsina *et al.*, 1992). But disease management, selling/ buying livestock and livestock products are reported to be performed by male. Few percentage (14 per cent) of Magar, Gurung pointed involvement of women in milking, similarly, Brahmin/ Chhetri indicated more male involvement (26 per cent of the respondents) than female involvement (19 per cent of respondents).

The women in rich farm families are less involved in livestock activities. But the situation is reverse with medium and poor farm households (Table 23 and Figure 23).
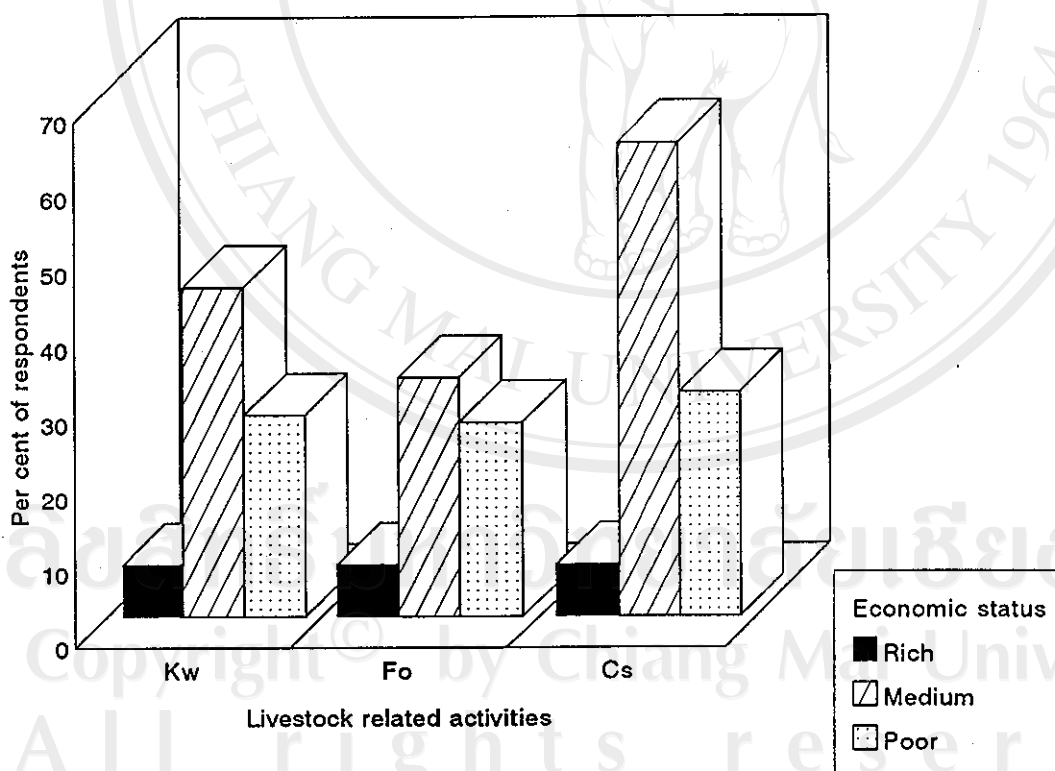
Kw= feeding khole and water; Fo= feeding fodder; Cs= cleaning shed

Figure 23 Womens' participation in livestock activities by economic group
Source: Survey, 1992

The female of medium farm family are highly involved in livestock activities than poor female farmers. But some activities like disease management, selling/ buying livestock and livestock products are exclusively performed by male in all socioeconomic strata (Appendix Tables 3 and 4).

3)   Tree subsystem

Considering the activities in tree subsystem, it was found that buying and searching of saplings were often carried out by male farmers. Furthermore, they were highly involved in logging and buying and selling of logs. Planting of saplings was done by both. Bedding materials and fuelwood collection in other hand, were mostly performed by female (Figure 24). Fodder collection was mostly done by female with occasional assistance of male (Appendix Tables 5 and 6).
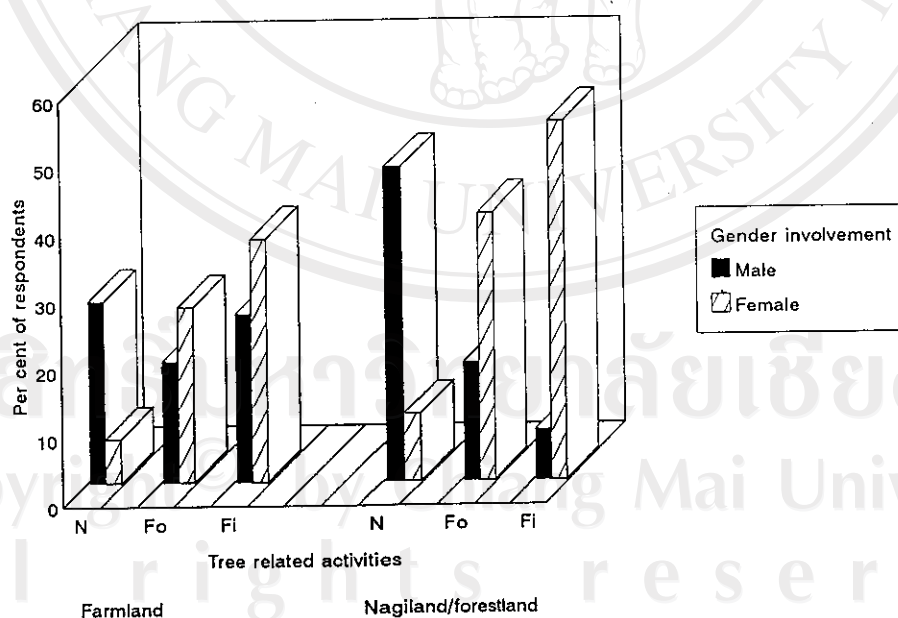
N= nursery management; Fo= fodder collection; Fi= firewood collection

Figure 24 Gender involvement in tree activities
Source: Survey, 1992

When the analysis was carried out across two ethnic group, it was revealed almost equal participation of both Magar, Gurung and Brahmin, Chhetri men and women on farmland tree activities (Table 22 and Figure 25). But in case of forest/ *nagi*land trees, more participation of women than men of Magar, Gurung and also than Brahmin, Chhetri women was found because of comparatively low access of Brahmin, Chhetri to forest/ *nagi*land resources.
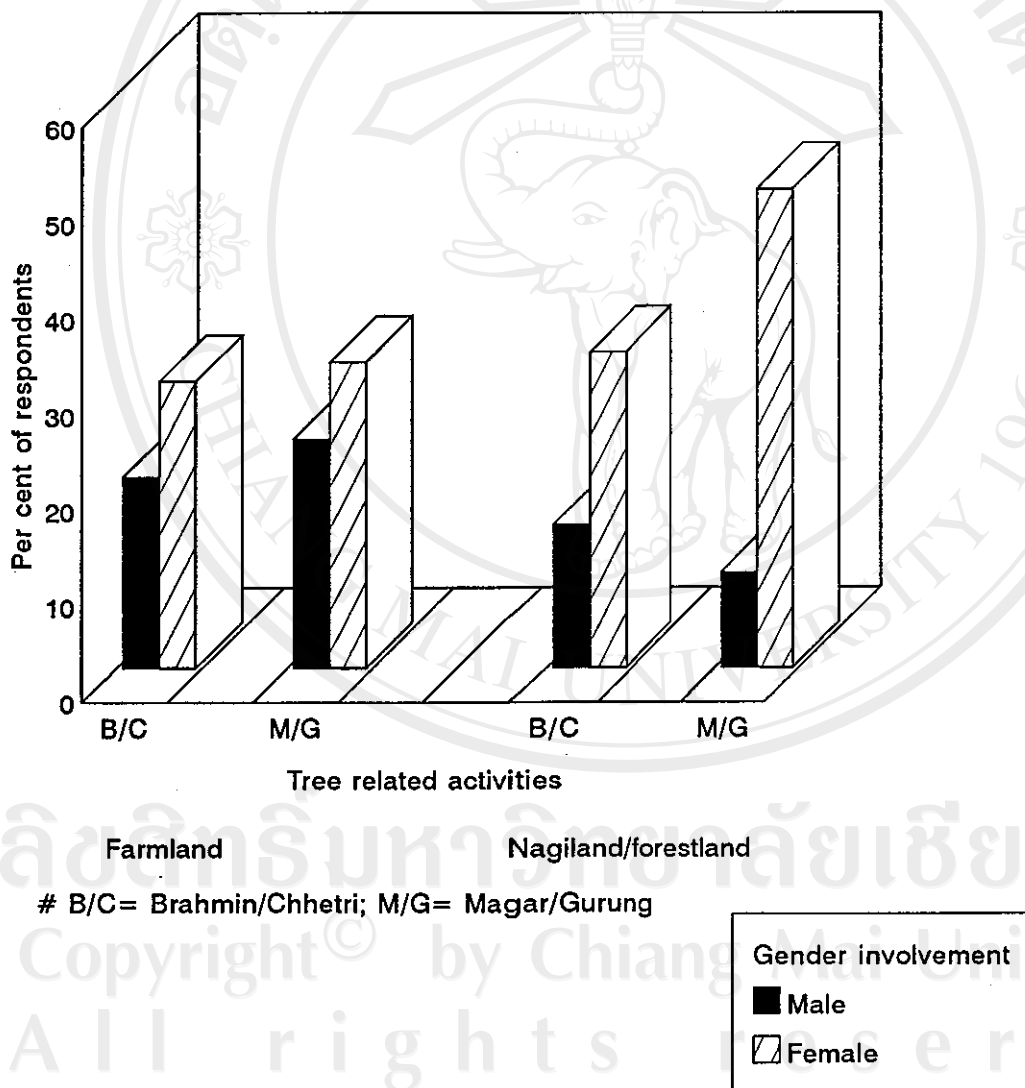

B/C= Brahmin/Chhetri; M/G= Magar/Gurung

Figure 25 Gender involvement in tree activities by ethnic group
Source: Survey, 1992

However, comparison between male and female reflected a clear distinction in fodder and bedding material collection from forest/ *nagi*land (42 per cent of Magar, Gurung respondents mentioned it as women's activities as compared to only 13 per cent for mens', similarly, 37 per cent of Brahmin, Chhetri respondents reported women and 22 per cent men). Timsina *et al.,* (1992) also observed more involvement of Brahmin, Chhetri women than men in fodder collection from the forests in eastern Nepal.
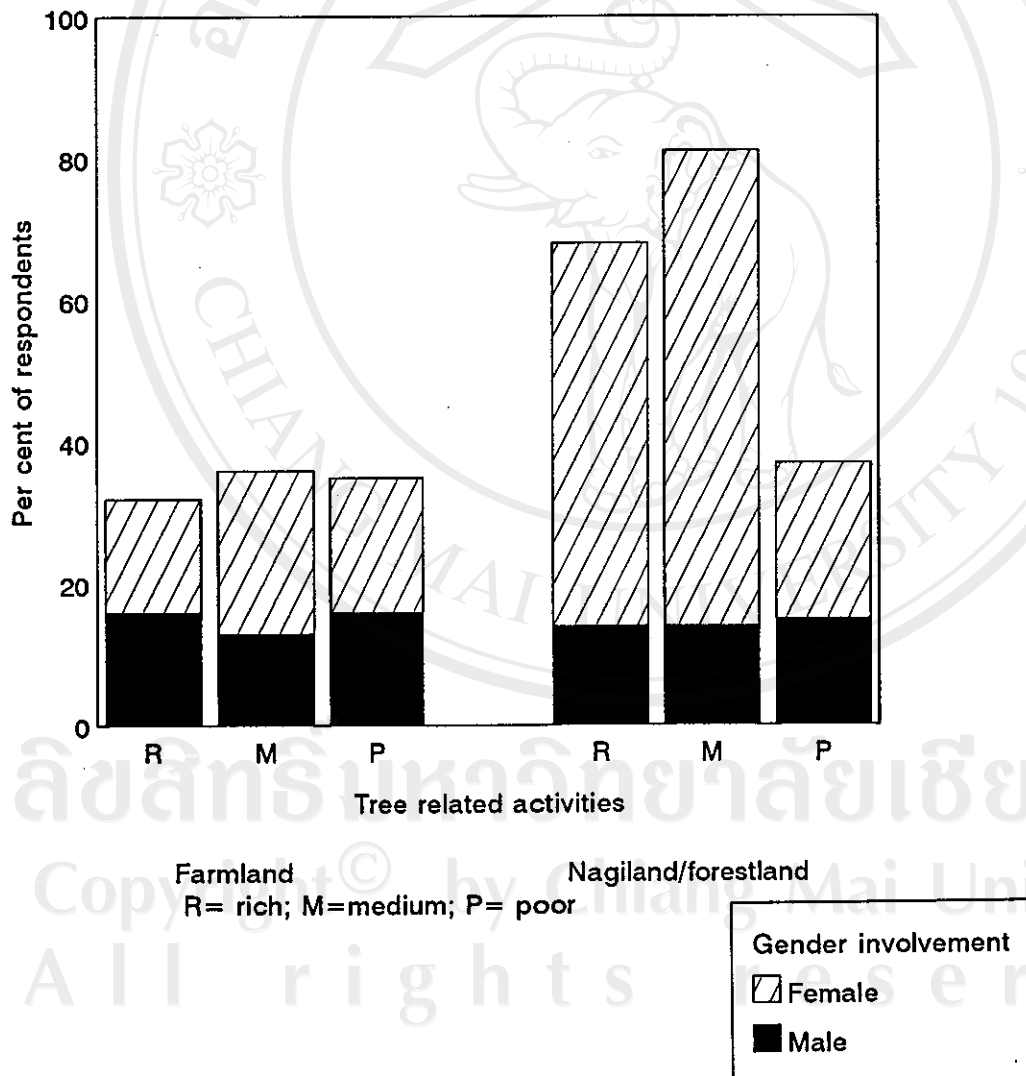

Figure 26 Gender participation in tree activities by economic status
Source: Survey, 1992

The close analysis with respect to different economic group indicated more participation of rich and medium women in tree activities compared that of poor women (Table 23 and Figure 26). Hence the extent of participation found to be directly related with access to land and tree resources.
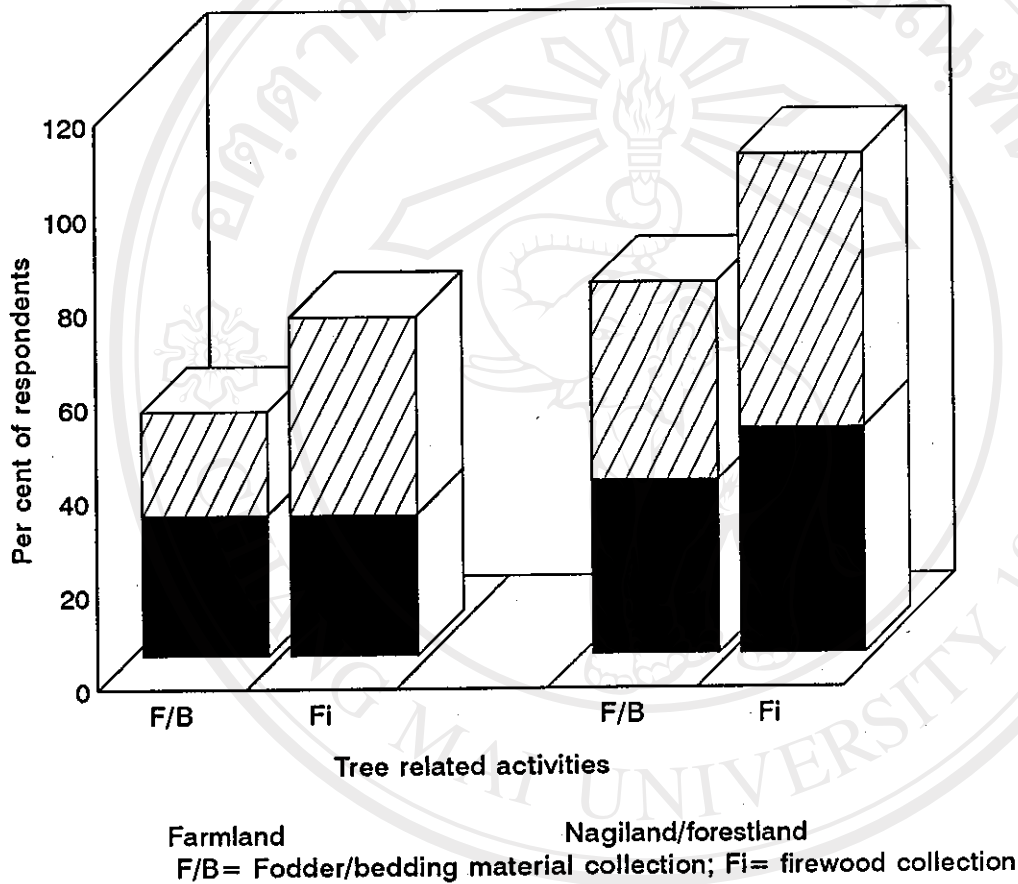
Farmland   Nagiland/forestland
F/B= Fodder/bedding material collection; Fi= firewood collection

Ethnic group
☐ M/G
■ B/C

Figure 27 Womens' involvement in fodder/bedding material/fuelwood collection
by ethnic group
Source: Survey, 1992

The poor farmers have to give first priority to food production rather than on tree growing as their farm produce is enough only for 6 to 8 months. Considering fodder and bedding material collection from *nagi*land/ forestland, more participation of women than men is revealed regardless of economic group. That is 50 per cent of rich, 56 per cent of medium and 20 per cent of poor respondents reported these activities done by women only (Figure 28). Same observation is also indicated by Paris (1992) in midhills of Nepal and Chauhan (1992) in India. However, around 20 per cent of rich, medium and poor respondents reported these are performed by men only. In fuelwood collection, women are relatively more involved than men as they are more responsible in cooking and feeding household members. This observation is also found by Timsina *et al.,* (1992).
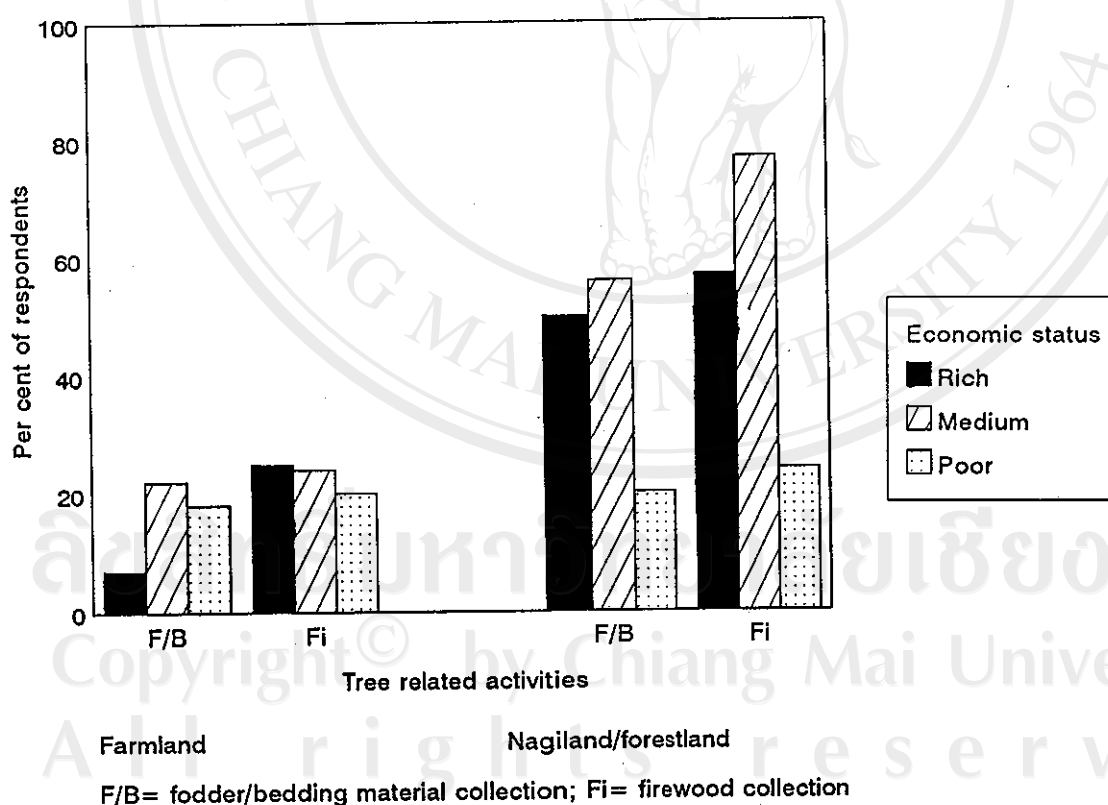

F/B= fodder/bedding material collection; Fi= firewood collection

Figure 28 Womens' involvement in fodder/bedding material/fuelwood collection
by economic group
Source: Survey, 1992

4.2.2 Labor use pattern on agroforestry activities by gender

In Nepalese subsistence economy of the hill farm household, study of labor use pattern is very useful, as time may be viewed as a scarce resource applicable for alternative uses and each member of the household allocate its scarce resource "time" in such a way that the household achieves its maximum welfare.

Rural women's workday is usually longer than that of men, so that time is a precious resource for women. Labor use studies are a useful tool to help identify women's needs and to plan for resource allocations.

T- test is followed as the statistical tool for showing significant differences ($p < 0.05$) in time spent for various agroforestry activities by gender and also with regard to socioeconomic group. At first, the t- test was carried out for the overall picture and then for detailed analysis, each related activities were tested for showing whether there is difference in time spent by gender, economic and also ethnic group.

1) Crop production

Labor use for different cropping activities by gender differs according to the nature of work, type of crop etc. (Tables 24- 28).

i)   Potato

It is found that Magar/ Gurung women allocate a total
of 31 days for sowing, weeding, digging/ harvesting and storage of potato while
Brahmin/ Chhetri spent only 14 days for the same activities. These conditions are
found significantly different through statistical t- test.

Table 24 Labor use pattern (days/ year) for crop production activities by rich
Magar/ Gurung farmers (E1R) (n= 14)

Crops	Activities							
	Sowing		Weeding		Harvesting		Storage	
	M^1	F^2	M^1	F^2	M^1	F^2	M^1	F^2
Potato	3	3	14.6	10.9	3.2	6*	4.7	7*
Maize	3.1	4	7.7	7	4.6	4	4.1	4.7
Millet	2	3.8*	7	10.7*	7	9.6*	3	4*
Soybean	2.5	2.4	2	3.6*	5.7	6.9*	3.5	4.3*
Wheat	3.4	6.1*	4.8	5.8*	5.5	4.3	3.8	5.8*

Note: * significant difference at (p< 0.05).
        1: male and 2: female
Source: Survey, 1992

However, figure represented to denote labor use does not include wage labor
apart from household. This can also be supported by larger *bari* land area owned
by Magar/ Gurung (average *bari* land is 1.33 ha) than that owned by Brahmin/
Chhetri (0.99 ha). When the comparison is made between male and female of same

ethnic group, no significant differences are found, as both men and women equally participate and allocate the same amount of time in potato growing and storage practices.

Table 25 Labor use pattern (days/ year) for crop production activities by medium Magar/ Gurung farmers (E1M) (n= 62)

Crops	Activities							
	Sowing		Weeding		Harvesting		Storage	
	M^1	F^2	M^1	F^2	M^1	F^2	M^1	F^2
Potato	14.6	12.9	10.6	9.1	11.9	11.9	3	3.5
Maize	7.4	6.4	13.2	9	7.4	6.1	5.2	6
Millet	12.5	13.3*	8.7	9.6*	7	7.5*	4.2	5.6*
Soybean	3.3	2.8	5.1	3.7	3	2.7	2	2.5
Wheat	2.2	3	3	2	2.3	2	4	2

Note: * significant difference at (p<0.05).
       1: male and 2: female
Source: Survey, 1992

Comparison by economic group (rich, medium and poor) also indicates no significant difference on labor use for potato production by gender of all economic group. However, more close analysis reveals that in potato harvesting and storage, labor use by male and female of rich Magar, Gurung group is found significantly different indicating higher female participation (13 days per year) than male (7.9

days per year) in case of harvesting and storage. Poor Magar, Gurung women also spent significantly more time (5.9 days/ year) than men (4.5 days/ year) in potato storage.

Table 26 Labor use pattern (days/ year) for crop production activities by poor Magar/ Gurung farmers (E1P) (n= 42)

Crops	Activities							
	Sowing		Weeding		Harvesting		Storage	
	M^1	F^2	M^1	F^2	M^1	F^2	M^1	F^2
Potato	5.7	4.3	10.4	10	9.2	9.7	4.5	5.9*
Maize	4.7	3	8.1	10.8*	5.6	4.3	3.8	4.9*
Millet	6	6.6*	6.8	8.8*	9.6	10*	1	4*
Soybean	1.9	2.6*	5.9	6	3.5	5.6*	1.8	2.5*
Wheat	2	3*	2	4*	5	4	2	1.7

Note: * significant difference at (p< 0.05).
    1: male and 2: female
Source: Survey, 1992

ii)   Maize

The involvement of men and women in maize growing activities are not found different in all ethnic and economic group (average of 25 days/ year). But analysis across economic group indicated that labor use of medium group women (31 days/ year) is found significantly greater than that of poor women

(26 days/ year). In some activities like weeding, drying and storage, women

involvement is significantly higher than men.

Table 27 Labor use pattern (days/ year) for crop production activities by
medium Brahmin/ Chhetri farmers (E2M) (n= 18)

Crops	Activities							
	Sowing		Weeding		Harvesting		Storage	
	M^1	F^2	M^1	F^2	M^1	F^2	M^1	F^2
Potato	2.2	2.1	4.7	4	5.1	5.8	4.5	5.7*
Maize	5.3	3.7	6.6	6.8	4.8	4.2	5.7	6.2*
Millet	6.1	7*	4.6	5.6*	8	8.4*	6.1	8.2*
Soybean	2.2	2.4	2.2	2.2	3	3.2	2	2.2
Wheat	4	3.6	2.6	1	2.3	2	2.5	2

Note: * significant difference at (p< 0.05).
       1: male and 2: female
Source: Survey, 1992

iii)   Millet

There is found significant difference between time spent for

millet sowing, transplanting, weeding, harvesting, threshing, drying and storage by

male and female of both ethnic group and also of medium and poor economic group

owing higher involvement of female. Magar, Gurung women work 31 days/ year as

compared to men working 25 days/ year while Brahmin, Chhetri women use 29

days/ year as compared to men using 24 days/ year.

Table 28 Labor use pattern (days/ year) for crop production activities by poor
Brahmin/ Chhetri farmers (E2P) (n= 9)

Crops	Activities							
	Sowing		Weeding		Harvesting		Storage	
	M[1]	F[2]	M[1]	F[2]	M[1]	F[2]	M[1]	F[2]
Potato	5	5.7	4.7	4	5.1	5.8	4.5	4.7*
Maize	9.4	10.8*	6.6	6.8	4.8	4.2	5.7	6.2*
Millet	5.4	6.2*	4.6	5.7*	8	8.4*	6.1	8.2*
Soybean	3	3.5	2.2	2.2	3	3.2	2	2.2
Wheat	6	4.3	2.6	1	2.3	2	1.3	1.8

Note: * significant difference at (p< 0.05).
1: male and 2: female
Source: Survey, 1992

iv) Soybean

Soybean may also be regarded as female's crop to perform all
production activities in rich and poor Magar, Gurung . But in the rest of
socioeconomic groups, nearly equal participation of male and female is observed.
There exists significant difference between female of Magar, Gurung and Brahmin,

Chhetri ethnic group showing more involvement of Magar, Gurung (15.2 days) in sowing, weeding, harvesting, drying and storage of soybean than that of Brahmin, Chhetri (10.61 days).

Table 29 Labor use pattern (days/ year) for crop production activities by ethnic group

Crops	Magar/ Gurung		Brahmin/ Chhetri	
	Male	Female	Male	Female
Potato	32	31	15	14
Maize	25	23	25	25
Millet	25	31	25	29
Soybean	13	15	10	11
Wheat	14	15	11	9
	(n = 118)		(n = 27)	

Source: Survey, 1992

v) **Wheat**

There seems no significant difference on gender activities among different socioeconomic group except rich and poor Magar, Gurung group in which male and females' labor use in sowing and intercultural operation of wheat crop are significantly different. In both group, female spent more time than male. Similar situation is also observed for postharvest activities in wheat in case of rich Magar, Gurung (Table 24).

Table 30 Labor use pattern (days/ year) in crop production activities by women of different economic status group

Crops	Rich	Medium	Poor
Potato	27	31	26
Maize	20	25	26
Millet	28	33	29
Soybean	17	11	12
Wheat	22	9	11
	(n = 14)	(n = 81)	(n = 50)

Source: Survey, 1992

2)   Animal husbandry

Both male and female farmers participate in animal husbandry. Women spend 25 - 30 per cent of the total daily working time in major livestock activities. Time spent daily by women in Salle village shows quite more than that reported by Acharya and Bennett (1983) as 3.71 hours per day by a woman in farming and animal husbandry work. But, this is less as compared to 6.5 working hours of Pakistani women in livestock activities (Adapted from Paris, 1992). Further, Katuwal (1990) reported that women in eastern hill of Nepal spend more than 6 hours each day on these activities.

Female spend more time on the livestock activities than their male counterparts regardless of ethnic group. Paris (1992) indicated higher participation of women than men in midhills of Nepal. Shrestha *et al.*, (1992)

reported that women spend on an average 23 per cent of total daily working hours on livestock activities; comparing this involvement with input of men, 21 per cent per day with livestock, it appears that women devote more time to livestock activities, however, the difference was not significant. And also in Bangladesh, the author indicated higher women participation in all livestock activities and in all farm size holdings. But in Salle village, this case is revealed significantly only in case of Magar, Gurung. Even though Brahmin, Chhetri women spend less time regarding these activities (5.6 months/ year) than Magar, Gurung (6.07 months /year), it does not show significant differences. However, this result can be compared with the finding of Shrestha et al., (1992). According to the authors, average daily working hours of women in livestock activities found to be greater in Brahmin, Chhetri (5.25 hours/ day) than in Magar, Gurung (4.5 hours/ day) in midhills, however, this is greater in Magar, Gurung (4.75 hours/ day) than in Brahmin, Chhetri (3.9 hours) in high hills situation. Both high and mid hills are covered in Salle observation.

It is found that women's labor use for livestock activities in every socioeconomic strata, is more than that of men but not significantly different. However, detailed analysis on each activity shows interesting result. In feeding, shed cleaning and compost making processes, women of medium and poor Magar, Gurung and Poor Brahmin, Chhetri socioeconomic group allocate significantly greater time than men. Similar case occurs in case of feeding water to livestock with only rich and medium Magar, Gurung and in case of preparing and feeding *khole* with only medium and poor Magar, Gurung. The findings of more women involvement than

men for such activities are also reported by Timsina *et al.*, (1989). Feeding management and shed cleaning are important routine jobs performed by women.

In another aspect of animal husbandry like milking, disease management, selling and buying of livestock and livestock products (*ghee*, curd etc), labor use of men is greater than that of women regardless of socioeconomic strata. Women provide about 37 per cent and men provide 54 per cent of the labor required for milking. Time allocated by women in milking shows direct relationship with economic status, indicating higher involvement in rich and lower in poor. It may be due to large stock in rich farm families and women in rich households are often busy with only household works since they can have wage labor for farming activities.

Table 31 Labor use pattern (days/year) for livestock activities by socioeconomic group

Activities	Rich Magar, Gurung		Medium Magar, Gurung		Poor Magar, Gurung		Medium Brahmin, Chhetri		Poor Brahmin, Chhetri	
	M^1	F^2	M^1	F^2	M^1	F^2	M^1	F^2	M^1	F^2
Preparing & feeding *khole.*	40	45	43	48*	31	37*	42	42	34	45
Feeding water	34	45*	43	47*	33	34	39	40	38	45
Feeding fodder, forage, straw.	34	38*	36	37*	30	32*	25	26	31	45*
Shed cleaning and compost making.	42	45	34	44*	32	36*	41	45	27	45*
Making *ghee, curd* etc.	2	2.3	6.7	7	9	10	17	23	4	8
Milking	67	60	41	29	30	22	39	24	21	16
Disease management.	7	5	2	1	5	2	3	3.3	4	1
Selling & buying of livestock.	3	2.6	5	1	3	2.5	4	3.6	4	2
Selling *ghee, curd*	15	12	-	-	7	3	14	8	5	4
	n = 14		n = 62		n = 42		n = 18		n = 9	

Note: * significant difference at (p< 0.05).
1: male and 2: female

Source: Survey, 1992

3) Tree activities

Rural women are among the most frequent and most important forest users in Nepal. They are the ones who suffer most due to inadequate sources of fodder and fuelwood in their locality. As the forests accessible to them are nowadays declining, dependence is increasing towards multipurpose trees on farmland.

Analysis shows that labor use by women in farmland tree activities is significantly greater than by men in Magar, Gurung ethnic group. However, there is no significant difference in case of Brahmin, Chhetri and also between women of these ethnic group. As Brahmin, Chhetri do not own *nagi*land, only Magar, Gurung women are involved more than men in case of *nagi*land tree activities. With regard to economic group, almost same amount of time is allocated by medium and poor women. In case of medium group, labor use by women is found significantly greater than that by men only in farmland tree activities but such case is not found in forest/ *nagi*land tree activities. No significant difference is noted among socioeconomic strata.

Fodder collection is most time consuming job and women perform 84 per cent of this work. Women on an average spend almost 26 days per year gathering fodder and bedding material as compared to 21 days per year devoted by men. Between socioeconomic strata except medium and poor Brahmin, Chhetri, there

exists also a greater variation indicating significantly higher time allocated by women than by men. Similar results are indicated by Timsina (1992). The involvement of women in fuelwood collection is more (12 days/ year) than men (10 days/ year) because they have more responsibility in cooking and feeding household members.

Table 32 Labor use pattern (days/ year) for forestry/ tree related activities by socioeconomic group

Activities	Rich Magar, Gurung M[1] F[2]		Medium Magar, Gurung M[1] F[2]		Poor Magar, Gurung M[1] F[2]		Medium Brahmin, Chhetri M[1] F[2]		Poor Brahmin, Chhetri M[1] F[2]	
Farmland: Nursery related activities.	3.7	3.3	2.8	2	1.7	1.4	2.3	1.8	2.9	1
Fodder collection.	18	23*	21	30*	24	29*	20	25	21	26
Firewood collection.	8	7	12	11	19	14	12	13	11	13
Logging	0	6	1	9	3	11	1	10	2	12
Forest/ nagi land: Nursery related activities.	3	3.5	2.6	2.2	1.5	2.2	1	1	NA#	
Fodder & bedding material collection.	23	27	26	33*	18	23*	25	24	20	28
Firewood collection.	7	6	9	9.5	6.5	9.4*	5.9	5	8.5	9
Logging	0	7	1	9	2	10	1	10	2	11
	n = 14		n = 62		n = 42		n = 18		n = 9	

Note: * significant difference at (p< 0.05); # not available.
1: male and 2: female
Source: Survey, 1992

Table 33 Results of t- test (p < 0.05) for labor use pattern

Activities	By gender	By economic status	By ethnic group
Crop Production:			
Potato	NS	NS	S
Maize	NS	S	S
Millet	S	S	S
Wheat	NS	NS	NS
Soybean	S	S	S
Livestock Production:	S	NS	NS
Tree Management:			
Farmland	S	S	S
Forest/ *Nagi*	S	S	S

Despite the fact that females dominate in fodder and fuelwood collection and in their overall contribution to tree activities, observations show that males do put in more time than women in other subcategories such as all nursery related activities, chopping logs, cutting trees for timber etc.

4.2.3 Time allocation pattern for daily activities by gender

The daily work routine of gender was prepared through various PRA approaches like "Activity Profiles", "Daily Routines" and "Participant Observations".

The monthly distribution of activities (Table 34), on which both men and women were involved, were useful to be described before explaining about daily

chores. The extent of involvement by gender was already clear from the involvement observation and labor use pattern.

Table 34 Schematic display of activities by month

Months	Major activities
January	Potato sowing, firewood collection, vegetable cultivation
February	Potato sowing, firewood collection
March	Land preparation, maize sowing and wheat sowing
April	Land preparation, maize sowing, soybean sowing, wheat harvesting
May	Maize hoeing/ weeding, potato harvesting, potato storage and seedbed preparation for rice
June	Soybean weeding, land preparation for rice and rice transplanting
July	Weeding in rice field, tree plantation and earthing up in maize
August	Land preparation and sowing millet and weeding in rice field
September	Maize harvesting
October	Weeding millet and harvesting rice and soybean
November	Land preparation for wheat
December	Land preparation for potato, firewood collection, millet harvesting, wheat sowing

Source: PRA and RRA, 1992

Table 35 Daily work routine of gender by detail activities during winter season* (average of 3 women, 4 men)

Activities	Time taken	
	Women	Men
Grinding of maize and making fire in *chulo*	2 hrs	-
Sweeping and cleaning the house	10 min	-
Bringing water from the spring (1st)	20 min	-
Feeding grasses,tree leaves & straw to livestock (1st)	10 min	15 min
Feeding grasses, twigs to goats (1st)	10 min	10 min
Cooking lunch	25 min	-
Firewood gathering at around farmland	25 min	15 min
Giving feed to chicken/ pigs (1st)	15 min	-
Cleaning utensils	15 min	-
Cooking *Khole* for livestock[1]	20 min	10 min
Working in the field	2 hrs	4 hrs
Eating lunch and cleaning the kitchen wares	25 min	10 min
Cleaning shed (day time 1st)	30 min	20 min
Feeding *Khole* to livestock (1st)	10 min	10 min
Feeding tree leaves, straw & water to livestock (2nd)	10 min	10 min
Giving feed, water to goats (1st)	15 min	-
Cleaning shed (2nd)	35 min	30 min
Bringing water from spring (2nd)	25 min	-
Giving feed to chicken/ pigs (2nd)	10 min	-
Discussion with neighbors	15 min	1 hr
Preparing snacks for laborers	20 min	-
Feeding tree leaves & straw to livestock (3rd)	10 min	-
Feeding grasses, tree leaves to goats (2nd)	10 min	5 min
Feeding water to livestock	20 min	10 min
Cooking dinner and cleaning utensils	1 hrs	-
Total	11 hrs & 25 min	7 hrs & 30 min

Note: 1 : Livestock here indicates only cows, buffaloes and oxes.
    * The interview was done during November and December and farmers were asked about the whole winter season.

Source: PRA, 1992

The detail of daily work routine is influenced by the household size, socioeconomic status and physiographic conditions. Shrestha *et al.*, (1992) stated

that the daily work carried out by women at different altitudes and in different ethnic group was considered different (but not statistically significant). The daily work routine by detail activities for monsoon and winter season are shown in Tables 35 and 36 respectively. In Salle, the total working hours per day spent on household, livestock, tree and field activities were observed higher in female (12 hours 49 minutes) than in male (8 hours 5 minutes) (Tables 37 and 38). Siwi (1990) revealed that Indonesian women work more than 10 hours per day as compared to less than 10 hours for men. It was also found different for different seasons (Tables 35 and 36) indicating more time spent in monsoon than in winter. The daily working hour of Nepalese women found to be little bit less than that of Indian women who spend 14 to 16 hours per day during crop season (Chauhan, 1992). The Salle observation for monsoon is higher than that shown by Acharya and Bennett (1983) as 11 hours 21 minutes per day. Women contribute substantially more to domestic tasks than men. On average, 4.07 hours per day is spent on cooking and cleaning by women whereas men spent only 10 minutes (Figures 29 and 30). Acharya and Bennett (1983) indicated 4.04 hours spent by women on cooking, cleaning, doing laundry and caring for children. They also reported that women do 70 per cent more work in the house and subsistence agricultural production than men. Similarly, Stephens (1992) showed that women have to work 2 to 3 hours longer each day than men. The total time spent in all crop and household activities is higher for women (59 per cent) than men (41 per cent) in Thailand (Shinawatra et al., 1987). Their time throughout the day is very fragmented due to their multiple economic and domestic responsibilities and there is little time for any leisure.

The daily work routine of women in the Salle village can be described like this. They start housework at about 4 a.m and finish at 9 p.m. In early morning, they grind corn and clean the house. Men get up later than women.

Table 36 Daily work routine of gender by detail activities during monsoon season* (average of 3 women, 3 men)

Activities	Time taken	
	Women	Men
Grinding of maize and making fire in *chulo*	2 hrs	-
Sweeping and cleaning the house	10 min	-
Bringing water from the spring (1st)	20 min	-
Feeding grasses,tree leaves & twigs to livestock (1st)	15 min	10 min
Feeding grasses, twigs to goats (1st)	20 min	10 min
Cooking lunch	30 min	-
Firewood gathering at around farmland	15 min	15 min
Giving feed to chicken/ pigs (1st)	15 min	-
Cleaning utensils	15 min	-
Cooking *Khole* for livestock[1]	15 min	10 min
Working in the field	3 hrs	5 hrs
Eating lunch and cleaning the kitchen wares	30 min	10 min
Giving tea snacks to guests	15 min	-
Cleaning shed (day time 1st)	30 min	25 min
Feeding *Khole* to livestock (1st)	10 min	10 min
Feeding tree leaves,twigs & water to livestock (2nd)	15 min	10 min
Giving feed, water to goats (1st)	15 min	-
Cleaning shed (2nd)	35 min	30 min
Bringing water from spring (2nd)	20 min	-
Giving feed to chicken/pigs (2nd)	10 min	-
Discussion with neighbors	10 min	40 min
Preparing snacks for laborers	35 min	-
Feeding grasses, tree leaves to livestock (3rd)	15 min	10 min
Feeding grasses, tree leaves to goats (2nd)	20 min	10 min
Giving snacks to laborer	10 min	-
Feeding water to livestock	30 min	10 min
Cooking dinner and cleaning utensils	1 hr	-
Total	13 hrs & 35 min	8 hrs & 40 min

Note: 1 : Livestock here indicates only cows, buffaloes and oxes.
   * The interview was done in April and farmers were asked about the whole monsoon season.   Source: PRA, 1992

Women do the cooking in all households and they spent about 4 hours in this activity. If a family has only one woman, the man sometimes does the cooking if the woman is sick. Food is cooked three times a day; lunch is eaten in the late morning, a snack in the afternoon and dinner in the evening. The main staple food for poor families is maize and also sometimes boiled potatoes, the richer people eat rice.

Table 37 Daily work routine of gender by group of activities during winter season (average of 3 women, 4 men)

| Activities | Time taken | | | |
| | Women | | Men | |
	Hour	Min	Hour	Min
Cooking food	3	15	-	-
Cleaning the house and utensils	1	5	-	10
Bringing water from the spring	1	-	-	-
Feeding ruminants	1	45	1	5
Feeding chicken/ pigs	-	35	-	-
Firewood gathering at around farmland	-	25	-	15
Working in the field	2	-	4	-
Cleaning shed	1	5	-	55
Discussion with neighbors	-	20	1	5
Total	11	25	7	30

Source: Time allocation study, 1992

Table 38 Daily work routine of gender by group of activities during monsoon season (average of 3 women, 3 men)

Activities	Time taken			
	Women		Men	
	Hour	Min	Hour	Min
Cooking food	4	5	-	-
Cleaning the house and utensils	1	-	-	10
Bringing water from the spring	-	45	-	-
Feeding ruminant	2	30	1	10
Feeding chicken/ pigs	-	35	-	-
Firewood gathering at around farmland	-	15	-	15
Working in the field	3	-	5	-
Cleaning shed	1	15	1	5
Discussion with neighbors	-	10	1	-
Total	13	35	8	40

Source: Time allocation study, 1992

Roasted maize and soybeans are most popular snacks. Women normally bring water from the *Pandera*. However, if the water source is near, children also help with this task. Fetching one load of water takes 10 minutes to half an hour depending upon distance of spring from house and quantity of water output from the spring. Women have to collect water five or six times a day for drinking, cooking, cleaning kitchen wares and preparing animal feed, depending upon the size of the family, number of livestock and use of water.

Magar , Gurung women also prepare alcoholic drink (*Jand*) from maize and millet by themselves. Every Magar, Gurung households, despite poor or rich have *Jand* and they offer especially this drink to the guests.

Note: L= livestock; F= fieldwork; C= cooking and cleaning
Fi= firewood collection; W= water carrying
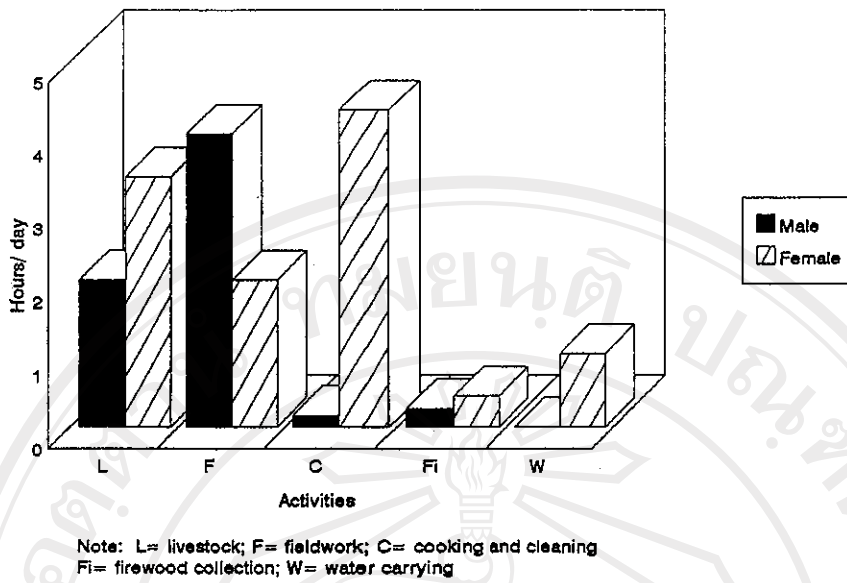
Figure 29 Time spent by gender on agroforestry and household activities in
winter season
Source: PRA, 1992

Note: L= livestock; F= fieldwork; C= cooking and cleaning
W= water carrying
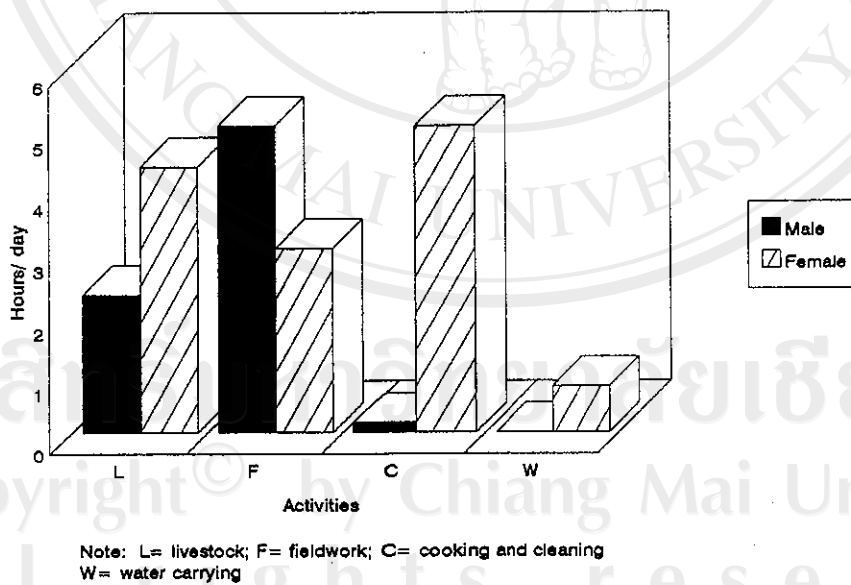
Figure 30 Time spent by gender on agroforestry and household activities in
monsoon season
Source: PRA, 1992

4.2.4 Decision making

The whole process of decision making in the household is a complex one, and it is difficult to pinpoint which of the members has made a particular decision. Although men are culturally accepted as the decision maker in the household, the decisions that they make are usually suggested by other members of the household, particularly by the wives. The information are not easily obtainable from a questionnaire survey, and a participant observation method is useful for finding the less obvious factors. For example, when asked directly a question such as "who made this decision?" the answer was invariably the husband or the head of the family. But in actual practice the women of the house, particularly, the wives exercised a great deal of influence. The husbands of this community almost always consult their wives informally before taking a major decision.

To examine the degree to which women make decisions in areas important in the household, four main areas of decision making have been distinguished: crop production, livestock, tree management and household activities.

1) Role of gender on decision making of various agroforestry activities

A role of gender on decision making should have been studied with respect to men as well as women in further detail. Finding of such type results would be rather more informative to understand the assess on decision making relating to the various agroforestry activities. However, time requirement as well as

the financial constraint were the main lacuna to perform the detail study. In this study, womens' activities were considered in detail since they are invisible and unseen to the most of activities concerning to collection of facts and findings.

i)   Crop Production

In almost all cases of different operations directly related to crop production (choice of area/ land for different crops, cropping pattern, planting time, harvesting time, adoption of plant protection measures etc), half of decisions are made by both sexes with common understanding (Appendix Tables 7 and 8).
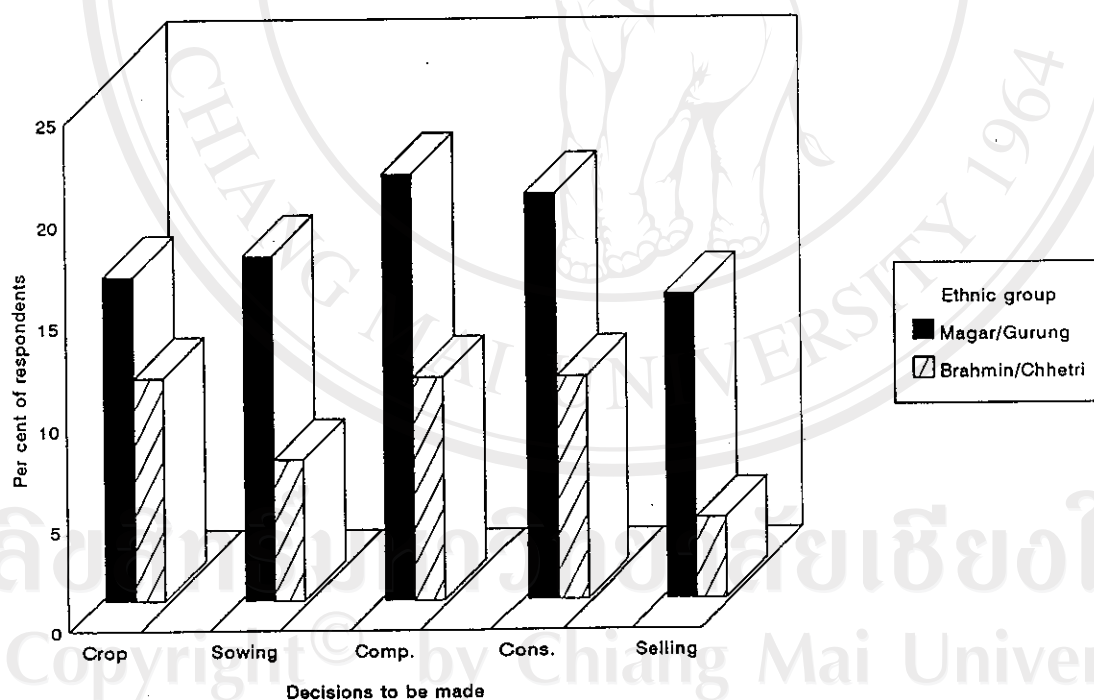
Comp. = Use of compost; Cons.= Household consumption of grain

Figure 31 Womens' decision making role regarding crop production by ethnic
group
Source: Survey, 1992

Rest of the decisions are generally made either by men or women alone. In the activities like amount of compost to be applied, time of weeding and amount of grain for the whole year consumption, women have comparatively better role. Same observations were also revealed by Timsina *et al.*, (1990). The extent of overall decision regarding crop production activities is found to be affected by ethnicity. Magar, Gurung women have better role as compared to Brahmin, Chhetri (Table 39 and Figure 31). But the comparison among three economic status group reveals that women of resource poor families have strong role in decision making as compared to women of resource rich and medium families (Table 40 and Figure 32).
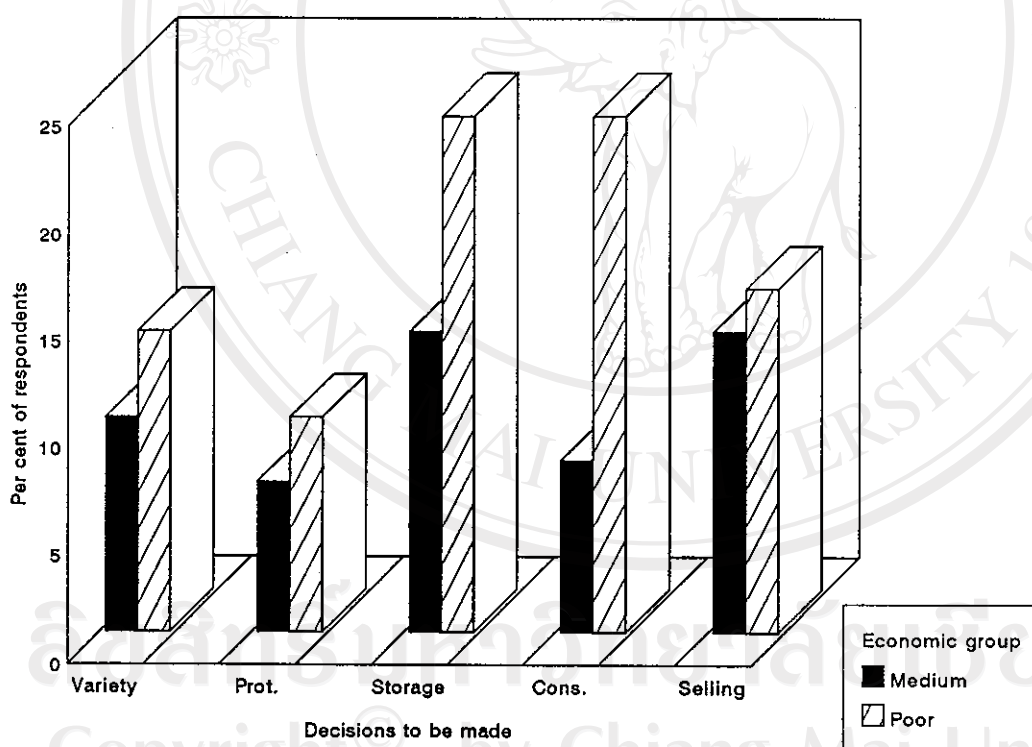
Prot. = Plant protection; Cons.= Household consumption of grain

Figure 32 Womens' decision making role regarding crop production
by economic group
Source: Survey, 1992

ii) Livestock management

In practices relating to livestock, male heads of families take almost half of decisions jointly with their wives. However, in certain decisions on choice of area and person for fodder collection and feeding management in dry season, involvement of women is greater (about 19 per cent) (Appendix Tables 9 and 10). Thangavelu (1992) cited that decision making on animal management and husbandry is more by the women than by men in Malaysia. Timsina *et al.*, (1990) also showed that Nepalese women's decisions become critical in animal production activities. Animal purchase is mostly decided by men.
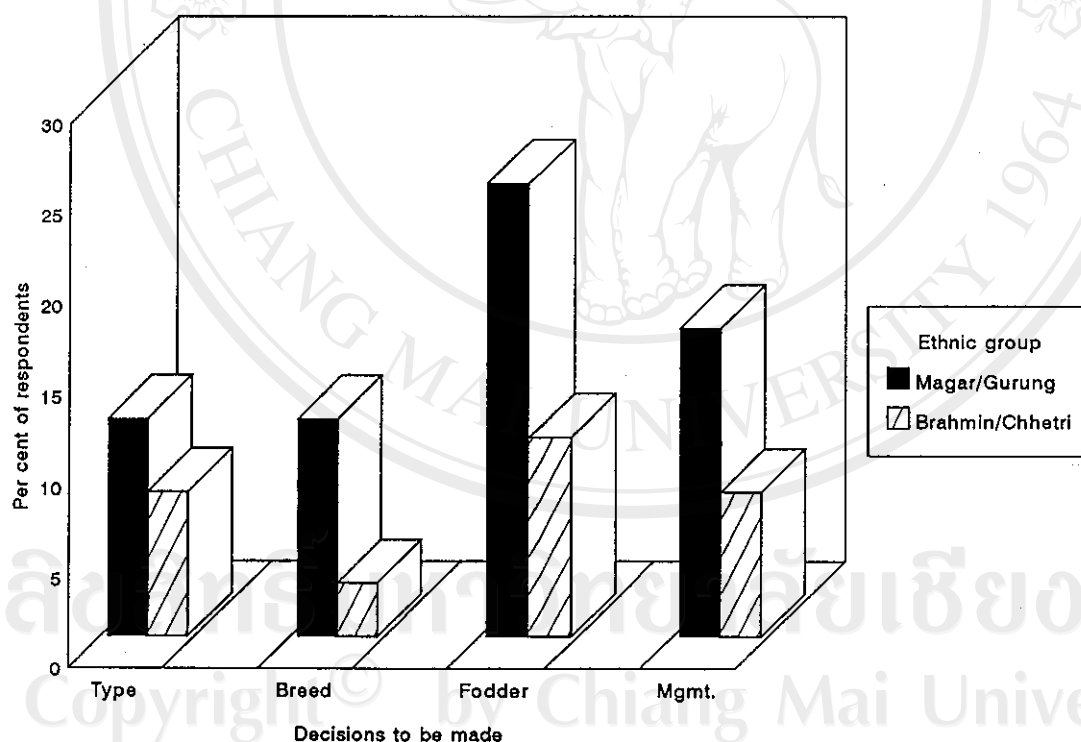
Mgmt.= Feeding management; Fodder= Fodder collection; Breed= Selection of breed

Figure 33 Womens' decision making role regarding livestock production by
ethnic group
Source: Survey, 1992

Table 39 Gender related decision making processes concerning agroforestry production by ethnic group

| Activities | Per cent of respondents | | | | | |
| | Magar/Gurung | | | Brahmin/Chhetri | | |
	M^1	F^2	B^3	M^1	F^2	B^3
Crop production	36	16	48	49	8	43
Livestock management	43	14	43	49	8	43
Tree management	58	11	32	61	7	35
HH & other activities	51	14	35	65	18	27
	n = 118			n = 27		

Note: 1: male, 2: female, 3: both
Source: Survey, 1992

Participation of farm women in decision making is associated with caste. Women of Magar, Gurung caste has stronger decision making role as compared to that of Brahmin, Chhetri (Table 39 and Figure 33). But status of economy is observed to be negatively correlated with involvement of farm women in decision making (Table 40 and Figure 34).
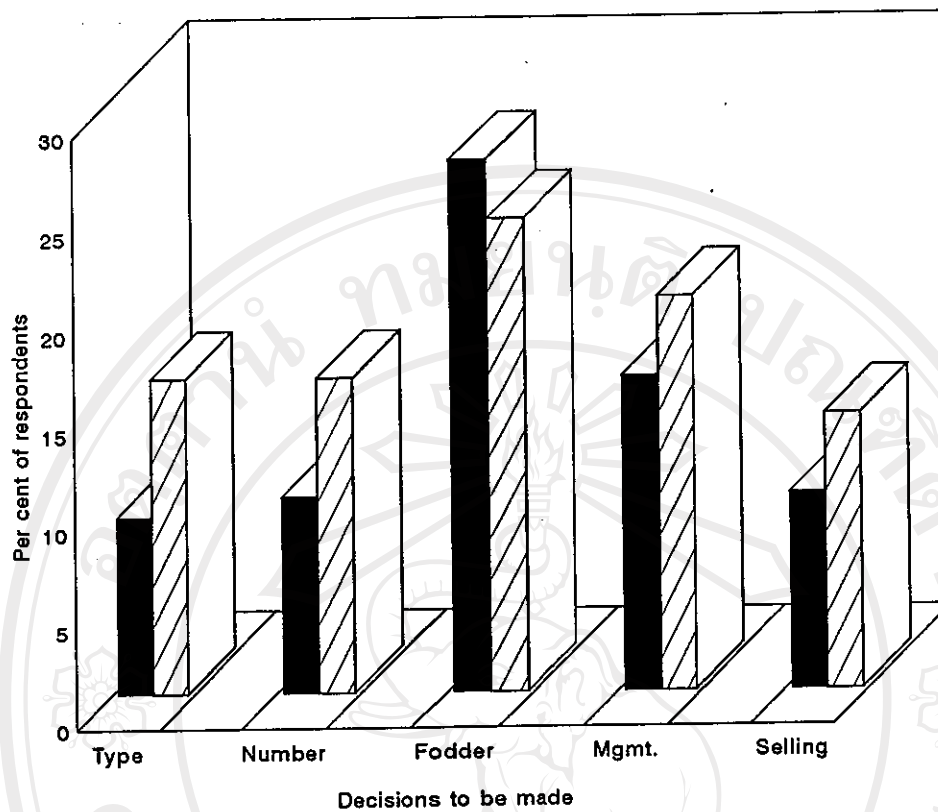
Mgmt.= Feeding management; Fodder= Fodder collection
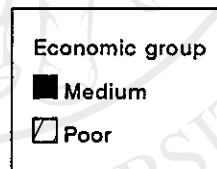
Figure 34 Womens' decision making role regarding livestock production by
economic group
Source: Survey, 1992

Therefore, farm women in higher socioeconomic status do not enjoy as much

of involvement in decision making process regarding livestock husbandry and

management, as those of middle or lower socioeconomic status families.

Table 40 Gender related decision making processes concerning agroforestry production by economic group

| Activities | Per cent of respondents | | | | | | | | |
| | Rich | | | Medium | | | Poor | | |
	M[1]	F[2]	B[3]	M[1]	F[2]	B[3]	M[1]	F[2]	B[3]
Crop production	55	7	38	31	14	55	46	18	36
Livestock management	56	7	37	40	13	47	50	18	32
Tree management	70	15	29	63	7	30	65	15	20
HH & other activities	32	8	57	48	11	41	68	17	15
	n = 14			n = 81			n = 50		

Note: 1: male, 2: female, 3: both
Source: Survey, 1992

iii)   **Forestry management**

Sixty five per cent respondents reported decision regarding tree activities are generally made by men. For the majority of remaining, decisions are taken equally with the consultation of women (Appendix Tables 11 and 12). Magar, Gurung women are comparatively participating more in decisions related to tree planting and management than those belonging to Brahmin, Chhetri (Table 39 and Figure 35). The extent of decision making role on time and place of fuelwood collection is found to be indirectly related with economic status (Table 40 and Figure 36).
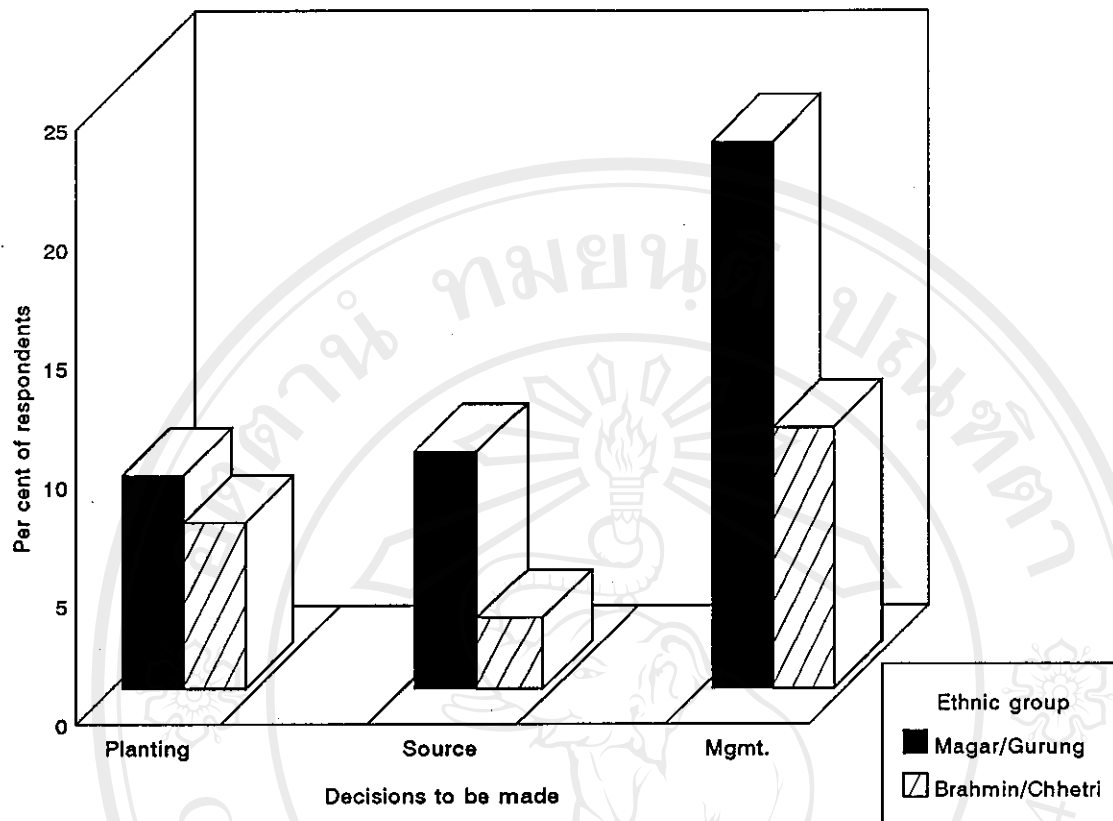
Planting = Where to plant; Source= Sapling source; Mgmt.= Cutting management

Figure 35 Womens' decision making role regarding tree management by ethnic
group
Source: Survey, 1992

iv)   Household and other activities

Decision making concerning the internal household activities in the rural

families are mostly found to be taking principal role by women. Regarding

expenditures on household use, about 1/3 rd of the decisions are made by women.

However, the extent is negatively correlated with socioeconomic status (Tables 39, 40). But buying and selling of land/ house and sending children to school are often decided by men. It is found that women's involvement is meager in decision making on participation of village meetings and training activities (Appendix Tables 13 and 14).
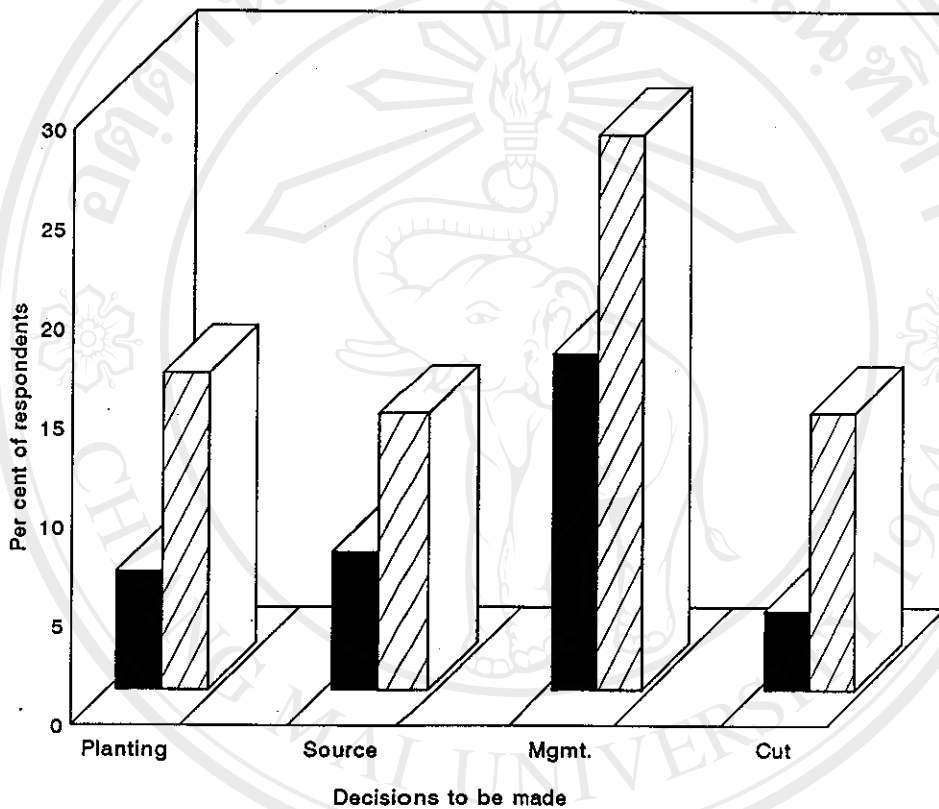
\# Planting = Where to plant; Source= Sapling source; Mgmt.= Cutting management;

Cut= Cutting timber
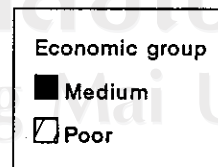
Figure 36 Womens' decision making role regarding tree management by
economic group
Source: Survey, 1992

2) Access and control of resources

One of the several keys that need to be considered is control over and access to resources and benefits contributing to family welfare and agricultural productivity (Tisch, 1992). The relationships between and division of labor with gender affect how household and local resources are allocated. The management and control of these resources are important to sustainable agroforestry system. Who has access to the resources used for agricultural activities, in tree growing and animal production is also critical. Some of the main local resources include land, forests, water etc.
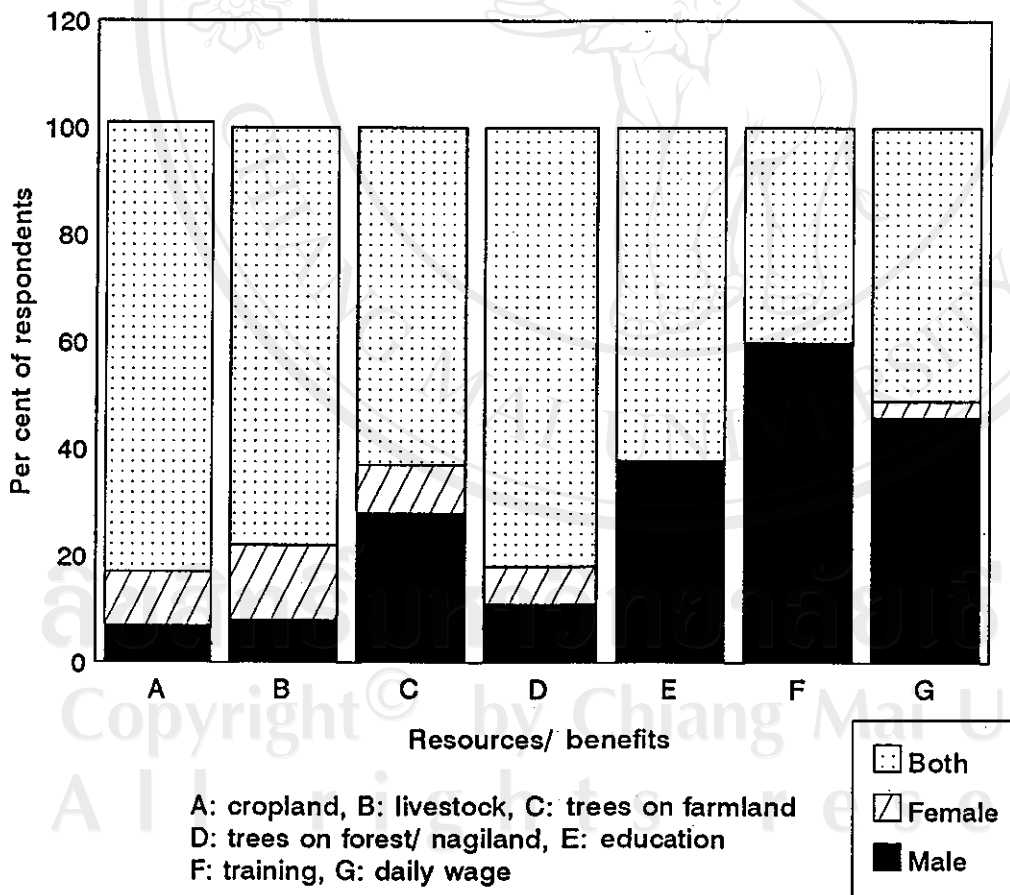
Figure 37 Access of resources by gender in Magar/Gurung
Source: Survey, 1992

The issue of intra-family equity arises because of implementation of new forms of control over resources e.g. *nagi*land, introduction of new tree species and availability of technical help and training for management. In this study, equity issues of gender and socioeconomic status are considered.

However, equity issues differ with ethnicity, religion, class, age and gender. Decisions regarding management of household along with farm, tree and livestock production are affected by the control of resources. Analysis of resource control indicates degree of decision making, concerning particular aspects of agroforestry system. For instance, access to and control over *nagi*land may be critical factor in convincing a farmer to plant new tree species. Planting new multipurpose tree species on the edge of terrace of farmland with crops may seem sensible to the researcher and project planner, but first it must be understood who in the family is seen as responsible for farmland.

It is observed that even though women have access to resources e.g. cropland, livestock, trees, daily wage etc., they have very little control over them. This also differs with ethnicity as mentioned above; indicating Magar, Gurung have comparatively more access and control over these resources.
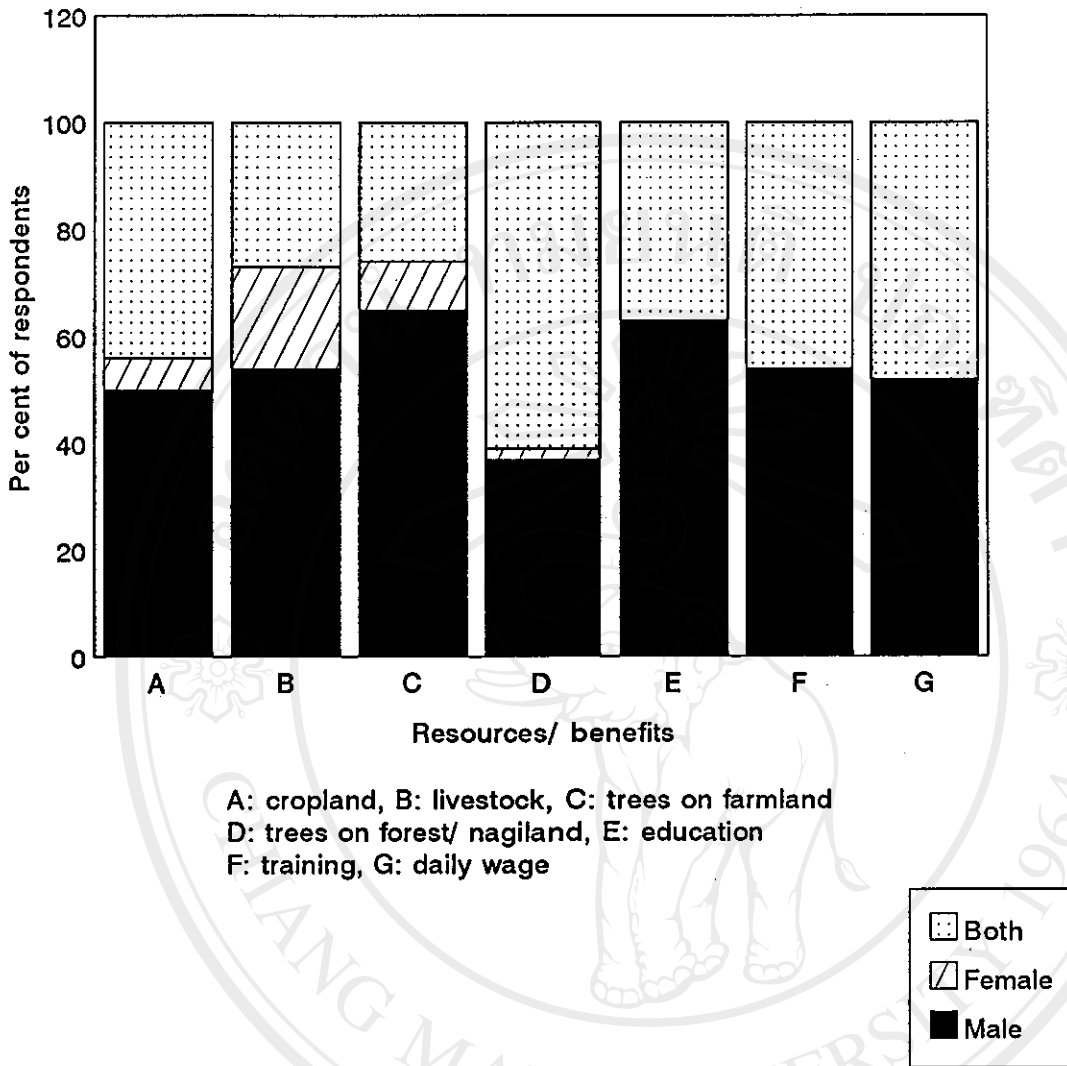
Figure 38 Control of resources by gender in Magar/Gurung
Source: Survey, 1992

Furthermore, the control and responsibility over resources shifts with location. Women are mostly involved in care and management of trees near the homestead or farmland whereas for trees on *nagi*land, men are responsible (Figures 37 and 38). Most of the respondents indicated no or negligible access and control over education, training activities etc.

4.2.5   Perception about resource situation in the village by gender

Sustainability depends on information about local resources. These resources are controlled differently by men and women. There are many agricultural and resource management areas where men and women's knowledge differ. The degree of gender differentiation in knowledge base shapes problem identification and technology adoption within the household.
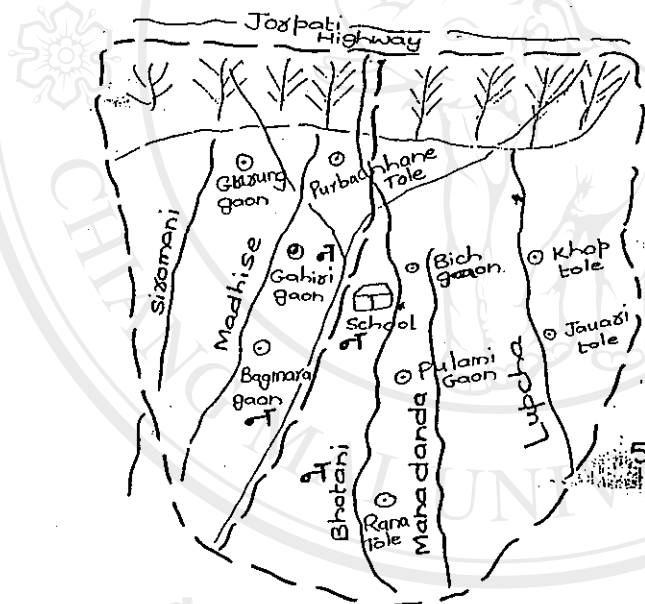
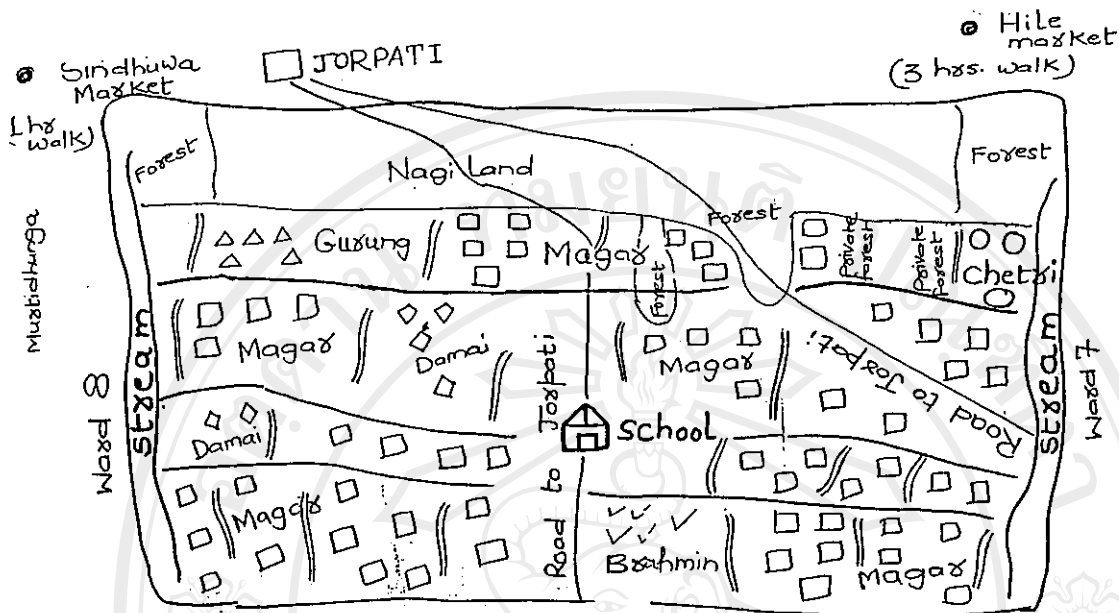Figure 39   Resource map drawn by male farmers
Source: Survey, 1992

Figure 40 Resource map drawn by female farmers
Source: Survey, 1992

The agroecosystem resource mapping by PRA Techniques revealed different

perceptions, views and thinking of male and female farmers about their resource

situation in the village. This also provided an opportunity of people to show a group

of outsiders a version of their area which needed certain emphases and areas for

intervention. The villagers, particularly male, expected the researchers to be capable

of offering assistance of some form no matter how the exercise was introduced. In

this situation, they wished to prompt certain conclusions and make certain points.

Female, on the other hand, had none of the expectations and wished just to show an

accurate version of their area. The maps drawn by male and female are different and

are presented in figures 39 and 40. The male farmers considered political/ administrative boundary of the village and draw a more accurate map in this aspect. They showed the whole area with location of households of different social groups, grassland/ forest, and major streams and drinking water resources. Discussions with men were centred on the lack of sufficient forest/ fodder for maintaining their livelihood. The women, on the other hand, were not familiar with the administrative boundary so they fixed their own boundary covering the village. But the maps drawn by women farmers seem more detail and convey descriptive information about resources; for example, regarding water resources i.e., springs, they not only consider location but also the point source and distance from house. These different perceptions may be due to the fact that women mostly work around the homestead and so they are more concerned about these situations. As men have more access to the world outside the village and to politics, training, meeting and discussions, so they have different perception from women. Figures 39 and 40 indicated that as compared to men, women had detailed perception about the village with regard to household situation which also directly showed the access of women to resources necessary for household activities. Women located from small private forests to the springs in the map, which indicated that they had access to these resources.