ECONOMIC PERFORMANCE OF THE USER GROUPS IN COMMUNITY FORESTRY: AN APPROACH TO THE STUDY OF PARTICIPATORY DEVELOPMENT WITH REFERENCE TO KABHREPALANCHOWK DISTRICT, NEPAL

A THESIS SUBMITTED TO THE GOKHALE INSTITUTE OF POLITICS AND ECONOMICS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ECONOMICS

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CERTIFIED that the work incorporated in the thesis entitled "Economic Performance of the User Groups in Community Forestry: An Approach to the Study of Participatory Development with Reference to Kabhrepalanchowk District, Nepal" submitted by Mr. Bal Krishna Upadhyay was carried out by the candidate under my supervision. Such material as has been obtained from other sources has been duly acknowledged in the thesis.

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Dr. V. S. Chitre

(Research Guide)

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Acronyms

ADB	Asian Development Bank
AIDAB	Australian International Development Assistance Bureau
CBS	Centre Bureau of Statistics
CF	Community Forestry
CFUG	Community Forest User Group
CFUGC	Community Forest User Group Committee
CPFD	Community and Private Forest Division
CPR	Common Property Resource
CPRI	Common Property Resource Institution
DANIDA	Danish International Development Agency
DFID	Department for International Development
DFO	District Forest Officer
DFOf	District Forest Office
DOF	Department of Forest
EFEAP	Environment and Forest Enterprise Activity Project
ERDG	Energy Research and Development Group
FAO	Food and Agricultural Organization
FRSC	Forest Research and Survey Centre
GDP	Gross Domestic Product
GTZ	Gesellschaft for Technische zusamenarbeit (German Agency for Technical Co-operation)
HMGN	His Majesty's Government of Nepal
ICIMOD	International Centre for Integrated Mountain Development
ILO	International Labor Organization
JFM	Joint Forest Management
MOF	Ministry of Finance
MFSC	Ministry of Forest and Soil Conservation
MPFS	Master Plan for the Forestry Sector
NACRMP	Nepal Australia Community Resource Management Project
NARMSP	Natural Resource Management Support Program
NAS	National Academy of Science
NRC	National Resource Council
NPC	National Planning Commission
NSCFP	Nepal-Swiss Community Forestry Project
NUKCFP	Nepal-UK Community Forestry Project
PF	Panchayat Forest
PPF	Panchayat Protected Forest
OP	Operation Plan
SDC	Swiss Development Corporation
TU	Tribhuvan University
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VDC	Village Development Committee
WCED	World Conference on Environment and Development

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CHAPTER I

INTRODUCTION

1.1. INTRODUCTION

Conventional policy analysis of the performance of Community Forestry normally focuses on the technical aspects: per hectare tree density and incremental volume of forest biomass. Similarly, the performance of Community Forestry is assessed in terms of the number of groups formed, community forest area handed over to the groups, total number of beneficiary households in the groups, and average income and expenditure of the groups. What has been missing in the conventional policy analysis is how the forest user members work, how the group formulates and enforces rules of product harvest and distribution, whether the group protects the forest effectively, whether forest user members have a long time horizon, whether the groups distribute forest products among user members and how the groups perform in terms of the current distribution of the forest products among the user members effectively reflecting the future consciousness of the members into the outcomes of the group decisions.

Community Forestry is a socio-technical process, which involves user members' interaction with the forest and rules pertaining to the use and protection of the forest. Therefore, attributes associated with the institutions or rules, user members and forests are in simultaneous interaction in a functioning Community Forest User Group (CFUG). Forest has a regeneration rate. Withdrawal of forest products beyond the regeneration rate causes the eventual extinction of the forest stock. The Community Forest User Groups rely on political decisions to determine the appropriation of forest produce for the current needs because there is no market for the forest produce in the hills. The political decision-making process that settles the withdrawal of a smaller amount of the forest produce for the user members in the current period takes care of the maintenance of the regeneration condition of the forest for the future.

This thesis takes the choice-theoretic problem faced by the household members of the CFUG, as its point of departure (see chapter V). In this choice-theoretic problem, the determination of the typical hill household's equilibrium requires simultaneous optimal choice of the current and the future consumption of forest products obtained from the group, labour input in the group and alternative activities and expenditure on monitoring of the forest use over time. The implications of this choice-theoretic problem for this study are as follows. First, the household should choose just the level of current withdrawal of produce from the community forest, which will ensure that the regeneration condition of the forest is well maintained for the future, consistent with its time preference or future consciousness. Second, a typical household should invest its current labour input in group activity in such a measure (and such a way) as to transform into a community forest protected for the future as per its preferences. Third, a typical household should invest the real produce from alternative activity as membership fee into group activity in such a way that it contributes to the monitoring of the forest effectively to protect it for future use.

Therefore, if user members use their labour input in group activity and membership fee in the monitoring of the forest use, the group improves its management activism or effectiveness. The thesis is that a CFUG distributes a smaller amount of fuel wood, fodder and leaf litter when its management activism is higher and thus performs better in the sense of protecting the forest for the future, in accordance with the time preference of its household members. Similarly, if the households are future conscious, they intend to receive a smaller amount of fuel wood, fodder and leaf litter in the current period and thus CFUGs perform better. (The word CFUG or CFUGs is interchangeably used hereafter). Therefore, the performance or the extent of the distribution of forest produce in the current period among the user members depends upon the management activism of the CFUG and its user members' time preference. Therefore, an understanding of the performance of CFUG and deducing the policy implication from it to improve its performance requires an understanding of the institutional aspects or management activism of the CFUG and user members' future consciousness. In addition, the leader's education, and the other attributes associated with the forest (that is, forest area and its types) and user members (that is, the caste and the literacy status of the household head, family size, livestock in standard units, net crop income and forest products from alternative sources) can influence the performance of CFUGs. This study investigates into the performance of the 19 Community Forest User Groups of the kabhrepalanchowk district of Nepal, keeping these hypotheses in mind.

And, the principal thrust of this study is that given a high management activism of the CFUG and its user members' high future consciousness, a CFUG performs better in terms of the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

1.2 DEPENDENCE ON FORESTRY

Forestry has a strategic role in Nepal's economy. The Master Plan for the Forestry Sector (HMGN 1988) estimates that forestry contributes by 15% in Nepal's total agricultural Gross Domestic Product. Approximately, 5.5% of the total GDP of Nepal originates from forestry sector (Chapagain, Kanel, and Regmi 1999). Forestry provides full time jobs to 1.36 million people, of whom many are involved in fuel wood and fodder collection (equivalent to NRs. 13,872 million per year), for their subsistence (Bhatta 1992).

Similarly, 90% of the total population of Nepal depends on the forests for their subsistence for timber (for house construction, furniture and agriculture implements), fuel wood, fodder and litter. Therefore, the availability of these forest products in adequate quantity is necessary for people's livelihood. Fuel wood alone contributes by 75.9% in the household's total energy consumption (HMGN 2002a).

Next, fodder (grass and tree leaves) is the major source of livestock feed in hills (Gilmour and Fisher 1991). According to the Agriculture Perspective Plan (HMGN 1995a), fodder from forest and own farmlands contributes more than 40% in livestock nutrition.

Leaf litter is used as livestock bedding and then as compost manure when it is decomposed (Mahat 1985). Agriculture and livestock are an integral part of the rural economy of Nepal. Approximately, 92% (or 2.4 million hectares) of the total land holding (that is, 2.6 million hectares) consisted of agricultural land (HMGN 1993). About 90% of these land-holding households own livestock. The Irrigation Master Plan (HMGN 1992) suggests that 1 hectare of cultivated land requires 2 to 5 hectares of degraded forest area and grazing land to provide forest residues for compost and for maintaining livestock population. Wyatt-Smith (1982) demonstrated that each household (of five to six members with average farm holding of 1.25 hectares) requires 3.5 hectares of land for fodder, 0.3 to 0.6 hectares of land for fuel wood, and 0.4 hectares of land for timber to sustain its agriculture led economy.

Hill forest protects soils and water source. If forest is protected, it maintains the natural system of the hills and contributes to the productivity of the hill economy. Thus, the challenges in the forestry sector are to supply basic forest products and maintain the natural system of the hill economy (HMGN 1980). As forestland is limited, it is essential that the existing forests be well maintained for the future while providing the forest products for the current needs.

The Master Plan for the Forestry Sector (MPFS), giving due emphasis on people's' dependence on forest products and deteriorating condition of the forest, projected the supply and demand situations of timber, fuel wood and fodder in 1988 for the fiscal years 1985/86, 1990/91, 2000/01 and 2010/11. The Master Plan assumes that without plan and projects there would emerge deficits in the supply of timber, fuel wood and fodder compared with the projected demand (see chapter II). This deficit situation necessitated further correction in the forest management and governance. The policy implication is that the government efforts to solve forest product supply are neither enough nor effective. The deforestation and its allied problems heightened because of the ineffectiveness of the government mechanisms in monitoring the forest use effectively and protecting the forest for the future. Therefore, the Master Plan for the Forestry Sector (HMGN 1989) recommended handing over the forest to the CFUG to enable them to share forest products among themselves and to protect the forest effectively. Therefore, the Community Forestry Policy is implemented in the hope that village people residing in the proximity of the forest resource will be able to monitor forest use effectively and protect the forest for the future. The Community Forestry Policy empowers forest users to form the Community Forest User Group. The user group is entrusted with the responsibility for the use and protection of the forest for the future. If CFUG is representative, enforces harvest and distribution rules and monitors the use of the forest effectively, it improves its effectiveness or management activism. Then, it can protect the forest for the future. The user members should be future conscious about the protection of the forest for the future; that is, they should have a long time horizon. However, in practice or empirically, the influence of the CFUG's management activism and its user members' future consciousness on the distribution of fuel wood, fodder and leaf litter has not been examined. Thus, this thesis assesses empirically the influence of the effectiveness of the CFUG and its user members' future consciousness on the distribution of fuel wood, fodder and leaf litter.

1.3 DEVELOPMENT OF FOREST POLICY IN NEPAL

In this thesis, we argue that the Forestry Policy that favours people's involvement in forest management and governance can contribute to the protection of the forest while providing adequate forest products for the current needs. His Majesty's Government of Nepal relied on centralised forest management for the protection of the forests and supplying the basic forest products among the people until 1976 (see chapter II for the theoretical reasons for the centralised management of forest). However, the state forest department was not able to protect the forest effectively and supply forest products among the people because of the insufficient staff and low budget. The lack of access roads to the hill areas complicated the forest protection, and made the product distribution tasks almost impossible. Since people's livelihood depended on the forest and land resources, they harvested forest products and converted forestland into farmlands illegally.

In 1970s, various accounts at the national (for example, Energy Research Development Group 1975, National Forestry Conference Kathmandu 1974 and His Majesty's Government of Nepal's Task Force on Land Use and Erosion Control 1974) and at the international level (Eckholm 1975 and 1976, and World Bank 1978b) both mirror the grim future of the country and its forest because of the alarming deforestation and its allied problems of soil erosion, floods and scarcity of forest products. However, the debates as to whether tree cover in hills declined or unchanged remained unsettled in the academic literature (see chapter II).

Thus, because of the government's inability to protect the forests and supply forest products among public, it introduced the National Forest Plan in 1976. The National Forest Plan (HMGN 1976) recommended handing over the national forest to Village Panchayats, thus proposing a new policy decentralising the forest management. The plan remained silent on the community component of the Community Forestry.

The sixth five-year development plan (1980-85) for the first time accorded top-most priority to fulfilling people's needs for forest products and people's involvement in plantations on the Panchayat Forest and Panchayat Protected Forestland and its protection effectively (HMGN 1980). However, this program focused on afforestation in drier and ecologically sensitive zones in the hope that the fuel wood crisis could be resolved. This early approach depended on the political leaders of the Panchayats ignoring the critical role of real forest users' indigenous skills and knowledge of forest management (Hobley 1996). Consequently, panchayats were not able to control access to the forests and their use effectively. Consequently, the World Bank (1991) actually decided to support efforts to encourage management by smaller groups more closely associated with particular forest tracts and to give them responsibility for forest in good condition as well as degraded lands. Thus, until 1987 Community Forestry existed mainly in its rhetoric.

In 1987, the government revised its legislation and introduced the concept of CFUG (Joshi 1997). The Master Plan for the Forestry Sector (HMGN 1988 and 1989) aimed at granting rights over the use of forest to the village people and suggested handing over of all the accessible forest of the hills to the user groups. The ninth five-year plan (1997-2002) aims at stabilising the demand for and supply of forest products, and increasing the productivity of forests through increased participation of people in forest management and governance (HMGN 1997). This thesis evaluates this policy of the ninth plan.

His Majesty's Government of Nepal after the establishment of the multiparty democracy in 1990 adopted more liberalised approach for the overall development of the country (HMGN 1990). Consequently, it introduced the Forest Act, 1993, and its byelaws, 1995. This Forest Act (HMGN 1998) categorises the forests into four categories: Community Forest, Private Forest, Leasehold Forest, and Government Managed Forest. Forestland under private ownership with planted, nurtured or conserved forest is called Private Forest. A national forest leased to an individual or a group of individuals or a corporate enterprise against the payment of royalty is Leasehold Forest. The Government Managed Forest is the government owned land, governed by the District Forest Office/any other government agency.

According to the Forest Act (1993), a community forest is a national forest of government owned land handed over to a user group who is responsible for its development, conservation and utilisation. A Community Forest User Group (CFUG) is a group of member households entrusted with the responsibility of the protection of and development of the public forestland, and sharing the produce among themselves. A Forest User Group Committee is a small executive body (with usually 7-15 members) of a CFUG.

Various international donors have been providing financial and technical assistance to foster Community Forestry in Nepal. Currently, the Community Forestry Program is supported by DANIDA (Danish International Development Agency), Denmark), GTZ (Gesellschaft fur Technische Zusammenarbeit), German government, SDC (Swiss Development Corporation), Swiss government, Department for

International Development (DFID), UK, USAID (United States Agency for International Development), and AIDAB (Australian International Development Assistance Bureau), Australian Government. Furthermore, His Majesty's Government of Nepal has been independently implementing Community Forestry in some district (HMGN 2002b). The Australian Government has been providing financial and technical assistance to foster Community Forestry in the kabhrepalanchowk and sindhupalchowk districts. This thesis assesses the economic performance of the 19 CFUGs of the kabhrepalanchowk district.

The Forest Act of 1993 and its bylaws (1995) provide authority to village people to design the institutions of their own, formulate and enforce rules for the protection of the community forest, and share the forest produce among them. Because of this policy, villagers take more interest in forming a group and request the DFO to hand over the forest for the group's management. At present, the Community Forestry covers 73 of the 75 districts of the country. As of October 2002, 15.7 percent of the total national forest area (that is, 58,28,000 hectares, HMGN 1999) of Nepal has been handed over to the 11, 632 Community Forest User Groups (HMGN 2002b). Furthermore, approximately 30.6 % of the total households (that is, 41,74,374 households, HMGN 2002c) of Nepal have been accommodated as the beneficiaries of the handed over forests. However, the influences of the management activism of the CFUG and its user members' future consciousness on the distribution of fuel wood, fodder, and leaf litter among the user members remains unexamined.

The Forest Act provides that the District Forest Office creates CFUG. This act provides basic outlines of the constitution and operation plan of the CFUG, which a field staff adopts. The CFUG constitution details who the members of the group are, how the executive committee of the group is formed, how the group boundary and the forest territory are defined, what types of punishment and fines can be used, what rules can be adopted for the harvest and distribution of forest produce, and how the funds of the CFUG are to be managed. The operation plan provides the details about the location, area, and physical condition of the forest, activities permissible on the user groups' forestland (for example, prohibition for grazing). The plans also specify what products cannot be removed from the forest (for example, soil and stones), who can remove the products and when the products can be removed. Thus, the government determines policy concerning the management and governance of community forest. Under this co-management of forest, the CFUG is provided with rights to distribute forest products among the user members for their current needs, and protect the forest for the future. The CFUG adopts political decision making to select general as well as executive members, formulate, and enforce rules for the harvest and distribution of forest products. It settles the current withdrawal of forest products through political decision making. The members of the group decide in the meetings in such a way that the future of the forest is well considered in the decisions while withdrawing the quantities of fuel wood, fodder and leaf litter for the current needs. The preferences of the user members are reflected in the decision-making.

1.4. COMMON UNDERSTANDING

Common understanding among the user members of the dependence on forest products for the current and as well as for the future needs and long term benefits of a protected forest can serve as a trust among themselves, which is reflected in the decision-making of the CFUG. This long-term benefit of the protected community forest fosters future consciousness about the protection of the forest for the future while providing forest products for the current needs. Consequently, user members join the group for the effective protection of the forest. Leaders canvas in the meetings or village people's forum in such a way that it helps extend the concept of Community Forestry and benefits of co-operation in Community Forestry among the user members. Consequently, user members develop common understanding (Lin 2001, and Ostrom 1998a and 1994) that the protected forest is essential for their livelihood. Familiarity of the user members with each other and proximity to each other shape the attitude of positive reciprocity among themselves. Therefore, users develop the attitude that a long-term benefit of Community Forestry is possible through co-operation. This makes rule formulation and enforcement easier. Rules become credible in the sense that it is easily understood and followed by user members. Hence, a CFUG is characterised as a credible and an effective organisation at the local level.

1.5. ANALYTICAL ISSUES OF THIS STUDY

The major analytical issues of this thesis are as follows.

a) Whether and why Community Forest User Groups' high index of management activism make CFUGs perform better in terms of the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

b) Whether and why user members' high future consciousness make CFUGs perform better in terms of the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. By future consciousness, we mean user members' alertness about the protection of the forest for the future or a long-term time horizon of the user members. The thesis is that a future conscious household intends to receive smaller quantities of fuel wood, fodder and leaf litter from the CFUG in the current period.

c) How far do the other relevant variables, namely, leaders' primary education, forest related attributes (area and types of the community forest: natural forest of mixed species without plantation of pines, plantation forest of pines plus natural forest and plantation forest), the caste and the literacy status of the household head, family size, size of the livestock in standard units, net crop income and fuel wood, fodder and leaf litter from alternative sources (that is, own farmlands and government forest), influence the distribution of fuel wood, fodder and leaf litter.

Fuel wood consists of fresh fuel wood and sita added together after correcting moisture contents in them. Fodder consists of grass and tree fodder/leaves.

Management activism of a CFUG includes the following three aspects: a) process of decision-making, b) enforcement of property rights, and c) monitoring of implementation of the decisions.

The process of decision making consists of the procedures for making the CFUG representative of the concerns of the user members and for functioning effectively. The process of decision-making ensures sharing of information about group activity and the role of the protected forest among the members of the group. Specifically, the process of decision-making is taken here to consist of the following five components: a) representation of at least i) one household from each of the castes of the general members, and ii) one woman in the executive committee, b) four years' average of the total of the monthly and annual meetings, c) four years' average attendance of the executive committee members in the executive committee meetings, and d) whether or not decision-making is done for the harvest and distribution of fuel wood, fodder, and leaf litter by the executive committee, or assembly, or both.

The enforcement of property rights denotes the effectiveness of the CFUG to ensure users' stake in Community Forestry. A CFUG is effective if property rights are enforced. The property rights are enforced if CFUG specifies membership fee, rules of harvest (including specification of produce, day/date, time of entry into and exit from forest and quantity for withdrawal) and distribution of fuel wood, fodder, and leaf litter (or weighing of fuel wood, fodder and leaf litter). Thus, the enforcement of property rights has six components, namely, specification of a) the membership fee, b) produce, c) day/date, d) time, e) quantity and f) weighing of products, to be distributed.

The monitoring of the implementation of the decisions refers to the methods of keeping the forests intact, controlling forest use behaviour of the users, and strengthening the relationship among the user members. The monitoring of implementation includes the following four aspects: a) use of forest guard / group patrol, b) application of punitive measures (or fines) against rule breakers, c) harvest of produce in group, and d) mobilisation of fund (in rupees) in village level activities.

The methodology of data collection and approach followed to develop the average index of the process of decision-making, enforcement of property rights and the monitoring of the implementation of the decisions are given in chapter V.

Further, this study focuses on the following additional analytical issues.

a) The educated executive members may be more worried about the improved livelihood of the members. They can educate the forest user members to withdraw forest products in such a way that the regeneration condition of the community forest is well maintained. Therefore, we intend to see whether there is a significant statistical relationship between the percentage of executive members educated at least with some primary education (any grade from the 1st to the 5th grade) and quantities of fuel wood, fodder, and leaf litter received by the user members from the CFUG.

b) Forest area may have a scale effect on the quantity of fuel wood withdrawn from a community forest, that is, the quantity of fuel wood withdrawn from the forest increases with an increase in the community forest area by a hectare. However, in this study we argue that CFUGs with a larger forest area supply a smaller quantity of fuel wood and litter. The possible reasons are as follows. First, the community forest area is generally categorised into 3-6 blocks. For example, Banskhark kha community forest has an area of 5.1 and it has 3 blocks consisting of 1.5 hectares, 2 hectares and 1.6 hectares. The vakundebesi community forest has an area of 23.25 hectares and it has 3 blocks consisting of 7.5 hectares, 8.5 hectares and 7.25 hectares. The CFUGs launch pruning of branch wood and thinning/singling of trees (henceforth referred to as cultural operation) in a block of the forest. The CFUGs supply fresh fuel wood and fresh sita (or remains of fresh fuel wood) therefrom once in a year. The executive committee members also told us that sometime they even harvest fresh fuel wood from a part of a block of the total community forest area. Therefore, out of the given area of a community forest, fresh fuel wood and sita are appropriated from a small area. Consequently, the CFUGs with larger forests may supply a smaller quantity of fuel wood. Second, the quantity of fresh fuel wood (including sita) withdrawn from a community forest may depend upon the density of trees. If the larger forests have poor density of tree, a smaller quantity of fuel wood may be harvested. The density of tree may depend on the quality of soil, slope of the forest, altitudes and weather conditions and measures (for example, weeding out of unwanted species and planting of trees in open space) adopted to improve the conditions of trees. Thus, growth and size of the trees and their branches may be influenced by these factors. For example, the trees and their branches may have poor growth thus supply less fuel wood because of the poor soils. Third, the numbers of times fresh fuel wood withdrawn from a particular block will determine the quantity of fuel wood. If the groups with larger forests launch cultural operation from a block of forest from which fuel wood was withdrawn earlier, then quantity of fuel wood withdrawn from that block would be smaller as compared to the total forest area. Further, the executive members instruct user households to prune one third of the tree branches. A supervisor from among the executive members or a knowledgeable person from among the general members is nominated to monitor the cultural operation in each group of household of fuel wood appropriators. A group consists of 15-25 households. Therefore, the group withdraws that part of the branches, which do not jeopardise the growth of tree. This can be referred to as the forward-looking strategy of the CFUGs to enhance regeneration of tree with a hope of getting more of the same in the future. Thus, the thesis is that CFUGs with a larger area of forest supply a smaller amount of fuel wood among the user members. Similarly, the supply of leaf litter depends on the branches of the standing trees. After pruning of branch wood of a block of forest, the leaf litter supply may reduce for a total forest area. Similarly, a large forest with poor density may produce a smaller quantity of litter. Therefore, we hypothesise that CFUGs with a larger area of forest supply a smaller amount of leaf litter among the user members.

c) Next, pruning of branch wood/thinning of trees does not hamper the growth of grass (of the forest floor). It means large community forest can produce a larger quantity of grass. Further, the user groups do not appropriate branch fuel wood from a small fodder tree. It means that a large community forests posses the potential of supplying a larger quantity of fodder. Thus, we intend to answer whether an increase in the community forest area increases supply of fodder from CFUG.

d) The Community Forest User Groups of the kabhrepalanchowk district own three types of forest: plantation forest of pines, natural forest of mixed species with plantation of pines (henceforth referred to as plantation plus natural forest) and natural forest of mixed species without plantation of pines (referred to as natural forest). Fodder trees and timber for agricultural implements are not available from the plantation of pines. The user members told us that pine timber is of softwood. Therefore, user members give less priority for using pine in house construction. The pinewood can be used for furniture. As agricultural implements require hard timber, pine can not be used for this purpose. Further, user members told us that the plantation forest makes the forest floor dry, thus drying up the water source. However, natural forests of mixed species contain fodder trees. They also contain timber of hard and softwood. Households use hard wood timber in house construction and in making agricultural implements. Similarly, user members told us that the natural forests do not make the forest floors dry and they protect water source. Therefore, natural forests have more uses (as fodder trees, timber for agriculture implements) and ecological benefits. Consequently, user members are conscious to protect the natural forest for the future. Thus, the thesis is that the Community Forest User Groups with natural forest distribute a smaller amount of fuel wood among the user members. Fodder and Leaf litter can be obtained throughout the year as plantation plus and natural forests contain mixed species of trees. However, leaf litter from plantation forest can be harvested from middle of March to middle of June, or, for 2 to 3 months. Therefore, the direction of the relationship is not clear a priori. We intend to investigate into two additional research questions in this context as follows. a) Whether there is a significant statistical relationship between the plantation plus natural forest and the quantities of fodder and leaf litter received by the user members from the CFUG. b) Whether there is a significant statistical relationship between the natural forest and the quantities of fodder and leaf litter received by the user members from the CFUG.

e) The households of Brahmin/Chhetri caste are more aware on matters relating to Community Forestry. If community forests are preserved, they conserve soils and control floods thus protecting natural system. Therefore, the thesis is that the caste Brahmin/Chhetri want to receive smaller quantities of fuel wood, fodder, leaf litter from the community forests.

f) A literate household head may be more worried about the livelihood of his family members in the current period. He may educate his family members to appropriate fuel wood, fodder and leaf litter from the community forest in such a way that the regeneration condition of the forest is not jeopardised. Therefore, we intend to see whether there is a significant statistical relationship between the literacy of the household head and the quantities of the fuel wood, fodder, and leaf litter received by the household from the CFUG.

g) The thesis is that the households are conscious to protect the forest for the future. However, the households may intend to receive more in the current period because of their larger requirements in certain circumstances. Therefore, we postulate two hypotheses as follows: a) user members with a larger family size plan to receive larger quantities of fuel wood, fodder and leaf litter from the community forest, and b) user members with a larger size of livestock in standard units intend to receive larger quantities of fuel wood, fodder and leaf litter from the community forest.

h) Households with more net income from crops may be more conscious to protect the forest for the future. They may own more land and trees. Therefore, they may receive larger quantities of fuel wood, fodder, and leaf litter from own farmlands, thus, want to receive smaller quantities of the same from the community forest. Therefore, the thesis is that a typical household with a high net income from crops receives smaller quantities of fuel wood, fodder, and leaf litter from the community forest.

i) For the user members, own farmlands are their private property. They can harvest fuel wood, fodder and leaf litter whenever they want. Since, community forest is a group property, households have to depend on the decision of the group to receive fuel wood, fodder, and leaf litter from the community forest. Therefore, we hypothesise that a typical household obtaining a larger amount of fuel wood, fodder, and leaf litter from its own farmlands receives a smaller amount of the same from the community forest.

j) There is no effective monitoring of the government forest in the hills. Households appropriate fuel wood, fodder and leaf litter depending upon their necessities and labour force in the family. Therefore, we postulate that a typical household receiving larger quantities of fuel wood, fodder and leaf litter from the government forest would want to receive smaller quantities of the same from the community forest.

1.6. APPROACH TO THE STUDY

The thesis is that CFUG makes political decisions for the withdrawal of produce in such a way that the future of the forest is taken care of well. The household's preferences for forest products for the current needs and protection of the forest for the future are reflected through the political decision-making process.

This study begins with the choice-theoretic problem of a typical household as its analytical framework or the point of departure. The typical household is in equilibrium if the following three conditions of the choice-theoretic problem hold well. First, the marginal rate of time preference between the current and future consumption of forest produce equals the marginal rate of transformation between the current and future forest produce from group activities. Second, the marginal rate of time preference between future consumption of forest produce and the current consumption of leisure time equals the marginal rate of transformation between future forest produce and current expenditure/application of labour in group activity. Third, the marginal rate of substitution between the current consumption of produce from alternative activities and future consumption of forest produce from group activity equals the marginal productivity of expenditure out of the produce from alternative activities on monitoring of forest use.

Following the implications of the choice-theoretic problem, this study develops three linear multiple regression models: for fuel wood, fodder, and leaf litter. Then, we select the 19 functioning CFUGs of the kabhrepalanchowk district. A CFUG distributing fuel wood among its members for the three fiscal years of 1996/97, 1997/98 and 1998/99 is defined as a functioning one. The study uses three years' average quantity of fuel wood, fodder and leaf litter (see chapter IV for the methodology of data collection and data processing). The three-year average is used to avoid the problem of fluctuation in the data of the quantities of fuel wood, fodder and leaf litter.

This study examines the usefulness of the use of leisure time of a typical household in the group activity in terms of the index of the process of decision-making, enforcement of property rights and monitoring of implementation. Furthermore, the study examines the implications of the typical household's time preference between the current and future consumption of forest produce or the future consciousness of the user members about the protection of the forest for the future.

Motivation for the Main Themes and Hypotheses

Some of the insights obtained from the field survey regarding the future consciousness of the user members about the protection of the community forest for the future are described below to provide a motivation for the main themes and hypotheses of the present study.

Protected service benefits of the community forest encourage forest users to be future conscious. For example, the members of the vakundebesi CFUG have planted bamboo saplings and constructed barricades in the community forest to safeguard the trees from landslides during rains. In response to our query where from they received the resource and why they constructed barricades the treasurer replied "we mobilised our members to create barricades so that our trees will be safeguarded from floods". In Thulopakha community forest (of plantation of pines), the users have planted saplings of mixed tree species. This forest is above the Tukucha village. The user members expect water to spring up after the trees grow up. The forest users told that spring water sources dry up in plantation forests. Similarly, the sanobanamaldol community forest caught fire some time before 8 years preceding the survey. The user members planted saplings of mixed species. The chief of the CFUG, told us that "we collected some of the saplings from District Forest Office and others from our forest, we mobilised user members to plant saplings and water the plantation". The forest had a very good regeneration.

The chief of the indresworthalpu ka CFUG told us that "we (or the downstream farmers) are getting water for irrigation and domestic use because of the protected community forest upstream. Availability of plenty of water from the protected community forest facilitated the cultivation of cash crops like potatoes, vegetables, thus improving the quality of life of the farmers. Therefore, we work effectively to protect the community forest for the future so that services of the protected forest are well maintained while providing the forest products for our current needs".

Next, the dependence on the forest products for livelihood is the prime motivator for getting involved in the group and protecting the community forest for the future. While we were attending the meetings of the executive (in vakundebesi) and the general body (in voltasethulipokhari), the members made the following remarks with regard to the critical role of the hill forest in people's livelihood: "The forests are intimately linked with our rural life. No fuel wood; no cooked food, no fodder; no milk hence no nutrition for our family members and no income for the day to day needs. There is no market in hills to purchase forest products. Even if products may be available in the market, we can not afford them. Therefore, we have to be very much careful to appropriate the forest products for our current needs. In case we appropriated more of the forest products in the current period, less may be available for the future. Consequently, we will have to face problems because of the shortages of forest products."

Commonality of the interests among the user members ensures the effectiveness of the CFUG, thus protecting the forest for the future. The executive members of the khawakoratmate panchkhal, VDC (Village Development Committee), told us that "great precaution should be taken to represent households with similar interests in forest products so that the forest can be effectively protected for the future." (A VDC is an electoral political unit at the local level, similar to Panchayat. It has nine wards. The ward is the smallest level of administration in Nepal and community in this study refers to households living within the defined boundary of the ward of a CFUG). For example, some of the households of ward 1 of the rabiopi VDC, who were not included in the khawakoratmate CFUG, misappropriated the forest products of the khawakoratmate community forest. Consequently, the executive members of this group organised discussion with the representatives of ward 1 of the rabiopi, VDC and compromised to represent only 34 households. The executive members of the khawaokoratmate told us that the members of Rabiopi are co-operating in the forest protection effectively at present.

Similarly, incorporation of some caste households serves as a mechanism for protecting the forest effectively. For example, the Magar households of bhagbate, who are non-members residing at a distance of 2-3 kilometres in bhagwate of phoolbari VDC frequently stole the trees of the vakundebesi community forest. The executive members of the vakundebesi CFUG organised meetings and included some households of Magar household residing in ward 7 of khanalthok VDC so that they can convince the Magar households who stole the trees not to do so. Consequently, the executive members of the Vakundebesi CFUG told that stealing of trees by the Magar households of bhagwate has stopped.

However, the alienation of some castes or forest dependants can hinder the forest protection of the CFUG. For example, the executive members of the dharapanikhareti told us that the forests are the traditional property of the Brahmin caste (that is, Satyal). Therefore, a majority of the members belong to this particular caste. However, the Magar households residing at the western and north-eastern boundaries of the forest are not included in this group. Consequently, the Magar households steal trees from the dharapanikhareti community forest.

Sincerity and commitment of the leaders or the executive members in making the CFUG effective in terms of providing forest products among the user members and protecting the forest for the future, ensures the effectiveness of the CFUG. Therefore, these characteristics of the leaders percolate enhancing the future consciousness among the user members. For example, the chief of the naubisegeruwapakha CFUG, who is also the forest guard, told us that he visits the forest at least three times (that is, some times early in the morning, mid day and evening) in a day. He told us that "he can detect even if a single back load of leaf litter is illegally harvested from the community forest." The effective monitoring keeps the forest away from its misuse by members as well as non-members. A discussion with the other members revealed that they have great respect for his sincerity and commitment to the tasks given.

Next, regular meetings of the user assembly and committee make interaction among the user members possible and in consequence they develop consciousness about the protection of the forest for the future. Lastly, the members commonly understand the rules. For example, to the query whether members can harvest tree fodder, the members of the sanobanamaldol and sanobandandal CFUGs replied that operational plan prohibits harvesting it. This common understanding of the rules ensures the effectiveness of the CFUG. The CFUG is effective in the formulation of its rules because the rules are transparent and commonly understood.

1.7. CURRENT STATUS OF RESEARCH IN COMMUNITY FORESTRY AND THE SIGNIFICANCE OF THIS STUDY

A number of cross sectional and case studies document rural people's knowledge and skills, about the forest control system, the forest use rules, the socio-economic characteristics of the rural people and the influence of institutional rules on the condition of the forest. Currently, the focus of research on Community Forestry has widened, involving the coverage of the institutional aspects and distribution of forest products (see chapter III). What has been missing in such research is the empirical analysis covering the influence of the CFUG's effectiveness and user members' future consciousness on the CFUG's performance in terms of the distribution of forest produce.

Edmonds (2002) compared the quantity of fuel wood collected before (without group) and after the hand over of the forest to the group, using the data from a sample of 1,200 households. Using user group dummy variable in OLS regression, he estimated the effect of CFUG on fuel wood collection. Without controlling for differences between areas with and without group he found that the households without groups, extracted a larger quantity of fuel wood by 14% than that of the households with groups. The limitation of his study is that he does not consider the indicators of management activism and its influence on the distribution of fuel wood. Thus, he concluded that government initiated Community Forestry institutions (or CFUG) are associated with a statistically significant reduction in resource extraction. However, the data used by Edmonds does not state the institutional mechanism that lowered the fuel wood extraction. Thus, he leaves unanswered the question as to why the forest user groups reduce the forest product collection. Our study fills in this gap.

In this study, we address the factors that hinder or foster the performance of CFUG in terms of the distribution of fuel wood, fodder, and leaf litter.

The choice-theoretic problem of this study implies that a low time preference of the user members for the consumption of forest produce in the current period contributes to the protection of the forest for the future.

Similarly, the investment of current labour input in group activity and real produce for the monitoring of forest use contribute to the protection of the forest for the future.

Further, this study determines the indicators of effectiveness of the CFUG management in terms of the index of the process of decision-making, enforcement of property rights and monitoring of implementation. Moreover, this study assesses the user members' consciousness about the protection of the forest for the future. Then, it assesses the relationship between the effectiveness of the CFUG and user members' future consciousness and the performance of CFUG in terms of the distribution of fuel wood, fodder, and leaf litter.

Thus, this study provides answers to the following three questions. What makes a CFUG an active institution? Why does a CFUG perform better with higher management activism? Why does the user members' high future consciousness make a CFUG perform better?

However, this thesis does not address the factors which make forest user members more or less future conscious about the protection of the forest over time.

To our knowledge, ours is the first study of its kind in community forestry, which investigates into the influence of the management activism of the group and user members' future consciousness on the distribution of fuel wood, fodder and leaf litter among the user members. *The central proposition of this thesis is that the social choices or the group actions, which are the decisions of the meetings, take care of the future of the community forest while deciding to withdraw forest produce for the current needs. There is no market for forest products in the hills. Therefore, household preferences are reflected in the social actions of the group.*

1.8. ORGANISATION OF THIS THESIS

This thesis has nine chapters and eight appendices. The organisation of the thesis is as follows.

Chapter II deals with the forest economy of Nepal. It has three sections. In the first section, we focus on Nepal's geography, agro-ecological divisions, economic situation and forest cover. In the second section, we present Nepal's population growth and its distribution, macroeconomic statistics of the demand and supply of forest products, available arable land per capita for the 14 countries including Nepal and growth of livestock population. The third section has three parts: the evolution of the forest policy of Nepal a) forest policy until 1975, b) forest policy from 1976 to 1992, and c) policy incentives (including economic, legal and institutional) for village people in Community Forestry.

Chapter III, which reviews the literature on the subject, has five sections. The first section deals with the attributes associated with the forest. Forest has a regeneration rate. If forests were used beyond their regeneration rate, it would cease to exist after some time. Forests have common pool resources characterised by excludability and subtractability. Excess withdrawal of forest products hampers the regeneration condition of the forest. Therefore, forest user members should judiciously use the community forest so that its regeneration condition is well maintained. In section two, this chapter describes the theoretical principles that motivate the forest users to be involved in a group. Similarity or commonality of interests among people motivates them to be involved in a group. In the literature pertaining to repeated game theory, we discuss that if interaction (with expected benefits for those who co-operate and punishments to those that shirk) perpetuates, participation will succeed. The theory of the CFUG is the extension of the economic theory of the state. In other words, if a group effectively co-ordinates its activities, it can succeed. Similarly, if leaders formulate and enforce rules effectively, CFUG will be able to protect the forest for the future while providing just enough products for the current needs. In the following section, dealing with the attributes associated with the user members, we describe the factors pertaining to the interdependence, heterogeneity, common understanding and group size that influence the working of Community Forestry and its performance. The next section following it deals with institutional aspects. We describe the characteristics of the common property resource institutions. Then, we describe the indicators of the effectiveness of CFUG. Similarly, we present the Oakerson's theoretical framework applicable to the study of the performance of natural resource management like community forestry. Further, we discuss the Ostrom's design principles that can be used to determine the institutional effectiveness of the natural resource management at the local level. In the last section, we present the findings of the community forestry related studies. The broad trends of community forestry related studies are as follows. Some studies deal with the institutional indicators of performance of community forestry. Others deal with forest product use patterns and their contribution to people's livelihood. The next category of studies deals with the influence of local forest management on the condition of the forest. However, there is a lack of a study showing the influence of CFUG's effectiveness and its members' future consciousness on the distribution of fuel wood, fodder and leaf litter among the user members.

Chapter IV deals with the methodology of this study, including the criteria adopted for the selection of the district, Community Forest User Groups, sample member households, methods used for data gathering, data editing, processing and analysis.

Chapter V focuses on the analytical framework or the choice-theoretic problem of this thesis. The choice problem of the typical hill household is to determine the simultaneous optimal choice of consumption of forest produce from group, labour input in the group and alternative activities and expenditure on monitoring of group forest over time. The next section of this chapter deals with the implications of the choice-theoretic problem of the study, principal hypotheses and additional hypothesis and analytical issues.

In **chapters VI, VII and VIII**, we examine whether the conclusions of the choice-theoretic problem and their implications are validated by the empirical results of the linear multiple regression models for fuel wood, fodder and leaf litter, respectively. The thesis concludes with the conclusions and their policy implications in **chapter IX**.

1.9. APPENDICES

This thesis has eight appendices as follows.

APPENDIX A

This appendix deals with the attributes associated with the institution or CFUG. It presents the roles and responsibilities of the user assembly and the executive committee, official positions of the members of the executive committee, and information about the index of the management activism of the CFUGs and its components. We also describe the leaders' or the executive committee members' education status in this appendix.

APPENDIX B

This appendix presents information about the average quantities of fuel wood for the fiscal years of 1996/1997, 1997/1998 and 1998/1999 received from CFUGs by member households (per child and adult member of the household). In addition, this appendix gives the average quantities of fuel wood obtained per child and adult member of the household from own farmlands, government, and secondary community forest. A table showing average weight of fresh fuel wood for the households of vakundebesi, banskhark ka, voltase and sallenibaguwa CFUGs is given at the end of this appendix.

APPENDIX C

This appendix presents the average quantities of fodder received from CFUGs by the member households per child and adult member of the household for the fiscal years of 1996/1997, 1997/1998 and 1998/1999. Next, the information about the average quantities of fodder received per child and adult member of the household from government forest, secondary community forest, and own farmlands is given in this appendix.

APPENDIX D

This appendix presents the average quantities of leaf litter received from CFUG by the member household per child and adult members of the respondent household for the fiscal years of 1996/1997, 1997/1998 and 1998/99. Similarly, the average quantity of leaf litter received per child and adult member of the household is given in this appendix.

APPENDIX E

This appendix deals with forest related attributes: forest area and types of community forest (plantation, plantation plus natural forest, and natural forest)

APPENDIX F

This appendix presents attributes associated with user members: future consciousness about the protection of the forest for the future, the caste and the literacy status of the household head, family size, average size of the livestock in standard units, average land owned by the household by land types, average crop production and yield by land types, net crop income, sex of the respondent household. A table presents the kilogram equivalents of *muri*.

APPENDIX G

This appendix presents the household interview schedule used to collect data for this study.

APPENDIX H

In this appendix, we present the checklist or discussion guidelines used to collect information from CFUG.

CHAPTER II

THE FOREST ECONOMY OF NEPAL

2.1 INTRODUCTION

This chapter is divided into three sections. The first section deals with general background information about Nepal's geography, agro-climatic divisions and economic situations and forest cover. The second section presents Nepal's population growth and its distribution, macroeconomic situation of the demand and supply of forest products, and growth of livestock population in Nepal that can influence the performance of CFUG. The available arable land per capita in 14 countries including Nepal is given in this section. The third section deals with evolution of forest policy in Nepal. In this section, first we describe in brief the historical trend of forestry policy in three parts, that is, before 1951, forest policy after 1951 to till 1975, Community Forestry Policy from 1976 to 1992. Then, we discuss the features of Community Forestry Policy that encourage households to be involved in Community Forestry and perform better. The conclusions drawn from the review of the forest economy of Nepal are given at the end of this chapter.

2.2 GENERAL BACKGROUND INFORMATION OF NEPAL

Geography, Agro-climatic Divisions and Economic Situations

Nepal, a landlocked Hindu kingdom, located along the southern slopes of the Himalayas between the arid Tibetan plateau of China in the north and fertile Gangetic plain of India in the south, is one of the smallest nations (0.03 percent of the Asian continental landmass, ADB/ICIMOD 1992). Its nearest coastline is the Bay of Bengal (with a distance of 1,127 km from southern border). The country has an elongated rectangular shape of roughly north-east to south-east orientation and an area of 147, 181 square kilometres. It is situated in the subtropical zone and lies between the longitudes 80^0 4' east to 88^0 12' east (with the east west length of 885 kilometres and mean width in the North-South of 193 km). Nepal has the greatest variation in altitude on earth, which ranges from 60 metres average height from sea level to 8,848-metres average height from sea level (m. a. s. l.).

Ecologically, the country is divided into three major regions: terai, hills and mountains. The terai region (60 m. a. s. l. to 300 m. a. s. l), a low east-west most fertile flat land, comprises 26% of the total land area of the country, where 48.4% of the people reside. This region is comprised of the most fertile agricultural land (that is, 65% of the total cultivated land in the region, HMGN 1997) with the alluvial soil deposits, which produces almost 60% of the total food grains of the country. The entire major rivers from north to south traverse from terai toward south and a large number of small rivers provide irrigation in dry seasons. Large-scale settlement in most part of the terai is a recent phenomenon that gained momentum after malaria came under control in the late 1950s.

The central hills located between terai (in the south) and Himalayas (in the north) cover almost 39% of the total land area of the country (HMGN 1997). Approximately, 27% of the land area of this region is cultivated. This region with elevations ranging from 310 metres to 3,000 metres is a complex of low-lying hills and rivers (principal rivers as Koshi, Gandaki, and Kkarnali) and tectonic valleys, and has sub-tropical to cold temperate climate. The maize of valleys and spurs (or tableland or tars) has been the traditional habitat and is extensively cultivated. The hill provides shelter to the 44. 3% of the total population. The rapid rise in population, the dwindling base of land resources and the consequent problems of ecological dislocation has been the most conspicuous feature of the hill region in recent decades (ADB/ICIMOD 1992).

The mountain region (the main Himalayas, the Trans-Himalayan valleys and Tibetan marginal mountains) occupying about 35% of the total land area of the country has more than 200 peaks exceeding 6,000 metres along with the world's highest mountain, the Mount Everest. In the mountain region, only 3% of the total land are arable. 7.3% of the total population reside in the mountain region (2002 c).

Nepal is predominantly a country of villages (about 28, 000, ADB/ICIMOD 1992). It has five development regions (that is, Far Western, Mid Western, Western, Central and Eastern Development Region), 14 zones and 75 districts. It has 3,915 Village Development Committees (that is, a Village Development Committee is a political unit at the local level and it has nine wards. The ward is the lowest level of administration in Nepal) and 58 municipalities, which are the lowest local level political units of the country. However, not all of the municipalities are necessarily urban in nature.

A bulk of the Nepal's population (that is, 85.8% of 23.1 million) lives in the rural areas. Approximately, 44% of the total population of the age group of 10 years and above is economically active (9.9 million). Two thirds of this economically active population has occupations related to agriculture and forestry. Poverty is pervasive in rural areas. About 68 to 74% of the rural population fall below poverty line (World Bank/UNDP 1991a). The per capita national income of about US $ 246 per annum puts Nepal among the lists of the poorest countries in the world (HMGN 2002a).

Forest cover of Nepal

Table 2.1 shows that forest (29%) and shrub (10.6%) cover 39.6% of the total area of Nepal (that is, 147,181 sq. kms). Forests (35.2%) and shrub (13.5%) in the Far Western Development Region cover about 48.7% of the total land area of the region. Whereas about 42% of the total land of Central Development Region (CDR) is under forest (33.5%) and shrub (8.5%). Table 2.1 shows the forest and shrub area by development region of Nepal.

Table 2.1
Forest and Shrub Area by Development Region (000 hectares)

Region	Total land area		Forest		Shrub		Total forest and Shrub	
	Area	%	Area	%	Area	%	Area	%
FWDR	1953.9	13.3	687.4	35.2	263.9	13.5	951.3	48.7
MWDR	4237.8	28.8	1192.4	28.2	442.0	10.4	1634.4	38.6
WDR	2939.8	20.0	734.3	25.0	256.9	8.7	991.2	33.7
CDR	2741.0	18.6	918.6	33.5	233.8	8.5	1152.4	42.0
EDR	2845.6	19.3	736.1	25.9	362.6	12.7	1098.7	38.6
Total	14718.1	100	4268.8	29.0	1559.2	10.6	5828.0	39.6

Source: HMGN (1999 b).
Note: FWDR = Far Western Development Region, MWDR = Mid Western Development Region, WDR = Western Development Region, CDR = Central Development Region, EDR = Eastern Development Region.

The annual rate of deforestation was about 1.7% during 1978/79 to 1994. In the hills, this rate was about 2.3% while in the terai, 1.3% per annum.

As Nepal is situated in the subtropical zone, this location is favourable for the growth of various types of plants, and has rich supply of precipitation during the monsoons (Martens Jochen 1983). The major tree species of Nepal are hardwoods (53%), conifers-hardwoods mixed forests (22%), conifers (14%) and others (11%). Table 2.2 presents the percentage of major tree species types of Nepal.

Table 2.2
Percentage of the Major Tree Species Types of Nepal

Species type	Main species	%
Conifers	Blue pine, Chir pine, Fir, Hemlock	14
Hardwoods	Birch, Sal, Khair, Sisso, Tropical and Deciduous mixed hardwoods	53
Conifers-Hardwoods mixed forests	Bluepine-deciduous mixed, Chirpine-sal mixed, Fir-birth mixed, Hemlock deciduous mixed	22
Others	Shrub and Plantations	11

Source: The Master Plan for the Forestry Sector (HMGN 1988:11)

As Nepal has the greatest variation in altitude on earth, it has great variation in climate, vegetation and forest types. Table 2.3 shows the altitude, climate and forest types in Nepal.

Table 2.3
Altitude, Climate and Forest Types in Nepal

Altitude (in metre), Climate and Forest Types
Alpine Scrub
Temperate and alpine conifer forest
4 000 Sub-alpine
3 600 Birch and blue pine
3 300 Fir, spruce, cypress
Lower and upper temperature mixed broad-leaved forest
Temperate and alpine broad-leaved forest
3 000 Cool temperate
2 700 Oak dominant
2 400 Oak
Sub-tropical and semi-evergreen hill forest
2 100 Warm temperate
1 800 Oak, Rhododendron
1 500 Chir pine in abundance
Sub-tropical deciduous hill forest
1 200 Sub-tropical
900 Chilaune
500 Sal and associates
Sisso-Khair forest
Tropical and sub-tropical Sal forest

Source: Adapted from Stainton (1972)

2.3 POPULATION GROWTH AND ITS DISTRIBUTION IN NEPAL

One of the factors that contribute to increasing demand for forest products is the growth rate of population. Therefore, we present the macro level trend of growth of population, and its distribution in Nepal.

Nepal's density of population is 157 persons per square kilometre (HMGN 2002c). The census of 1952/54 recorded a total population of 8.3 million. It increased to 23.1 million by 2001. In terms of growth rate of population, it remained above 2 percent per annum from 1952/54 to 2001, except in the census of 1961(which recorded a growth rate of 1.65 percent per annum during 1952/54-1961). According to His Majesty Government of Nepal, Central Bureau of Statistics (HMGN 1995c), Nepal's population will increase two fold in a little over thirty years if this trend continues. Table 2.4 demonstrates Nepal's population size, its growth rate and regional distribution.

Table 2.4

Population Size, its Growth Rate and Regional Distribution of Population

Census	Population	Growth Rate	Density	% of population		
Year	Million		Per Sq. Km.	Mountain	Hill	Terai
1952/54	8.3	2.3	56.1			
1961	9.4	1.65	64			
1971	11.6	2.07	78.5	9.9	52.5	37.6
1981	15	2.66	102.1	8.7	47.7	43.6
1991	18.5	2.1	125.6	7.8	45.5	53.3
2001	23.1	2.2	157	7.3	44.3	48.4

Source: HMGN (2002c).

The above table 2.4 shows that 44.3 % of the populations live in the hills, 48.4% in Terai and 7.3% in mountains.

2.4. SITUATION OF THE DEMAND AND SUPPLY OF FOREST PRODUCTS AT NATIONAL LEVEL

The Master Plan for the Forestry Sector (HMGN 1989) projects the demand and supply of the forest products for the 25 years starting form 1985/86 to 2010/11. The plan estimates a deficit of supply over demand of timber, fuel wood, and fodder over the 25 years. The plan suggests that there will be shortages of these products if any further program is not initiated for the effective protection and management of the forest.

The demand for timber exceeds its supply. For example, the Master Plan estimates a shortage of supply of timber compared with demand by 0.2 million cubic metres for 1985/86, 0.5 million cubic metres for 1990-91, 1.1 million cubic metres for each 2000-01 and 2010/11, respectively.

The per capita fuel wood consumption in hills is 640 kilograms per annum, while the projected sustainable yield of fuel wood per capita from the forest is about 479 kilograms per annum (HMGN 1988). Thus, there is a shortage of supply of fuel wood by about 25% per annum per capita, that is, a deficit of 161 kgs of fuel wood per annum per capita. The Master Plan projects that the deficit of fuel wood supply is 2.1

million tonnes in 1985/86. This fuel wood deficit will grow by 2.9 million tonnes in 1990/91 and 3.1 million tonnes each in 2000/01 and 2010/11 respectively. In Terai and Middle Mountains, where more than 90% of the people live, the deficit of fuel wood will grow from 2.6 million in tonnes in 1985/86 to 3.5 million tonnes by the year 2000. Subedi (1995) based on the data from the Master Plan, estimates the shortage of fuel wood will be even more critical in seven hill districts including Kabhrepalanchowk where the deficit of fuel wood will be more than two persons /hectare.

According to the Master Plan, there will be a surplus of total digestible nutrients in fodder supply, from 1985/86 to 2000/01. However, the plan estimates that there will be a shortage of total digestible nutrients in fodder by 0.2 million tonnes in 2010-11. The deficit in total digestible nutrition in fodder will rise from 2,40,000 tonnes (in 1985/86) to 6,10,000 tonnes in 2,000 (Bhatta 1992). An examination of the fodder supply situation (Subedi 1995) reveals that 63 percent of the 75 districts will face a shortage of fodder. Furthermore, 29 out of the 39 hill districts including Kabhrepalanchowk will have a shortage of fodder. The projected supply and demand of fuel wood, timber and fodder is given in table 2.5.

Table 2.5

Projected Supply and Demand without the Master Plan and Most Critical Forest Areas Likely to be degraded under the Present Trends

Item	S/D/B	1985-86	1990-91	2000-01	10-11	Most Critical Areas
Fuel wood (million tones)	Supply	9.2	9.7	12.1	12.1	All of the Terai, Mid-Western And Eastern Siwaliks
	Demand	11.3	12.6	15.2	15.2	
	Balance	-2.1	-2.9	-3.1	-3.1	
Timber (million cubic metres)	Supply	0.9	1	1.4	2.2	All of the Terai, Siwaliks and Middle Mountains and western Himalayas
	Demand	1.1	1.5	2.5	3.3	
	Balance	-0.2	-0.5	-1.1	-1.1	
Fodder (million tones)	Supply	6.6	6.7	7.4	8.3	Central, Far-Western, and Mid-Western Terai, Central and Mid-Western Siwaliks and all of the Middle Mountains, except Eastern region
	Demand	6.1	6.4	7.2	8.5	
	Balance	0.5	0.3	0.2	-0.2	
Degraded area*		25.9	158.8	741.3	1464.6	

Source: Master Plan for the Forestry Sector, Nepal, Revised Forestry Sector Policy (HMGN 1989)
*Forest area that will be degraded to meet deficits (in '000' hectares counting from 1985).

The implication of the deficits of timber, fuel wood and fodder, is that the effective forest management and governance is not sufficient through the efforts of the government alone. Therefore, the Master Plan for the Forestry Sector suggested to hand over the forest to user groups so that they can effectively protect the forest while sharing forest products for their current needs.

One of the possible solutions to meet the growing demand for timber, fuel wood and fodder is to depend on own farmland. However, farmers in Nepal, including many other countries, own less than 0.15 acre of per capita land each (table 2.6). Thus, there is a challenge to meet the growing demand for forest products for basic needs and maintaining forest for the environmental services (for example, safeguarding the hills from landslides, control of soil erosion and protection of water source). According to World Resources (WRI 2000-2001), an average person requires one cubic metre of wood products per year. In addition, if the wood demand doubles in the next 50 years the effects could be catastrophic.

2.5 DISTRIBUTION OF THE AVAILABLE ARABLE LAND PER CAPITA

People depend on common pool forest if they own very little land. According to World Health Organisation (1997), arable land per capita was less than 0.15 acre in 1990 and is expected to be less than 0.08 hectare in 2025 in 14 countries of the world, including Nepal (table 2.6). However, an area of about 0.25 square kilometre is required at present to sustain each human life, and it may be so in 2025. The rich countries may supplement their food resources with imports, but poorer countries may not be able to afford the imports to feed their hungry populations. Table 2.6 shows the per capita arable land in 1990 and 2025 in the 14 countries of the world.

Table 2.6
Available Arable Land Per capita in 1990 and 2025 for the Selected 14 Countries

Countries	1990	2025
Japan	0.04	0.04
Egypt	0.05	0.03
China	0.08	0.06
Bangladesh	0.09	0.06
Israel	0.09	0.06
Vietnam	0.1	0.05
Kenya	0.01	0.04
Somalia	0.12	0.05
Tanzania	0.13	0.05
Nepal	0.14	0.07
Haiti	0.14	0.07
Yemen	0.14	0.05
Jordan	0.14	0.05
Saudi Arabia	0.15	0.06

Source: Adapted from WHO (1997).

The above table 2.6 depicts that the per capita available arable land in Nepal is 0.14 in 1990 and it is expected to decline to 0.07 in 2025. The implication is that farmers may have to depend on common-pool forest resources for their subsistence when they own so little land on the average.

2.6 GROWTH OF LIVESTOCK POPULATION OF NEPAL

Livestock keeping is one of the livelihood strategies of the hill farmers. The growth of animal population raises demand for forestland for grazing, fuel wood (for cooking feed, Metz 1989, and Bajracharya 1983a), fodder (for feed, Chakraborty eds. 1997) and leaf litter (for bedding, The University of Reading 2001 and Mahat 1985). Thus, hill farmers join in group to get produce for livestock. This thesis empirically finds that increase in the size of the livestock in standard units is associated with an increase in fuel wood, fodder and leaf litter appropriated from the community forest for the current needs (see chapters VI, VII and VIII).

The Master Plan for the Forestry Sector (HMGN 1988) states that the forest alone contributes to the extent of 37 percent of the total animal feed for livestock.

According to the World Resources (2000-2001), animal numbers have increased to satisfy the growing demand of meat by neighbouring towns and this trend has caused decline in natural forest because of grazing, and overexploitation. Table 2.7 demonstrates the trend of growth of livestock population (that is, cattle, buffalo, goat, sheep and chauri) in Nepal.

Table 2.7
Population of Livestock (in Numbers), Their Percentage Change and Annual Growth Rate in Nepal

Livestock type	Year		% change	Annual growth Rate
	1981/82	1991/92		
Cattle	6501.6	7359.3	13	1.3
Buffalo	2379.7	3116.3	31	3.1
Goat	3643.7	5515.5	51	5.1
Sheep	677.1	602.8	-11	-1.1
Chauri	55.5	58.6	6	0.6

Source: HMGN (2002c).

The above table demonstrates that the population of goat recorded the highest growth per annum (that is, 5.1 percent) during 1981/82 to 1991/1992. The growth rate of chauri (that is, 0.6 percent) was recorded to be less than unity per annum, while the growth rate of population of buffalo (3.1 percent) exceeded unity and cattle (1.3 percent) was a little more than one percent.

2.7 DEVELOPMENT OF FOREST POLICY IN NEPAL

Forest Policy before 1951

Before 1951, Nepal remained under Gorkha (1768-1846) and rana (1846-1950) rule (Regmi 1971). Land and its products were the principal economic sources during these periods. Therefore, the government adopted a policy of encouraging individuals to convert forestland into agricultural land as a measure of increasing revenue through taxation on converted land (Chapagain, Kanel, and Regmi 1999, and Regmi 1976). Any individual who cleared forestland for cultivation was exempted from taxation for a period of three years (Mahat, Griffin, and Shepherd 1986a, Mahat 1985). Though the state owned the forestland, the property rights and formal institutions to enforce these rights existed only in respect of agricultural land. There was no separate policy for the management of forest. Forests remained under "near open" access (Chapagain, Kanel, and Regmi 1999, and Regmi 1976). However, the hill people managed forests under traditional system. Under this system, village communities controlled access to and use of forest through informal rules (Fisher 1991).

In terai, export trade of timber (particularly of shorea robusta) was promoted for government revenue (Bajracharya 1983b and Regmi 1971). Thus, the "frontier" policy or revenue oriented policy of land use resulted in heavy deforestation in hills as well as in terai (Regmi 1971).

Forest Policy after 1951 to till 1975

Active involvement of His Majesty's Government of Nepal in natural resource management began after the overthrow of rana oligarchy in 1951. The country assumed constitutional monarchy and parliamentary democracy in 1955. In 1956, the government introduced its centralised five-year development plan (1956-61). The five-year development plans, from the first till the fifth (1975-80), emphasised the conservation and the management of forest and proper utilisation of forest products. The plans also aimed at making forest products available among the public and supplying raw materials for industries to attain socio-economic development of the country. Similarly, the priorities were given to strengthening the organisational base of the government forestry administration, to enable the forest staff to protect and develop the forest, and supply the forest products in adequate quantities effectively.

In 1957, Private Forest Nationalisation Act was instituted to enable the central level organisation to exercise control over the forests. All the private forests and village controlled forests were transferred to government ownership on the enactment of this act. This act was introduced to reduce the inequalities in private land ownership, for forest revenue for the government, and to resettle the migrants of the hills (Chapagain, Kanel, and Regmi 1999). In 1961 and 1967, the government introduced Forest Act and Forest Protection Special Arrangement Act, respectively. These acts defined the clauses of penalties against the misuse of the government forest, and strengthened the Forest Department's role in the monitoring of forest use and distribution of forest products among the public. However, these initiations disrupted the centuries of old traditional pattern of resource control and political rights (Bromley and Chapagain 1984). Villagers ceased to apply any traditional rules for the forest management and community responsibility for the forest protection disappeared. People misunderstood the acts to mean that the government removed the rights of access and use of forests. Consequently, there was widespread felling of timber and forests were heavily exploited (Bajracharya 1983a, 1983b and 1981).

Thus, Nepal's forests, once characterised by the proverb "Hariyo Ban Nepal Ko Dhan" (Green forests are the Nepal's wealth, HMGN 1976) were depleted both in quantity and quality at an alarming rate. However, very little attention was given to the distribution of forest product among the local people (Kashio 1999). Some other authors document that difficult terrain and insufficient staff and budget made it almost impossible for the government to achieve its objectives of protecting forests and distributing forest products among the public (Grgerson, Draper, and Elz, eds. 1989, Arnold and Campbell 1986, Bromley and Chapagain 1984). People illegally collected forest produce for their livelihood. Rural people had no option, other than to use the forest illegally.

Centralised management of natural resources was adopted because of the following two reasons. First, it was believed that foresters know better and local ignorant people needed to be mobilised and ordered. A statement suggested by Blair and Olpadwala (1988), namely, 'those who are to do work should be consulted and what they want, should not be considered' was popular in those days. The development experts believed that the people need to be educated and ordered.

Second, forest resource generates a number of common-pool goods. Common-pool goods can share with private goods in terms of the characteristics of subtractability (for example, timber, fuel wood, and fodder) and with public goods in terms of the characteristics of non-excludability (Gibson, Mckean, and Ostrom eds. 2000) (see chapter III). Harvest of fuel wood or timber by households reduces the availability of the same for the others and thus forest goods are characterised by subtractability. Overuse of the forest results in its deforestation. Deforestation in upstream causes soil erosion, loss of biodiversity, loss of habitat for wildlife and increases water run-off resulting in sedimentation in the downstream agricultural land (Jodha, Banskota, and Partap, eds. 1992, Ives and Messerli 1989, Blaikie 1988, Ives 1987). Similarly, the use of community forest for fuel wood, fodder and leaf litter is a local public good because it is difficult to put value on such products in the hills (Price 1990). The subsistence of hill people depends on forest goods (like fuel wood, fodder and leaf litter, Mahat 1987)) and they can not be excluded from the use of forest (see chapter III). The need of external authority or the government administration was felt necessary to protect the forests from degradation during 1960s and 1970s (Bromley and Cernea 1989).

In principle, the forest degradation problem can be solved with the specification of property rights. Property rights to forest specify who is allowed to use the forest, to which extent and for which purpose (Bromley 1989, and Hollowell 1943). Demsetz (1967) argued that private property rights ensures sustainable use of natural resource.

However, the World Bank (1992) and Arnold (1992b) mention that private property rights undermine the needs of subsistence people for forest produce. Others argue that the state can protect natural resources effectively (Bromley and Cernea 1989, Ciriacy-Wantrup and Bishop 1975, Ophuls 1973 and Hardin 1968), and thus, can supply the products to the needy.

As mentioned above, the government's forest department was not able to protect the forest effectively and supply forest products among the public because of insufficient budget and staff. Therefore, in recent decades (since 1970s), there is a change in policy from centralised management of forest to decentralised management and then devolution. The following five reasons enabled the government to take policy action to foster Community Forestry in Nepal.

First, the development experts in Nepal highlighted fuel wood use pattern and its influence on deforestation and its allied problems of soil erosion and flood control within the country. For example, the Energy Research and Development Group (ERDG 1976) estimated that the per capita annual consumption of fuel wood in the hills was 640 kilograms while the per capita fuel wood available is only about 83.3 kilograms. Thus, this author projected 556.7 kilograms of fuel wood deficit per annum per person in the hills. The per capita annual consumption of fuel wood in terai is about 380 kilograms but the estimated per capita annual yield of fuel wood in terai is 72.1 kilograms. Thus, the deficit of per capita availability of fuel wood in terai is 307.9 kilogram. Overall, the per capita fuel wood deficit per annum is 432 kilograms in Nepal. The estimated fuel wood yield is only 3.51 cubic feet or 77.7 kilograms per capita per annum.

Therefore, the ERDG concludes that "the deficit of consumption over yields is seen to be highest in the hills; and since the hill population is nearly 60% of total population, the resulting rates of forest clearing is alarming. The ERDG projects that all the commercial forest (that is, 12% of the total forest area) will be used within 12-14 years at the present rate of fuel wood consumption. Nepal's forest area declined by nearly one half from 6.4 to 3.8 million hectares in the last 20 years. Furthermore, the growing stock reduced by 2% per annum. The World Bank (1978b) estimated that at the presumed rate of deforestation in the hills, the hill areas of Nepal would be totally deforested within 15 years (that is, by 1993).

However, the debates whether forest cover declined in hills are still not settled. For example, some authors argue (Ives and Messerli 1989) that the grim prediction of earlier analysis was untrue. They argued that forest density declined but forests were not totally tree-less. Some other authors argue that (Jackson, eds. 1998, Fox 1993, Metz 1989, Mahat 1985, and Bajracharya 1981 and 1983a) the starting of deforestation in Nepal dates back to 80 to 100 years ago because of the tax policies of the government, which encouraged conversion of forestland into agriculture (Regmi 1971). Tree density declined because of the heavy pressure for fuel wood and fodder during the past 40 years. Thus, deforestation is not a recent phenomenon in Nepal. Some authors (Fisher 1989, and Messerschmidt 1986) document that the forest area is in a better condition in terms of height and amount of regeneration than they were in the past. Others document that tree cover in private land has been expanding (Gilmour and Nurse 1991, Gilmour 1990, and Carter and Gilmour 1989).

The first Task Force on Land Use and Erosion Control of the National Planning Commission brought out its report in 1974 (HMGN 1974). This draft report assessed the problems of deforestation, soil erosion and landslides. According to this report, "the basic problem of land use is the excessive pressure of population on land resources, which has led on the one hand to devastation of forest resources, subdivision of agricultural holdings below economically viable limits, while leading, on the other hand, to accelerating soil erosion and declining soil fertility and productivity. There is now an apparent shortage of agricultural land." The scarcity of usable land and the simultaneous deterioration of land resources meant that a more "conservation oriented land use pattern" was considered appropriate. Though the fifth five year plan (1975-80) stressed on the need to control deforestation, soil erosion and land slides, it did not give due recognition to peoples' involvement (HMGN 1976).

Second, the Eco-doom reports by Eckholm (1975) and the World Bank (1978a and 1978b) popularised the effects of deforestation on the fuel wood economy (with the possibility of an alarming fuel wood shortage) and on hill natural system at the international level. According to Eckholm (1975), the consequences of fuel wood shortages is not limited to economic burden on the people of the particular locality. He mentions that "accelerating degradation of woodlands throughout Africa, Asia and Latin America caused by fuel wood gathering causes profound challenges to environmental stability and land productivity causing accelerated soil erosion, increasingly severe flooding, creeping deserts, and decline in soil fertility".

The demand for fuel wood, fodder and animal bedding was so much greater than the capacity of the forest to produce the products that 25% of the area of the hill forest had disappeared in a decade and that the rest would go in 15 years unless something was done to balance the supply and demand (HMGN 1980). Furthermore, one-half of all erosion was man-made, much linked to the degradation of pastures and forested land. A huge area needed to reforest rapidly but the State Forest Service was ill constructed in all respects for this task.

Third, the international agencies like the World Bank (1975) and International Labour Organisation (1980) prioritised fulfilling the basic needs of rural people as a strategy of rural development. Thus, the development experts emphasised participation of rural people in natural resource management to sustain their livelihood (Korten 1994, Cernea 1992, Seddon 1987 and Eckholm 1976b).

Fourth, the development thinkers suggested designing a programme in such a way that it would enable people to participate effectively. In other words, the people whose livelihood depended on their immediate natural resources should be able to manage and govern the resources by themselves and thus determine their development. Therefore, the need for change in development thinking from below was emphasised (Chambers 1994, Jodha, Banskota, and Partap, eds. 1992, Hough and Norbu 1989, and Korten 1984).

Fifth, the Bromley eds. (1992b) and National Academy of Science & NRC (1985) demonstrated empirically that the traditional societies possessed indigenous knowledge and skills to manage natural resources effectively so that they were able to protect natural resources. For example, Berkes (1992) defines success of the commons in terms of the avoidance of resource depletion and degradation through over-consumption over a long time. One can argue that demands were fewer too. Consequently, the traditional societies extracted natural resources in a way so that they were able to protect the resource stock for the future (Mckean 1992b, and Messerschmidt 1986). However, there is a lack of literature showing the influence of the effectiveness of the local resource management and resource users' future consciousness on the distribution of forest produce among user members.

Community Forestry Policy in Nepal (from 1976 to till 1992)

The government had neither the technical capability nor the manpower to manage the forests on a wider scale especially in the hills. The government staff were low paid. Thus, there was a problem of incentives for the government staff to work effectively. By 1970, it was therefore apparent that forestry department would never be able to fulfil the task of managing the forests and that the involvement of community in production, management and distribution of forest products was indispensable. Therefore, the government revised its forest policy, encouraging involvement of village people in forest management and governance. Thus, the government took initiatives to revise its centralised forest management and governance to a decentralised one in the 1970s.

In 1976, the government introduced the National Forest Plan and accorded top priority to forestry development for local use in hills (HMG 1976). This plan recommended that joint co-operation between Forest Department and people was essential to protect the forest, and to initiate plantation in barren lands to produce fodder, firewood, leaf litter and timber for the village people. Priority to forestry development for local use in hills was given because of the following three reasons. First, two thirds of the population lived in the hills and mountains. Second, the pressure on forest and on fuel wood and fodder in particular had tremendously increased during the previous 15-20 years. Third, investments in forestry have been overwhelmingly confined to terai (World Bank 1980).

The intention of the plan was translated into a legal document with an amendment of the Forest Act of 1961 in 1977. This act aimed at handing over of forests to Panchayats through the Schemes of Panchayat Forest (PF) and Panchayat Protected Forest (PPF). An area up to 125 hectares of without trees or shrub land of the government shall be maintained in the area prescribed by HMG for developing through reforestation and such area is called PF. An area up to 500 hectares shall be established in the area prescribed by HMG for the protection and proper management of the government forest or any part thereof and such area is called PPF. These rules decentralised the right to control and management of forest to the panchayat together with the access to and use of forest by people through Panchayat. Thus, Community Forestry was implemented in 1978. The original area limits were lifted in 1988.

The sixth five year plan (1980-85) accorded top-most priority to fulfilling needs of forest products. This plan recognised that protection and development of forests, scattered all over the kingdom, is neither possible nor even practical through government efforts alone. Panchayats were given the major tasks of planting seedlings and enhancing the regenerative capacity of the forest. However, the Panchayat administration could not stimulate the interest of the villagers for effective participation for the protection and distribution of forest products among themselves.

According to the World Bank (1992), panchayats 'gave the villages the most degraded lands, which required high investments for reforestation and offered only delayed benefits'. Such an outcome is not surprising because panchayats are 'large administrative units with little previous involvement in forestry (World Bank, 1992). Colchester (1994) mentions that the programs have not been without problems because the panchayat is too large a unit and too far removed from day-to-day decisions, to effectively supervise and manage the local forests. These efforts did not encourage people's effective participation in the protection of the forest. Rather, one of the studies indicated that Community Forestry under the Panchayat Forest (PF) or Panchayat Protected Forest (PPF) Scheme is imposed from the government. For example, out of the 419 chairpersons in Dolakha district, most members did not know what they were expected to do if they were in the forest committee (Britt 2002).

Thus, the early approach of decentralisation in Community Forestry ignored the social and political problems associated with forest access and property rights (Hobley 1996). Consequently, His Majesty's Government of Nepal instituted the decentralisation act (Decentralisation Act 1982) and its byelaws (Decentralisation byelaws 1984). These initiatives empowered village panchayats to form consumers' committee to use any specific forest area for afforestation, and for forest conservation and management of forest on a sustained basis (Regmi 1984). Thus, as per the motto of decentralisation act and its byelaws, forest legislation of 1978 was amended in 1987 and thereof the concept of consumers' committee was introduced.

In 1988, His Majesty's Government of Nepal introduced the Master Plan for the Forestry Sector. This plan summarises the condition of forest as follows. "Nepal's forests are declining in both quantity and quality, over the last two decades more than half a million hectares have been lost. The remaining accessible forests have been degraded so that they now consist of mostly mature and over mature stands with poor prospects of regeneration (HMGN 1988)". It recognised that a comprehensive program embracing legislative and policy measures that encourage forest user group for the protection, development, and sustainable use of forests is required. The Master Plan for the Forestry Sector accorded top priority to the promotion of Community Forestry and suggested spending approximately 46.6% of the annual budget in Community and Private Forestry.

The revised forestry sector policy of the master plan states that forests near villages will be managed with the people's participation (HMGN 1989). The master plan suggested a) handing over of all the accessible hill forest to communities for their continuous use entrusting forest protection and management to actual users, c) providing all of the incomes to the users' group with an obligation to spend a bulk of it on forest improvement and development. d) emphasising on an extension approach to disseminate information on forestry development program and the rights and responsibilities of the people in regard to the use of forest resources and e) formulation of simple management agreements or plans along with its periodic improvement emphasising socio-economically viable arrangements.

Incentives for Forest User Members in Community Forestry

In this study, we argue that Community Forestry related a) economic, b) legal and c) institutional provisions provide incentives to foster the Community Forest User Group, thus encouraging households to perform better. We view that CFUG performs better if households receive a smaller amount of fuel wood, fodder, leaf litter in the current period so as to preserve more fuel wood, fodder and leaf litter for a better regeneration of the forest in the future. Policy provisions are considered to be exogenous in this study.

His Majesty's Government of Nepal, after the establishment of multi-party democracy in 1990, adopted more liberalised approach for the overall development of the country (HMG 1990). Accordingly, the government introduced the New Forest Act in 1993 and its byelaws in 1995. The Forest Act and its byelaws provide economic, legal and institutional incentives for village people to be involved in the Community Forestry and work for protecting forest effectively while providing forest products for the current needs. Similarly, the ninth five-year plan (1997-2002) aims at involving people for the protection of the forest and for meeting people's current needs for basic forest products.

Community Forestry Related Objectives in Nepal

Forestry is a part of a larger problem of rural development (Arnold 1998b and 1992b, Gregerson, Draper, and Elz 1989 and FAO 1978). Therefore, it is essential that forestry, agriculture, livestock and human livelihoods should be integrated in rural forestry (Arnold and Dewees, eds. 1995). For example, the ninth five year development plan (HMGN 1997a) adopts that the rural development efforts should be based on the status quo of natural environment (that is, including geography and biological diversities and the opportunities created by such environment of the country).

The Master Plan for the Forestry Sector (HMGN 1988) integrates agriculture, irrigation, and forestry to increase village people's income, reduce poverty, and achieve sustained economic growth. The Master Plan for the Forestry Sector defines the following four development imperatives for the long-term political, social, economic, and ecological or sustainable development of the country. They are a) satisfaction of basic needs, b) sustainable utilisation of the forest resources, c) participation in decision-making and benefit sharing, and d) socio-economic growth.

Nepal's major constraint on development is poverty. Approximately 42% of the population lives below the poverty line (HMGN 2001). Almost 86% of the population lives in rural areas (HMGN 2002c). Rural people rely heavily on the forest for their livelihood, farm manure and livestock keeping (Chakraborty, Freir, Kegel, and Mascher 1997, Mahat 1985, Bajracharya 1981). Thus, access to the forest is key to the rural livelihood. The Master Plan intends to make forest dependants self-reliant on forest products. Thus, forests have an essential role in poverty alleviation.

To attain sustained economic growth for the long run, forests have to be used in a sustainable way. The concept of sustainable forest use connotes a) the uses of forest for the production of goods and services; and b) use of the forest in such a way that the ecosystem integrity is maintained (Centre for International Forestry Research 1996, and Maser 1994).

To maintain ecosystem integrity, forest product extraction has to be done in such a way that the regenerative capacity of the forest is well kept (CIFR 1996, Ascher 1994, and Ascher and Healy 1990). Similarly, plant and animal diversities as well as ecological function of the forest can be maintained, if the forest is protected as a complete ecosystem (Boss 2000, Burger, eds. 2000, Berkes, eds. 1989 and Damn and

Poore 1979). The ninth plan aims at utilising Nepal's environmental and biological diversity in such a way that it contributes to rural incomes, poverty alleviation, accelerated economic growth, employment and sustainable development. In hills, where forests serve watershed functions the single priority of keeping tree intact will not protect the integrity of the ecosystem. Therefore, it is essential to conserve the forest so that its ecosystem, genetic resources (HMG 1989 and 1988) and land are well maintained.

Poverty alleviation contributes to socio-economic growth. As people get regular access to forest products, it fulfils their daily domestic as well as farm needs. Availability of leaf litter for farm manure and fodder for livestock ensures income from farmlands and livestock (Chopra, Kadekodi, and Murty 1990). Increased availability of forest products helps reduce time for the collection of forest products for children and women. Poverty alleviation also complements sustainable forest management. Sustainable forest management fulfils basic needs of forest products and thus can thin out poverty. Once people's basic needs are met, they contribute to sustainable forest management (Gilmour 1994). People are ensured the supply of forest products. In these contexts, participation of people in the group, in designing of their own rules to safeguard the forest ecosystem, harvest and distribution of products is most crucial (Montalembert and Schmithusen 1994, Ascher and Healy 1990). As hill people heavily depend on the forest, their exclusion from the forest without adequate compensation may be difficult (Bromley 1986).

The Master Plan aims to achieve increased participation of village people (or user groups) along with their upgraded feeling of ownership of forests. As mentioned above, forestry is basic to people and the economy in hills. Therefore, poverty alleviation through forest product provision can also contribute to reducing regional imbalance in hills. The ninth five- year development plan (1997-2002) adopts poverty alleviation as the long-term objective of regional development. This requires generation of more production and employment. This plan stresses the need for attempting a poverty alleviation program through social mobilisation, social organisation and people's empowerment. Such intention of government can contribute to participatory development. His Majesty's Government of Nepal is committed to maintaining the forest ecosystem through sustainable use of the forest. For example, the government showed its commitment toward this by signing the Forest Declaration of the United Nations Conference for Environment and Development. According to this declaration, "Sustainable forest management aims to meet the needs of the present without compromising the ability of future generations to meet their own needs" (UNCED 1992). In fact, the plan demonstrates the government's commitment to meeting people's demand for forest products through sustainable forest use.

Economic Incentives

In this thesis, we argue that the major economic incentive for the user group is the provision for the withdrawal of forest products for the current needs and protection of the forest for the future. This provision encourages user members to invest their income from alternative activities as membership fee and apply their labour in monitoring of forest use for the protection of the forest with a hope of getting more forest produce in future.

In principle, economic incentives influence the willingness and ability of the forest management to invest for the protection and development of the forest and make forestry sustainable (Mayers and Stephen 1999, Subramanum, Jagaannthan, and Meingen-Dick 1997, Scherr eds. 1995, and Montalembert and Schmithusen 1994). In community forestry, the economic incentives for the forest user members include the rights to distribute the product among themselves, raise membership fee and other funds (for example, from the sale of forest products and other sources). The CFUG can mobilise its fund in forest development and protection, and development activities at the village level.

- *Forest products*

The literature on common property resources focuses on the theme that produce or income motive induces rural people to be attached to the institutions related to natural resource management (Arnold 1998, Fisher 1989, Chakraborty, Freier, Kegel, and Mascher 1997, Hobley 1996 and Baland and Platteau 1996). In Nepal's context, The Forest Act (1993) allows a CFUG to harvest and distribute forest products among user members. The CFUG members receive forest products at free or at a reasonable price.

- *Rights to Raise Fund and its Mobilisation*

If the organisations cannot raise enough cash, labour, or contributions in-kind to fulfil their designated roles, they will not be viable. The user groups require some fund for their day-to-day expenses (for example, for the purchase of stationery, travel expenses to visit the DFO) as well as for the payment of salary to the forest guard. Thus, some fund may be fundamental to the long-term sustainability of the group as well as the forest. The Forest Act [section, 45 (1)] stipulates that the CFUG shall have a separate fund of its own. The fund consists of the grants received from the government, grants, donation or assistance from any individual or institution, membership fee, income from the sale of forest products (for example, timber), fines and other sources [section, 45 (2)].

Furthermore, the Forest Act (1993) and its byelaws (1995) provide that CFUG can raise fee from its members. In principle, the fee is an input in community forest management and it is an economic instrument. It can form an inducement to ensure the smooth working of CFUG. CFUG can use membership fee to hire forest guard for the monitoring of forest use and plantation of seedlings in open space. It limits the entry of villagers not paying the fee. Raising fee from forest members implies that those who use the forest should pay the fee. Making forest users responsible to pay for its use or degradation might encourage them to arrive at a political decision to distribute products among themselves in a fair manner so that the forest stock is well maintained. The implication is that if users are charged costs of degradation of the resource (or following the principle of polluter pays), they can change their behaviour from resource degrading to resource enhancing (Goodstein 2001, and Harou, Markandya, Bellu, and Cistulli 1998).

According to the Forest Act (section 25, 1993) a user group can independently fix the prices of forest products without informing DFO. Sales income from forest products can determine the levels of investment and reinvestment for protecting and/or improving the forest and in rural development activities. Continuity of a CFUG may depend on the extent to which it generates fund through sale of the products for its operation (like, hiring of forest guard and expenses for stationery). In other words, appropriate pricing policies are important in determining the economics (or resource allocation) of community forest management. However, improved forest product pricing that reflects both the amounts of forest products and opportunity costs of labour are important for improving the incentives for efficient forest product use (Montalembert and Schmithusen 1994).

However, in this thesis we argue that the political decision-making of the CFUG determines the quantity of forest produce for withdrawal. There is no market for fuel wood, fodder and leaf litter in hills. Therefore, CFUG does not have the option to determine the quantities of fuel wood, fodder and leaf litter for withdrawal based on market prices. Rather, it has to adopt the norms that take the future of the forest into account while providing adequate quantities of fuel wood, fodder and leaf litter for the current needs. This is best done where the decision making mechanism is representative and effective and thus the committee decisions and actions reflects the preferences of the user members.

The Forest Act provides that the CFUG has to meet the expenses incurred [section, 45 (3)] by the CFUG itself from the fund. Another requirement for the stability of the group as well as the forest is the provision of resource mobilisation for its improvement and for community development. The first amendment of the Forest Act (30 ka) states that CFUG has to spend at least 25% of its total income for the protection and development of the community forest. The rest of the 75% of its income can be utilised in other development activities at the village level.

A formally registered society, if it maintains a bank account can enhance its stability. The forest byelaws [36 (1), 1995) states that the bank account should be operated through the joint signatures of the two officials of the CFUG, designated by the CFUG.

Legal and institutional incentives

- *Recognition and forest use rights*

According to Ostrom (1992a), 'minimal recognition of the rights to organise' is a fundamental principle. The Forest Act [section 25, (1), 1993] provides that "a District Forest Officer (DFO) may hand over an area of national or public forest to a user group in the form of community forest to develop, conserve, use, and manage the forest in accordance with the operational plan". Note that a Community Forest is an area of a national forest handed over to a CFUG. This condition can provide an "enabling framework" for effective participation in decision making and protection of forest for future while providing forest products for the current needs (see, Knox and Meinzen-dick 2001, Poffenberger and McGean eds. 1996, Sarin 1996, Singh eds. 1986 and FAO 1978). However, the byelaws (31ka, 1995) prohibit a CFUG from selling forestland or from handing over the community forest to another group.

The Forest Act [41 (1), 1993] provides that users of a forest, desirous of developing and conserving the forest and also intending to utilise forest products for group welfare shall have to submit an application via range or ilaka office or to the District Forest Office [byelaws 27 (1), 1995]. Thus, households depending on a national forest form a group and its executive committee. The District Forest Office (DFO) staff, based on the outlines given in the Forest Act of 1993 develops the constitution for the group. Then, the group submits the constitution to the DFO for approval. The group assumes its formal status after the approval of the constitution.

- *Rights to Formulate and Enforce Rules*

The critical form of participation of user groups is in *decision making.* According to the Forest Act [section 25 (2), 1993], the district forest officer should provide the technical assistance to form a group, prepare constitution and operational plan on receiving an application. The constitution defines the rules of the user group. It defines who the members of the user group are, how the executive body of the user group (or the user group committee) is formed, functions or rights and duties of the group and executive committee (The roles and responsibilities of the general assembly and executive committee are given in appendix table A 1), how disputes are resolved, how land territory and borders are defined. how the funds earned from the sale of forest products are to be managed, what types of sanctions (or fines) can be imposed on rule-breakers, what types of rules are to be adopted for harvesting and distribution of forest products, etc.

The constitution also contains the lists of all users of the forest to be handed over. However, users living in different wards, or Village Development Committees or district can be included as users if they are originally the users of the forest. On doing this, the user group submits an application for registration at the District Forest Office (DFO). The user group is registered after the District Forest Officer approves the application. Then, a CFUG gets its autonomous and corporate legal status [43 (1)]. Thus, households sharing management responsibility of a national forest of public land and distributing produce among themselves are called Community Forest User Group or general assembly of members. The user group forms a small body of executive committee, which is referred to as CFUGC in this study. A CFUGC has 7 to 15 executive members across the 19 CFUGs of kabhre district. The group determines the representation of caste households and gender in the executive committee. The user group as a person may acquire, possess or transfer, or otherwise manage movable and immovable property. The user group may be sued in its own name [43 (2-4)]. The CFUG shall have a separate seal of its own. The forest user group has to submit another application together with the operational plan, for the handing over of the forest, after it is registered as a group (Annex 14 HMG 1998).

The executive committee prepares its management plan or operational plan with the assistance from DFO staff or a forest ranger. A national forest is handed over to a group after the operational plan is approved by the DFO. An operational plan is a rule for making rules. The operational plan describes the activities permissible on user group land. The plan specifies what products can and cannot be removed from the forest, who can remove them and when products are removed. The operational plan prohibits hunting and grazing on forestland. The operational plan gives details of punitive measures for rule breakers. The operational plan contains information about the location, area and physical condition of the forest. The operational plan is revised after five years. The DFO can revise the operational plan following the consent of the user group [byelaws, section 29 (2), 1995]. The DFO issues certificate of handing over of an area of national forest to the user group thereof [byelaws, 29 (2), 1995]. Thus, constitution and operational plan work as binding agreement between a CFUG and the government to follow the terms and conditions of the act and its byelaws. In fact, this binding agreement is a production and implementation plan for a CFUG. However, the operational plan is mostly social rather than being essentially technical. This binding agreement may incite village people's inducement to be involved in a CFUG (Seabright 1993). This binding agreement ensures village people's labour input and money involvement in risk sharing arrangement as CFUG.

Thus, right to use forest through formal organisation can strengthen the group's authority against outside challengers. It can enhance a sense of ownership, and build up confidence on the part of the user that the future benefits of the investment will be secured. However, the byelaws (section 31 (1) prohibit CFUG from a) deforesting the forestland or using it as security to obtain loan or to transfer it to another group, b) cultivating it for growing agricultural crops, c) constructing house, d) making it prone to soil erosion, and e) collecting stone, soil and sands. Note that under these agreements, the forest is handed over to the user initially for a period of five years as a risk sharing arrangement. In addition, the provisions for the protection and development of community forest and use of the forest biomass are specified in these documents. However, the act also grants authority to District Forest Office (DFO) to withdraw a CFUG if it does not function in accordance with the operational plan or operates in a way causing significant adverse effects on the environment [section 27 (1)]. The Act adds that before making such a decision the DFO shall give the accused user group a reasonable time to submit a clarification for its activities.

Furthermore, legal rights to user groups to draft and enforce rules require scope for flexibility (that is, regarding formation of group/committee, protection and development of forest, harvest and distribution of forest products and reporting) (Bruce 1999). If this is adopted, it allows members to tailor the organisations to their own objectives and local conditions. The Forest Act [26 (1), 1993) also allows a CFUG to make timely amendments to the operational plan as per the requirements. However, CFUG should inform the DFO about the changes made in the operational plan. If the amendment is considered to have significant adverse effect on the environment, the DFO may direct the CFUG not to implement this within thirty days of the receipt of the information.

- *Monitoring of the Leaders*

Provision for monitoring the leadership is another requirement that is thought to be helpful so as to monitor the work done by members of the organisation (Narayan and Rao 1994, and Shah 1993). According to the provision, the annual accounts of income and expenditure of a CFUG must be audited by the person or institution designated by the CFUG [byelaws, 36 (2)]. The audit report of a CFUG has to be submitted to the concerned DFO [byelaws, 36 (3)]. An authorised officer can carry out timely inspection of the income and expenditure accounts of the CFUG [byelaws, 36 (4)]. The first amendment to the Forest Act [27 (1ka), 1993)] stipulates that if there is a complaint that office bearers of the CFUG are working against the Forest Act and the regulations, the government can penalise them in accordance with the act.

- *Rights to Impose Sanction*

According to Sarin (1996) and Ostrom (1990), the right to sanction penalties against the violator is the grounding principle of conflict resolution with reference to natural resource management. The Forest Act (section 29, 1993) empowers CFUG to impose appropriate penalty on any person, if he/she is found working against the rules of the operational plan. The CFUG can recover the amount equal to the loss or damage from the member if there has been any loss or damage due to the breach of the operational plan. This legal recognition is especially important for forest product allocation and conflict resolution.

2.8. CONCLUSIONS

Nepal has varied agro-climatic divisions. Its location in the subtropical zone makes the growth of plants possible. It is a country of villages inhabited by a bulk of subsistence population, predominantly dependent on agriculture and forestry. The high growth rate of population, which remained around 2% during the last five decades, caused heavy pressure on forest. Consequently, the rate of deforestation recorded about 1.7% during 1978/79 to 1994. Further, there are deficits of timber, fuel wood and fodder supply as compared with their demands. The deficit situations suggested that adequate supply of forest products while protecting the forest for the future is not possible with government efforts alone. Therefore, the government introduced decentralisation and then devolution in forest management. The current forest policy provides economic incentives to CFUGs, enabling them to distribute forest products among the user members and establish fund to invest in forest protection and deploy in village development activities. Further, the provisions grant CFUG to make it as a representative body incorporating households of each of the castes, and women. The current policy entrusts CFUGs with formulation and enforcement of harvest and distribution rules of forest products, and mobilising its fund and labour in the protection of the forest for the future. *This thesis addresses the influence of the effectiveness of the rules in-use on the distribution of fuel wood, fodder and leaf litter among the user members.*

The next chapter deals with the review of literature.

CHAPTER III

REVIEW OF LITERATURE

3.1 INTRODUCTION

The importance of the influence of the management activism of the Community Forest User Group (CFUG) and its user members' future consciousness, on its performance in terms of the distribution of forest products, is indisputable. The challenge facing Community Forestry is how to establish its user group as a credible institution. CFUG is credible if its political decision process takes care of the long time horizon. If the political decision-making of the CFUG or its meeting decides to distribute a smaller amount of fuel wood, fodder, and leaf litter among the user members in the current period, then it embodies a long time horizon. The group reflects household preferences in the decisions of the meetings.

The aim of this chapter is to present a review of literature dealing with the factors influencing people's involvement in CFUG and factors determining the performance of user groups in Community Forestry. This chapter is divided into seven sections. Section 3.2 deals with the attributes associated with the forests. The general principles of participation that motivate individuals to participate in Community Forestry are given in section 3.3. The attributes associated with the user member that influence the participation and performance of natural resource management at the local level are presented in section 3.4. Section 3.5 presents institution-related attributes including the characteristics of the common property resource institutions, and those determining participation and performance of user groups in Community Forestry. Section 3.6 gives the review of the indicators of the theoretical performance of natural resource management consisting of Oakerson and Ostrom's framework to the study of the performance of resource management at the local level. The conclusions drawn from the review are presented in section 3.7.

3.2 ATTRIBUTES ASSOCIATED WITH THE FOREST

Hill Forests as a Source of Economic Goods or an Environmental Resource

A hill forest is a potential source of economic goods and environmental services. Forests provide multiple products[1] and have multiple uses. As an economic resource, hill forests provide tangible products like building materials, fuel wood, fodder, leaf litter, food from plants and animals and medicinal plants. Fuel wood is exclusively used in cooking in hills. Thus, it is a consumption good. Leaf litter is used as livestock bedding and as manure (or fertiliser) when it is decomposed. Thus, leaf litter is the input for livestock keeping and crop farming. Fodder (grass and tree leaves) is used as livestock feed (Chakraborty eds. 1997 and Palmer and Synnott 1992, Metz 1990 and 1989).

The environmental services provided by the hill forests include conservation of biodiversity, habitat for wildlife, protection of soil from erosion, and water source (Swallow eds. 1997 and Kramer, Healy, and Mendelson 1992). Forests are essential to maintain interrelationships between land use, soil and water and uplands and downstream areas. Protected forests in the uplands conserve soil, prevent erosion and reduce water run-off. If upstream forest is degraded it increases run-off of floods resulting in sedimentation in the downstream farmlands. Thus, agricultural land is lost. Interdependencies are rooted in the natural resource system in hills (Lele Sharachchandra 1998), which make participatory forestry a viable option.

To maintain interdependencies, there should be a trade off between tangible products and intangible services. For example, if more of the tangible forest products like trees are withdrawn, forests may lose their service functions (like soil protection).

In other words, the challenge is how to protect the forest for its goods and services in the future so that the service functions of the forest are well maintained, while providing products for the current needs. Since the Community Forest Users are granted with the rights for the protection and use of the forest, they should be alert about the protection of the forests for the future. The implication of this statement is that the user members need to be future conscious or concerned about the protection of forest for the future. The thesis is that future conscious user members intend to receive a smaller amount of fuel wood, fodder, and leaf litter for the current needs so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. Alternatively, future consciousness about the protection of forest for the future leads the households to exhibit a low time preference, which is reflected in the withdrawal of a smaller quantity of forest products for the current needs. The following section, which deals with the concept of reproducibility and biological or natural growth law, clarifies why user members need to be future conscious for the protection of the forests for the future.

Reproducibility

Reproducibility refers to the ability of the natural system to maintain its productivity when subject to stress and shock. Reproducibility or conservation is related to the notion of carrying capacity. According to Baland and Platteau (1996), "carrying capacity is the amount of the natural resource that can be exploited without endangering the reproduction of the ecosystem." Alternatively, a level of production with the use of a natural resource is reproducible if it lies within the upper limit set by the carrying capacity of the ecosystem within which it takes place. The concept of reproducibility is founded in the concept of the natural or biological law of renewable natural resources. According to this law, the growth of a renewable natural resource is the function of its stock. Alternatively, the forest has certain level of regeneration rate. Users can appropriate resource units (or forest products) from this natural resource till its stock does not cross the limit of its regeneration (Prato 1998 and Ostrom., Gardner, and Walker 1997). Figure 3.1 given below shows the biological growth law of renewable natural resources.

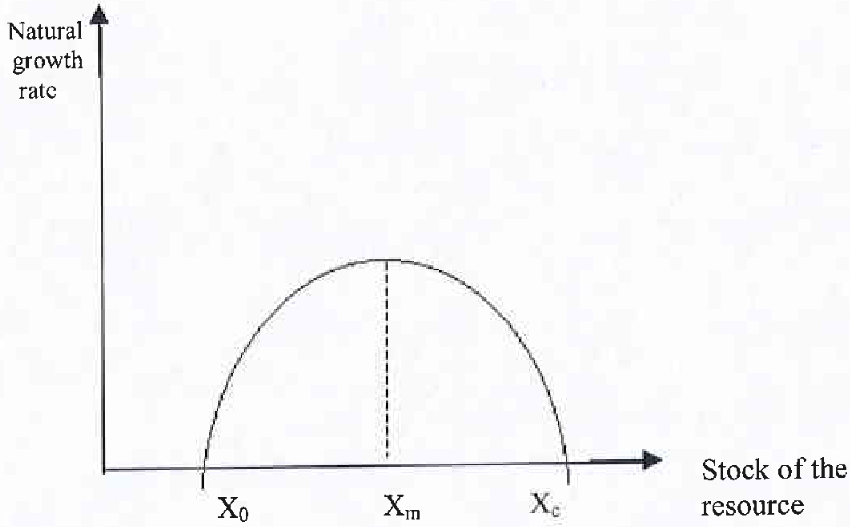


FIGURE 3.1. Biological growth law

In the above figure 3.1, Oy axis shows the natural growth rate of renewable resource. Ox axis depicts the stock or the size of the resource. X_c gives the maximum population or the maximum size of the resource. The biological growth law assumes that at any given level of stock of resource less than Xc, a surplus production exists that can be harvested in perpetuity without altering the stock level. The curve Xo Xc is called the logistic growth curve, which takes on a bell- shape between Xo and Xc. This curve shows the following three situations.

i) Stock of the resource increases at decreasing rate as the curve move upward from Xo till it reaches the maximum point (or Xm). X_0 is the minimum population below which the growth of population is negative. This critical point (or Xo) indicates that if the population of a resource falls below this, the species becomes extinct after some time. If the population is above the critical point, it can be maintained in perpetuity.

ii) The natural growth of the resource is constant when Xo reaches Xm. Xm shows that the stock of the resource reaches equilibrium (or zero growth) at this point, as recruitment and biomass growth exactly match natural mortality. Alternatively, the maximum point or Xm depicts that the quantity of the net growth of the resource is at the maximum. In other words, Xm shows that the surplus production is at the maximum. Xm is called the maximum biological yield or the carrying capacity of the resource. If the rate of resource extraction is below the maximum point (to the left), the resource is under-utilised. Thus, the use of the resource at any point to the left of Xm helps to save the resource for the future.

iii) The natural growth of the resource declines at a diminishing rate beyond the maximum point Xm. Thus, the withdrawal of the resource beyond Xm results in over use of the resource.

As natural factors like soil, altitude and weather conditions influence the biological growth rate of natural resource (like forest); they may complicate the accurate prediction of the maximum sustainable yield of the forest. However, the biological law of renewable natural resources has great relevance as a theoretical tool. The implication of the law is that the forest resource management should be very careful in withdrawing forest products for the current needs so that the forest stock remains intact.

Thus, the essential problems of forest resource management are associated with the appropriation of the forest products for the current needs and the maintenance of the forest resource system for the future. To maintain forest for the future, regulation of the withdrawal of forest produce for the current needs is crucial. The forest management should determine the quantities of forest products for withdrawal, time duration of withdrawal, location of harvest and technology of harvest to achieve the optimal level of extraction of forest products. If appropriation of forest produce for the current needs is not regulated, more of the future forest produce will be withdrawn (Ostrom, Gardner, and Walker 1997).

The next problem in forest management is associated with the provision of the forest resource system. Provision refers to the process of guaranteeing the productivity of the forest resource system to produce forest products over an indefinite period of time. Provision involves three types of activities: a) construction of a forest resource system, b) its maintenance, and c) regulation of the withdrawal of the forest produce. As a CFUG takes autonomous shape after a forest is handed over to it, the initial construction of a forest resource system automatically takes place. Therefore, CFUG is provided with the responsibility of maintaining the forest resource and regulating the withdrawal of the forest products effectively. CFUG must organise a variety of forest maintenance related activities like effective monitoring of forest use, plantation in open space, construction of fire lines, fencing and so on. The monitoring of forest use is effective, if appropriation of forest products does not threaten the critical forest stock necessary to protect the forest.

Next, CFUG should launch forest product extraction in such a way that the regeneration condition of the forest is maintained. Therefore, CFUG leaders must instruct and educate members to extract products (like fresh fuel wood and grass) in such a way that the growth of plants is protected. In fact, the role of effective monitoring of forest product withdrawal is crucial in this context.

Moreover, two physical variables, namely, **stationarity** and **storage** influence the problems associated with the appropriation of forest products and maintenance of the forest. Stationarity refers to the spatial confinement of the resource units or forest products before harvest. In contrast, storage is associated with the capacity of a resource to collect and hold resource units. Storage is directly linked with stationarity. Without storage, resource units cannot be retained. Thus, stored units, for example, green wood branches can be appropriated as needed. Thus, storage allows appropriators to bank resource units for use. Storage of resource units has a number of advantages. For example, it lessens the uncertainty of obtaining products. It ensures the predictability of the flow of the resource units. It is a learning exercise about how flow of forest products can be safeguarded.

The implications of the above-stated concept of reproducibility, problems of the appropriation of forest products and provision of the forest resource system, for this study, are as follows. If CFUG improves its management activism or enforces harvest rules and distributes produce among the user members and fines users collecting produce illegally, it can store more resource units in the community forest. Consequently, high effectiveness of the CFUG may contribute to the protection of the forest for the future. *The thesis is that CFUG's high management activism enables it perform better, which is reflected in the distribution of a smaller amount of fuel wood, fodder and leaf litter in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.*

Excludability and **subtractability** in the context of forests are characterised as follows:

Exclusion: Exclusion refers to the ease of excluding from, or limiting consumption of, resource units (Becker and Ostrom 1995). Forest harbours excludable products (like timber) and non-excludable services: benefit of protected soil (Cornes and Sandler 1986). Timber is excludable because once it is available to one person it reduces the amount available to others. The protective services of forests are non-excludable because they are available to all; no one can be excluded from the use of the quality air of the protected forest. Thus, because of these two types of products and services, exclusion problems emerge in forest use. The problem of exclusion will be severe, if village people use the forest in common, as a major source of subsistence. The users tend to collect or consume forest products free of cost unless rules are enforced through mutual understanding or trust. If the community members, residing in proximity to the resource are provided with the property rights to the forest (Agrawal and Gibson 1999), they can devise mechanisms for controlled supply of excludable forest produce in the current period so as to protect the forest for the future.

Subtractability: It refers to the degree of subtractability of one person's use from the available goods and services (Mckean 2000 and Becker and Ostrom 1995). Fuel wood and fodder are subtractable goods because their consumption by one person reduces their availability to others. However, the service functions of the forest like protection of soil and watershed are not subtractable because they are simultaneously available to all (Price 1990).

Thus, non-excludability results in because people cannot be excluded from the consumption of protective services (for example, from the consumption of air quality). Similarly, if the subsistence of people depends on the forest products (like fuel wood, fodder and leaf litter), they cannot be excluded from the consumption of these forest products. Likewise, the consumption of forest products by one person reduces the availability of the same for the others (subtractability). However, the withdrawal of forest produce beyond the regeneration capacity of forest can cause irreversible change.

Therefore, the judicious use of the forests and their protection are essential. The attributes of forest resources are given in table 3.1 below.

Table 3 .1
Attributes of Forest Resources

Consumption	Exclusion Easy	Exclusion Difficult or Costly
Subtractable	Private goods (wood, fodder, leaf litter, herbs)	Common-pool goods (wood, fodder, leaf litter, herbs)
Joint consumption	Club or toll goods (areas or products of religious significance)	Public goods (watershed protection, carbon sink, biodiversity reserve)

Source: Adapted from Gibson, Mckean, and Ostrom, eds. (2000), and Kiser and Ostrom (1982).

As demonstrated in table 3.1, goods and services (including those) from forests can be categorised as private goods, public goods, common-pool goods, and club or toll goods. Fuel wood, fodder, leaf litter and timber have the characteristics of excludability and subtractability. Hence, these forest goods are called private goods. In principle, the forces of supply and demand determine the prices of these goods (Cornes and Sandler 1986). Common pool goods are characterised by difficulty in exclusion and are subtractive. However, there is no market for private forest goods in hills. Therefore, this study uses the data on fuel wood, fodder and leaf litter in real terms. In contrast, public goods are characterised by difficulty in exclusion but are not subtractable. In fact, impure public goods like recreation (or picnic or tourism in forest) possess the characteristic of difficulty of exclusion. However, this service is subtractable after the forestland is intensively used for tourism and scientific study. Toll goods or club[2] goods possess the characteristics of relative ease of exclusion and relative lack of subtractability.

Forests as Common-Pool Resource

A forest is an ecological/ spatial resource system and it produces forest products or resource units. Individuals can appropriate different resource units for production or consumption from this resource system. This resource system is called a common-pool resource system. In hills, many individuals use resource units of this system. In fact, the system of joint use is applicable to the resource system but not to the resource units. Fuel wood, for example, is a resource unit. It cannot be jointly used because harvest of one unit of fuel wood by one person reduces the availability of the same for others. Moreover, it is difficult to exclude hill people from the use of the resource units of the common pool forest resource system. In addition, it is not fair on ethical grounds to exclude hill people from using the forest system because they are heavily reliant on the forest system. One way to prevent people from using this system without paying is to fence it. However, costs of fencing may be too high. If the hill forests are left without any allocation mechanism or control over their use, and measures for their improvement, they may be over exploited (Gibson, Mckean, and Ostrom 2000 and Ostrom, Gardner, and Walker 1997). Herein lies the role of an institution that can control forest use and work for improving the condition of the forest. One of the alternatives is to entrust the immediate forest users (as local people in hill context) with the judicious use of forest in the current period and for the protection of the forest for the future. The thesis is that if CFUG distributes a smaller amount of fuel wood, fodder and leaf litter for the current needs, then the common pool aspects of the forest are taken care of, well.

Public Good Aspects of Forest Resources

Note that **indivisibility** and **non-excludability** characterise a public good[3] (Ostrom, Gardner, and Walker, eds. 1997). The benefits of watershed protection, biodiversity, water quality, recreation, and carbon sink are public goods. Thus, the protection of the hill forest is essential to get the benefits of the public good aspects of forest resources. In addition, protected community forests can be used for tourism/recreation/educational purposes, which are as impure public goods. For example, the executive committee of the thuliban CFUG told us that they charge NRs. 300/ per person for foreign visitors, as an entry fee to the forest. However, excessive use of the forest for recreation is subject to crowding and depletion (Mckean 2000). In addition, unlimited visitors cannot use the forest at the same time. Once a threshold use is crossed, an individual user begins to subtract from another individual's use. Thus, joint use for recreation/education causes congestion and depletion. Therefore, the joint use of forests is called an impure public good (Price 1990).

There is no market for the public good aspects of forest resources. In principle, if the property rights are well defined, the market is perfect and a competitive equilibrium is efficient. This principle holds under the following four assumptions as a) enforcement costs are nil, b) property rights are well defined, c) markets are competitive and d) markets are perfect. However, the markets for the public goods aspects of forest resources like protection of water source and soil, and control of erosion, cannot be established. Thus, these services of the forests are open access resource. In other words, property rights for these public goods cannot be established and hence a market cannot be created for such service functions of the forest. Thus, this type of absent market is called as market failure in economic literatures (Hauro P. eds. 1998, Swanson 1996, Perman Yuema and James Mcgilvray 1996, Kerr eds., 1995, Tietenberg 1994, Pearce and Warford 1993, Kramer eds. 1992, and World Bank 1992). The following four reasons complicate the establishment of a market for the public good aspects of forest resources.

First, hill forests are characterised by **indivisibility**. As hill forests protect the natural system, forests cannot be divided or demarcated into different parcels and given to private individuals. There is no market price for the protected benefits of forests, which makes it difficult to award them to private individuals. Similarly, there is absence of credit and insurance markets in the forest hill economy, which limits the investment for private individuals. Furthermore, hill forest resources are used in common. Therefore, if the forest is awarded to a private individual, the subsistence of hill people is jeopardisėd. Thus, this complex hill forest system eludes the operation of a market. If the forest is left under no one's control, it can be over used because hill people exclusively depend on it (Arnold 1998).

Second, it is difficult to locate the productive zones of the hill forest because of the variability of the altitude, soils and weather conditions. Thus, the variability of the natural system complicates the task of accurately predicting the maximum yield of hill forests. Thus, hill forests cannot be divided into parcels and awarded on contract to individuals, which challenges the perfectness of the market.

Third, felling of trees by upstream farmers affects the productivity (through floods and sedimentation) of the down stream croplands. Timber felling causes loss of flora and fauna. These losses are the costs for the society. Alternatively, timber felling deprives communities from the benefits of the protected forest. Furthermore, once flora and fauna are lost there will be no food and habitat for wild animals. The usual analytical framework of cost and benefit methodology, which is based on the market pricing of the inputs and outputs has limited application because not all costs associated with the social losses can be appropriately accounted for. Similarly, it is not possible to bring the stock of flora and fauna into its original condition once they are lost (Irreversibility) (Barbier, Burges, and Folke 1995 and Ciriacy-Wantrup 1968). Moreover, it is difficult to collect information about the costs resulting from felling of timber. In other words, it is difficult to locate the affected parties and sufferings (or costs) from deforestation. Thus, this characteristic makes it difficult for the forestry system to be either created, or be managed competitively.

Fourth, if the forest is parcelled, it may involve substantial monitoring and enforcement costs. Therefore, if the community members who live in the proximity of the forest are provided with the communal property rights to the forest, they will effectively formulate and enforce rules to protect the forest for the future while providing forest goods for the current period. According to Bates (1997), local institutions are based on a micro-foundation. The admixture of rules, norms, and enforcement characteristics determines the economic performance of a local institution. The communities shape the economic performance because they define and enforce the rules of the game. CFUG devises operational rules, and implements and revise them depending upon the circumstances. Thus, the institution of property rights seeks to demonstrate how rational individuals might employ non-market institutions to secure equilibrium collective levels of welfare. The thesis is that the forest products for the current needs are withdrawn based on the political decision-making of the CFUG members. The current withdrawal of forest produce is determined in such a way that the future of the forest and hill people is taken care of, well. The group reflects household preferences in the decisions of the meetings.

3.3 GENERAL PRINCIPLES OF PARTICIPATION

In principle, four reasons motivate human beings to be involved in the group activity. *First, similarity of self-interest* of the individuals makes a coalition feasible. This theory says that when commonality of self-interest is aggregated in groups, it produces more/better outcomes. Although, individuals differ in their ideas and so on, the objective of their participation remains the same. Alternatively, the aspirations for economic betterment and sharing of ideas/ acknowledging one's capability in the society (Birchall 1999, Baland and Platteau 1998, and Olson 1965) motivate individuals to participate in the group activity. The forest user members' common interest can be furthered and strengthened if group membership is defined. Community Forestry can incorporate households of similar interests if all the traditional users are involved in the group. Similarly, if at least one household from each of the castes of general members and at least one woman are represented in the executive committee, CFUG can forward common interests.

However, in Nepalese context, Dahal (1994) mentions that it is difficult for women to exercise power over men in a public position like that of a chairperson of a forest user group because women's hierarchical social position is lower than that of men. Karki, Karki, and Karki (1994) document that where women were involved in the user group formation process right from the beginning, where women were better educated, or where male family members were absent due to temporary migration, the involvement of women in user group is stronger. These authors say that women have difficulty in speaking in general assemblies, and in occupying a high position in the forest user committee. Therefore, it is necessary to encourage women's involvement in the committee and make them feel free to express their ideas.

In an economic sense, if rural people's livelihood strategy is based on farm and forestland resources, and if they aim at maximising economic welfare rather than economic profit, they forward their common interest in the group activity. (Profit is maximised when the difference between revenue and costs is maximum. Economic welfare is maximised when rural people obtain their necessities through farmland and forest resources and earning from off-farm labour activities).

Second, the alternative game theory posits that if an interaction/ game is repeated between or among individuals with common interest/with similar self-interest, through policies affecting pay-off matrices, sequencing decision making, addressing time dimension, and lowering discount factors, co-operation can be beneficial and stable. This theory assumes a) face to face communication, b) exchange of mutual commitment, trust, and increase in additional value, c) reinforcement of prior normative condition and d) development of the group identity (Ostrom 1998a). However, Axelrod (1981) suggests that the "tit for tat' strategy reinforces co-operation. This strategy says "provide incentives or benefits to those who co-operate, punish otherwise". Co-operation can result if actors develop a positive reciprocity. Some other authors argue that co-operation will be optimal if the interaction or game is initiated through constitutional rules or binding agreements (or property rights like in the CFUG) (Ostrom, Gardner, and Walker, eds. 1997, and Mueller 1989). These authors argue that the enforcement of an agreement requires that the deviators are punished and co-operators rewarded. Next, individuals participate in joint activity, *if expected benefits from participation outweigh the costs* (Ostrom 1999b and 1990, Lam 1998, World Bank 1992, and Buchanon and Tullock 1962). The expected outcome from the set of cost-benefit calculation serves as the driving force for people's involvement in joint activity. In fact, participation in CFUG may be regarded as a zero-sum activity. In zero-sum activities, the gain by some members results in a loss for the other members. However, if the forest users perceive that all members benefit and if the benefit is greater than the sum of the individual contributions, then they are more likely to provide co-operation. The implication of the repeated game theory, with reference to the management of natural resources at the local level is that continued interaction among the members of an organisation can ensure establishment of practices and rules for co-operation. Consequently, such interaction can be habit forming (Seabright 1993), and the participation will contribute to the current and future benefits of the participants. The intuition is that if CFUG functions smoothly and effectively, then it can protect the forest for the future while at the same time providing 'just adequate' forest products for the current needs.

Third, the proponents of *economic theory of the state* believe that the state's role is to create an environment for co-operative activity in the country. The state creates this environment through a binding agreement. The state's effective monitoring and enforcement mechanisms motivate individuals to be involved in the group activity (Hardin 1997 and Ostrom 1990). State is a collective: it comes from the aggregation of its citizen's preferences (Arrow 1966). In other words, if state engages in economic activities, it benefits all of its citizens. State is the collective of capacities for better performance. It works for public benefit through the political process. The constitution of the state, and its act and byelaws enable it to launch and co-ordinate economic activities for the benefits of its citizens. Natural resources possess characteristics of public goods. Individuals have the dominant strategy of appropriating more of the natural resources and contributing less to their maintenance and improvement. State co-ordinates the economic activities of the country effectively. The government staff monitor economic activities and punish the rule breakers in accordance with the law. The economic theory of the state is in fact the theory of co-ordination. The intuition of the theory of co-ordination is that co-ordination benefits all, otherwise there are losses: co-ordinated we benefit, otherwise we lose. If this economic theory of the State is extended to the understanding of the theory of the group, Community Forest User Group is an alternative to the state theory of the forest management.

As mentioned in chapter II, the District Forest Officer creates CFUG in accordance with the constitutional rules for its creation. Thus, there is a binding agreement between the District Forest Officer and the CFUG. This binding agreement is in fact the extension of the theory of the contract. The State agent and the community group agree on the contract. Thus, the State can enter into exchange with the resource users whose livelihood depends upon the resource. Such a contract can block independent appropriation of the resource and thus enable effective enforcement of the contract.

The working of the theory of co-ordination in the group context requires consensus building. Consensus is made if members organise meetings, formulate, and enforce rules, and distribute produce at a politically set quantity while allowing the forest to grow for the future. If the group formulates rules for the harvest and distribution of produce for the current needs, effectively monitors forest use and checks unauthorised withdrawal of the forest produce and thus protects forest for the future, then co-ordination theory holds well.

Fourth, a critical mass of members or leaders is required to make participatory development rewarding (Baland and Platteau 1996). A catalyst may be required for this. In fact, leaders are the catalysts who can use their skills to resolve co-ordination problems making co-operative activity effective (Burns 1979). The leaders from among the farmers make the formation of a co-production framework or CFUG possible. Leaders can serve as a bridge between the general members and government staff. The charismatic leadership shapes a CFUG and makes it a viable and long enduring organisation at the local level. However, leaders should have mastery over the simple rules of office management (that is, record and account keeping of the CFUG activities, legal knowledge and skills of correspondence). They must be able to create an environment of trust among the participating members (Wade 1994 and 1988, and Shanumugaratnam 1992). Charismatic leadership (along with more experience and education) can foster co-operation by making people aware about challenges. They can convince members about the benefits of co-operation or the benefits of protected community forests. They can mobilise a sufficient number of people for launching co-operative efforts, and formulate and enforce rules and impose sanctions effectively (Baland and Platteau 1996 and Seabright 1993). Wade (1994 and 1988) finds that the leaders' knowledge about community life and resource management, and social, economic and lineage position provide compelling ground for the selection of the leaders. However, incompetence of leaders may pose a serious threat to the group activity. The leaders' role is critical to decide the issue of the appropriation of forest products, provision of activities for the monitoring of forest use and enhancement of forest stock. However, a leader's self-interestedness, corruption, laziness and partiality hinder co-operation (Colchester 1994).

Thus, the leader should be powerful to make credible commitments to non-co-operators (Baland and Platteau 1996). Sarin (1996) argues that accountability of the leaders is necessary for the smooth working of the CFUG and better distribution of forest produce among its members. However, leaders should have the capability to work in accordance with the consensus of the members. According to Sarin (1996), degree of community trust, credibility to the community, and commitment to the objectives of Participatory Forestry are the driving forces that should be taken into account while selecting leaders. Furthermore, the author suggests that leaders should be selected from the local members so that they can provide service to the institution as and when necessary.

Furthermore, continuity of a CFUG and regular flow of products require that it be able to create an environment of trust while instilling a preference for long time horizon among its members. It is suggested that repeated interaction, with substantial inputs on the importance of forest products for forest dependent households, along with the design and enforcement of rules can increase the possibilities for reputation and social benefits. Leaders should be capable of convincing CFUG members that the forest is for their livelihood and its continuity and regular improvement is for the welfare of rural people. Consequently, leaders must be able to instil a vision of long time horizon among the user members.

In Nepal's context, Dahal (1994) and Karki, Karki, and Karki (1994) mention that effective monitoring of forest use and enforcement of harvest rules require strong leadership. However, Karki, Karki, and Karki (1994) argue that leaders misuse their power if they are strong. Chhetri and Pandey (1992) document that some user groups do not want to give much power to a single leader. User members intend to take up the leadership because they want to show the political party that they have influence in the group. Shrestha (1996) argues that this kind of attitude on the part of the leaders hinders the working of the user groups. In this study, among other things, we also assess the influence of the leaders' primary education on the distribution of fuel wood, fodder and leaf litter.

3.4. USER MEMBER RELATED ATTRIBUTES

Salience

Salience or dependence refers to interdependencies in terms of the livelihood, as well as natural, market, and social interdependencies. First, the hill natural system itself makes farmers interdependent with the forest: no forest, no water; no water no life; etc. Second, the dependence on forest resource may depend upon the rural peoples' strategy of economic benefits. For subsistence hill people, economic welfare maximisation is the major objective rather than economic profit maximisation. If the hill people choose more cash income, they prefer to appropriate timber. However, there is no market for timber in the hills. Other forest products like fuel wood, fodder and leaf litter contribute to rural people's livelihood, so rural people intend to maximise economic welfare by cultivating their necessities from farmlands and forest resources, and earning from off-farm labour activities. Thus, the livelihood strategy of a household decides whether it is to be involved in an interdependent/ group activity or not. If rural people exclusively depend on forest products, then their interdependencies is high. For example, some authors (for example, University of Reading 2001, Adhikari 1998, Gilmour and Fisher 1991, Mahat 1985, and Bajracharya 1981) document that hill forests contribute to people's livelihood in various ways. First, forests contribute to rural people's livelihood by providing fuel wood for cooking and heating. Second, forests provide timber for house construction and agricultural implements and medicinal plants (for domestic as well as commercial purposes). Third, forests contribute to the hill agricultural system. Grass and tree leaves are the major sources of livestock fodder in hills. Leaf litter is used as livestock bedding. Then, it is used as fertiliser (or compost manure) after it is decomposed.

Next, if the scarcity of forest products heightens, forest users prefer to work in a group to have regular supply of forest products. For example, some authors (like, Gibson, Mckean, and Ostrom, eds. 2000, and Netting 1993, Gilmour 1988, and Boserup 1965) argue that forest product scarcity is the major factor that encourages forest users to be involved in the group activity. According to Gilmour (1990), Nepal's hills lost a great deal of their forest cover; consequently, people devised an indigenous system of forest management to regulate the use of the forest. Furthermore, Karki, Karki, and Karki (1994) mention that the scarcity of forest products and people's heavy reliance on them created awareness concerning forestry problems.

In contrast, Karki, Karki, and Karki (1994) also mention that conflicts over the allocation of user rights to individuals are reduced, if the community forest produces plenty of forest products for every user. However, Dahal (1994) mentions that hill people also exercise control over the use of the forest even if there is plenty of forest product supply. The appearance of local organisation will be more relevant, if forest products are moderately scarce. If forest products are relatively more scarce, it may be very difficult for the organisation to effectively protect the forest. Organisation can enforce rules of harvest and distribution in an effective manner, so that the forest is protected for the future. Thus, the effectiveness of the monitoring of forest use, and the protection of the forest has a major role in correcting the forest product scarcity.

Case studies of Community Forestry in Nepal reveal that the involvement of rural people in a number of forest user groups hinders co-operation. For example, Dahal (1994) documents that if user members of a particular CFUG have access to a number of community forests, then they may not be interested in contributing to the development of a particular user group, or they may not be interested in investing in the protection of a particular forest. Thus, the extent of reliance on a particular forest user group determines whether user members contribute to the protection of the forest for the future. However, Karki, Karki, and Karki (1994) document that if user members obtain forest produce from alternative sources, it is easier to enforce harvest rules. Similarly, compliance to the rules is less costly for the users. Nevertheless, Dahal (1994) documents that if the community forest is closely protected and if there is no alternative source of forest produce for them, the poor have to face hardships in getting forest produce. Similarly, farm forestry and purchases of forest produce from alternative sources can release the pressure on community forest.

According to Ostrom (1992a and 1992c), if the size of the resource is small and boundaries clear-cut, users may be able to predict the flow of products from the resource and protect the forest for the future. Knowledge of the external boundaries can help users establish entry and exit points for the resource. Furthermore, users may be able to monitor the forest use behaviour, if entry and exit points are set.

Second, the character of the local economy determines the dependence on the forest. For example, the developing countries are characterised by labour, credit and insurance market imperfections (Baland and Platteau 1996, and Gregerson, Draper, and Elz eds. 1989). Forest products often serve as the lender of the last resort (by providing seasonal employment) and provide income earning opportunities for the unemployed. Forest products can meet seasonal shortages. They guarantee village people's livelihood. Similarly, forests serve as an informal source of credit. They can be mortgaged to cope with a variety of contingencies such as social conventions, physical incapacity and drought (Chambers and Leach 1989). These economic incentives serve as a motivating force to be involved in CFUG to safeguard oneself from the risks of physical incapacity and drought. However, the analysis of the influence of the factors related to market imperfection, and related factors on the distribution of forest produce among user members is beyond the scope of this study, because of the time constraint and the limited knowledge about these issues.

Third, hill people have a built-in system in terms of their social structure. The social structure, norms, cultures, and ethical system links hill people together. Such resources make interaction among individuals possible and successful (Baland and Platteau 1996). For example, the studies on indigenous forest management find that the hill people effectively regulated the use of the forest for the current needs and protected the forest for the future (Chhetri and Pandey 1992, Gilmour and Fisher 1991, Fisher 1989, Messerschmidt 1986, and Molnar 1981). However, these studies do not show the influence of institutional effectiveness on the distribution of forest products.

Moreover, farmers in hills share their work among themselves on social occasions (like, marriage, fair or mela and so on) and farm work. These systems are called social pool resources: difficult to exclude oneself from the system and if deviated, harmful to oneself (or no co-operation from the society) (Gelobter 2001). There are interdependencies among each other. Productive work as agriculture is not possible without mutual help and co-operation. In fact, there are path dependencies in North's terminology (see North 1990). This path dependency provides warm glue for the onset of participatory development in Community Forestry. The prior experience of organising can make the co-operative endeavour habit forming (Seabright 1993). Continual interaction among members of an organisation can ensure the establishment of practices and rules for co-operation. These traits can further the accountability of the organisation through instilling and furthering trust among the members of the organisation.

Thus, dependence on the forest for subsistence livelihood makes association with the forest and its institution a necessity. If these interdependencies are properly arranged, human beings can achieve productive potential far greater than what they can achieve acting alone. However, Elster (1986) identifies three elements of interdependencies that might cause difficulties in collective action: a) the reward of each depends on the rewards of all, b) the rewards of each depends on the choices of all, and c) the choice of each depends on the choices of all.

The implication of the above stated theories of salience for this study is that the subsistence forest user members tend to be future conscious for the protection of the forest for the future, so that their livelihood is ensured, and linkage with the natural system is maintained.

Furthermore, as the population of the forest dependants increases, it gives rise to greater pressure on forest resources. In principle, there are three views on how population deepens pressure on natural resources (Carole 1994). First, increase in population causes severe pressures on the natural resources and reduces people's incomes (Mckean 1992a and 1992b, Hayami and Ruttan 1971, and Hansen 1939). Mckean (1992a and 1992b) and Hayami and Ruttan (1971) argue that increase in population forces the village communities to apply strict rules restricting the use of the land or forest. In other words, increase in population forces the community to devise rules for the protection of the natural resources thereby safeguards future produce from declining.

Second, Ehrlih and Ehrlich (1991 and 1971) demonstrate the relationship between population and the natural system in the following form: impact on environment (I)= Population (P)* Affluence (A)* Technology (T). Alternatively, the total environmental damage can be decomposed into three parts: number of people, consumption per capita (determined by income and lifestyle), and the damage done by each unit of consumption or environmentally harmful technology (Myers 1994). Population has significant influence on environment irrespective of the sizes of A and T. The more people there are, the greater is the impact on the environment.

Third, Grant (1994) states that population (P) and poverty (P) together influence the environmental condition (E). In his model, political instability also influences the environment. Population growth causes increase in consumption of natural resources and conversion of land to other uses. Furthermore, changes in the age structure of population in favour of the young causes more pressure on natural resources even if the growth rate of population were to decline (Oever Pietronella Van den 1994). For example, a family with a larger number of working age members may require more food, and thus more fuel wood to cook meals. To Burgess (1992), forest degradation results from an increase in population density. However, UNFPA (1991) argues that there may not be a one-to-one relationship between population and natural resource degradation.

In Nepalese perspective, Dahal (1994) and Karki, Karki, and Karki (1994) mention that population pressure can make the CFUG non-functional because an increase in food demand and the lack of alternative sources of income, create incentives for the gradual conversion of forests into agricultural lands. The lesson is that CFUG should be active to protect the forest effectively. The limitation of the above-described theoretical interrelationship between population and natural resources is that testing of these theories requires time series data on the use of forestlands and their products. This is beyond the scope of our study. This study examines, among other things, the relationship between the three years' average quantity of fuel wood, fodder and leaf litter, and the family size of the Community Forest User Member households.

Heterogeneity

Gordon (1954) in his theoretical formulation of common fisheries assumed homogenous actors but Olson (1965) in his writing on "Collective Action" introduced heterogeneity. Since the work of Olson, the influence of heterogeneity on collective action has been an issue of research (Baland and Platteau 1996). Mancur Olson (1965) recognised the possibility of a privileged group whereby some were sufficiently affected to bear a disproportionate share of costs of organising the provision of public goods. In principle, one of the sources of heterogeneity is the inequality in wealth and income. In village context, land, and livestock are the major assets. However, some farmers may have less of these assets and others more. Households possessing a larger area of land may acquire more forest products from their farms and thus they may have little inducement to be involved in the group and work for group success. In contrast, households with a smaller area of farmland may have to depend on community forest for products.

However, empirical studies demonstrate that households belonging to the wealthier category (in terms of land ownership and other economic assets) receive more produce from community forests (University of Reading 2001). Furthermore, Wade (1994 and 1988) reports that economic inequality is not necessarily an obstacle for resource regulation in South Indian villages. Appropriators with substantial economic and political assets may not have similar interests to that of the appropriators with fewer economic and political assets. The influence of wealth and income differentials on the performance of the CFUG (in terms of the distribution of fuel wood, fodder and leaf litter) can be assessed in terms of the grouping of households by wealth and income classes. However, in this study, we examine the influence of the size of livestock (in standard units) and crop income on the three years' average quantities of fuel wood, fodder, and leaf litter distributed by the CFUG among the user members.

Another source of heterogeneity is associated with the differences in terms of the capabilities of individuals to extract the resource. Individuals differ in physical capacity. Individuals with more physical power may appropriate more forest produce from best site. Third, location differences of households may significantly influence the appropriation of products. For example, households located near the resource can select the best site and appropriate more of the good quality products compared to that appropriated by the households located far from the resource. Varughese (1999) in his empirical analysis of the 18 CFUGs in the hills, tests the relationship between location differences and collective action (in terms of the condition of the forest). He finds that five of the seven CFUGs with greater location differences had higher collectivity.

Furthermore, caste differences may significantly influence the performance of the CFUG in terms of the distribution of forest produce. For example, upper caste households like Brahmin or Chhetris may own relatively more land and livestock than the lower caste households. Thus, the upper castes may require more leaf litter for livestock bedding and compost manure, and fodder for livestock feed. However, Varughese (1999) finds that caste differences have negligible influence on the organisation of collective activity. In this study, we also assess the influence of castes on the distribution of fuel wood, fodder, and leaf litter among the user members. Furthermore, Dahal (1994) in the case studies of Community Forest User Group in Eastern Nepal mentions that it is difficult to enforce rules in ethically homogeneous groups because most members of such groups have family ties. In heterogeneous ethnic groups, the user members monitor each other's activities and ensure that the extraction of forest products follows the defined rules with no group harvesting more than their specified share. Thus, heterogeneous ethnic groups are more successful in terms of the enforcement of rules.

Fourth, the rate of time preference of the users influences the condition of the resource. High time preference for current produce means impatience (Dasgupta and Heal 1979). Thus, household with high time preference may extract more produce for the current needs. Alternatively, if the discount rate for future benefits of the resource is high, larger forest produce is appropriated in the current period. In consequence, forests may be heavily exploited thereby threatening the future of the forests. The implication of the rate of time preference for the present study is that the user members with high time preference for future forest produce intend to receive a smaller amount of fuel wood, fodder and leaf litter in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

Fifth, heterogeneity is also influenced by access to information. Alternatively, the group can work actively, if information about the harvest and distribution of the forest products is shared among the user members (Bardhan and Johnson 2000, Baland and Platteau 1996, and Libecap 1995). For example, if CFUG makes its annual plan for the distribution of forest product, or makes political decision for the harvest and distribution of produce each year, and informs the members about the same, users are ensured of getting products regularly.

Next, the disadvantage of heterogeneous groups is that the establishment of common objectives is problematic. In particular, problems in collective action arise when users have differing alternative income earning opportunities (Baland and Platteau 1996). Kanbur (1992) suggests that a homogeneous background among members helps in defining common goals for the organisation, which is more efficient.

Furthermore, the perception of getting forest produce may differ depending on the sex composition of the village people. For example, Freudenberger and Mathieu (1993) mention that men want to clear forest to open new fields for cultivation, while women want to preserve them as a permanent source of firewood.

Common Understanding

The success of a CFUG depends on whether the users share a common understanding of their situation. One of the critical factors leading to the success of group activity is the common hardship. In fact, the experience of the shortages of forest products or a common threat of the scarcity of forest produce increases the perceived importance of working together (Gibson 1999). Thus, the saying that "we have to hang together, or else we hang separately" is most relevant. This would help to create the social glue that makes people help one another when ordinarily they would not, and generate substantial economic returns (Gibson and Koontz 1997). If hardship is permanent, collective action often breaks down. Next, if users' dependence on forest products is considerably high, they may share a common understanding. Third, the effective working of a CFUG requires that the members trust each other. If user members trust each other (Das and Sheng 1998, and Coleman 1987), the management will be able to formulate and enforce rules effectively. Trust can enable the CFUG management to maintain a stable regeneration condition of the forest while distributing forest produce among the members for the current needs. Village people gather in the hope that they would be benefited if they are united (Castells 1998). In fact, the success of CFUG depends upon the values of members of the groups with reference to the structure of the resource, authority, interpretation of rules, trust, and reciprocity (Ostrom 1998a and 2001).

Social cohesion among the farmers facilitates group activity. Thus, if the CFUG is strong it can provide the basis to work effectively. However, the erosion of social ties through market penetration can undermine the group activity. Market penetration extends business and thus creates employment opportunities outside the agriculture sector. Similarly, market penetration makes commercialisation in agriculture possible. In other words, if farmers grow cash crops and earn more income, they may use chemical fertiliser instead of litter, manufactured feed instead of fodder, and other energy sources (like LPG, electricity) instead of fuel wood. Consequently, farmers with a larger income may not be interested in being involved in the group, but farmers of more or less developed or commercial areas may be attached with the CFUG.

In principle, common understanding is much more relevant to the study of the performance of Community Forestry. However, there is the lack of a yardstick of common understanding, whose influence on the performance of Community Forestry can be verified in an empirical setting. If CFUG organises its meetings regularly then users can share information among themselves about the critical role of the hill forests. The implication is that users can improve common understanding among themselves to be future conscious about the protection of the forest for the future.

Group Size

In principle, Olson (1965) argues that a small group size raises the probability of successful collective action. In a small group, face to face communication is easier (Baland and Platteau 1996), monitoring costs will be low (Ostrom 1990), but may be not so in a large group. In a small group, it is easier to notice rule violation but it is not so in a large group. Thus, it is easier to arrive at common consensus and incur low transaction costs in a small group. Since small groups are supposed to be homogenous, they may have strong identity feelings. The implication is that a small group may be able to maintain close monitoring over the use of the forest. The group may be able to protect the forest for the future while providing produce for the current needs.

However, in large groups it may be difficult to arrive at identical feelings. The larger the group becomes, the less noticeable individual effort will be. The larger the group, the higher the costs involved in various co-ordination and organising activities. Large size also produces less incentive to invest in establishing a good reputation. As size increases, there are more people and there may be more pressure on resources. Community ties also becomes weaker thus leading to a decline in social pressure (Ostrom 1999a).

However, Olson's argument is hypothetical rather than empirical. Empirically, there are mixed results. Tang (1992) documents that a small group is better able to manage in an irrigation system. Ostrom (1998b) reports that community forestry groups that are moderate in size are more likely to reduce over-harvesting than are smaller groups, because they tend to utilise a higher level of guarding than smaller groups.

Gregerson, Draper, and Elz, eds. (1989) argue that the large groups do not successfully perform because it is difficult to monitor the resource use behaviour of the large group. However, common understanding, low discount rates, and low transaction costs are more important than the size of the group (Ostrom 1990). Singh and Ballabh eds. (1994) concluded that the size and composition of the natural resource management societies did not have any significant effect on the performance of co-operatives. Monitoring of resource use can reduce the level of organisation costs involved in the organisation of collective action (Poteete 2001, and Mckean 1992a and 1992b). Thus, the rule of thumb is limiting access by regulating the quantity and distribution of resources harvested rather than by reducing the number of harvesters. However, to Wade (1994 and 1988), existing social ties and authority structure assume greater importance than the optimal size of user groups (irrigation groups).

In the Nepalese context, Dahal (1994) documents that there is no correlation between the number of users and effectiveness of the user groups. Furthermore, Karki, Karki, and Karki (1994) find that there is less breaking of rules in a smaller user groups. The implication for this study is that a CFUG having a smaller number of users can launch forest product harvest and distribution activities, and protect the forest more effectively.

Proximity to the Resource

According to Ostrom E. (1992b and 1992c), proximity to the resource matters much with reference to the emergence of institutions at the local level. If users permanently reside near or in the forest, it is easier for them to monitor forest use and monitor the condition of the forest. Moreover, users may require less time to transport the products from the forest to their residence. Hence, users can use their saved time in other productive activities. The implication for this thesis is that CFUG members can formulate and enforce forest product harvest and distribution rules effectively because they live in proximity to the resource. Proximity to the resource makes user members watch their behaviour effectively so that the forest is protected for the future.

3.5 INSTITUTIONAL ASPECTS

Common Property Resource Institutions (CPRI)

In general, common property resource institutions can be categorised into four categories: private property, state property, common property, and open access or no property (Ostrom 1999b and 1990, Bromley 1999 and 1986, Bromley, eds. 1992b, Feeny, eds. 1990, Bromley and Cernea 1989, Gibbs and Bromley 1989). The first three differ in terms of the ownership: private, state, and common. By provision, each has rights to make decisions about the use and control of access to the resource. The ownership grants authority to exclude others and to make decision on the appropriation of produce, protection and development of the resource. However, under open access, there is no right and hence no property for the use of the forest resources. Furthermore, no resource user is in interaction with the others under this situation. Each user attempts to appropriate the maximum share of the open access resource or forest for his benefit. Consequently, appropriators over invest their time and resources in the use of open access natural resources. This causes over exploitation of natural resource resulting in the 'tragedy of the commons "(Hardin 1968). However, it was taken mostly as accepted theory in the literature until mid 1980s (Ostrom 2001 and 1999b). The conventional tool that can be applied to solve the tragedy of commons or problems of open access is the Coase Theorem[4] (1960). However, the application of the Coase theorem requires locating the users, which is a difficult task. Similarly, establishing agreement may involve a cost that is beyond the Coase Theorem or the Neo-classical Framework.

A number of authors like Dahlman (1980), Furubuttn and Pejovitch (1972), and Demsetz (1967) argued that private property could protect the natural resources through their sustainable use. It assumes perfect and competitive markets, no transaction costs; thus, the enforcement of private rights results in efficiency. However, according to the Arnold (1992b) and World Bank (1991b), private property undermines the needs of the subsistence people thus neglecting their employment and incomes. Next, private property rights may not be socially beneficial in hill economies like Nepal. His economic well being motivates a private individual. He/she may resort to taking maximum advantage from cutting trees without considering ecological services of the trees. Moreover, private ownership may create inequitable distribution of income. Since insurance and credit markets are not developed in the hills, private individuals may not get loans and consequently private owner may not be able to launch tree farming on a commercial scale. With private property, for which the owner has secure claim over the resource, there may not be any problem of breach of rules. However, if open access or state owned resource is converted into private property, the private owner may have trouble in arriving at a credible commitment from the previous users. Similarly, if the local people traditionally use a large natural system and it is converted into private property, it may not be possible to arrive at a credible commitment for a private owner. Moreover, if a common forest is privatised monitoring costs may be prohibitively high.

Next, some other authors argue that the state protects the forest effectively and supplies the products to the needy (Bromley and Cernea 1989, Ciriacy and Bishop 1975, Ophuls 1973, and Hardin 1968). However, state forestry is criticised on the following grounds. First, government's objective of revenue maximisation through awards of timber harvesting to private agents at subsidised rates, increased deforestation, leading to severe environmental degradation (Montalembert and

Schithusen 1994 and Reppeto and Malcolm 1988). Second, very little attention was given to providing forest products at the local level (Kashio 1999). Third, several factors like lack of data on the physical boundary and the condition of the forest, poor infrastructure, remoteness, low number of staff and inadequate funds, lack of equipment, excessive bureaucracy and lack of rewards for professional capacities, poor training, corruption, distrust of the local people on government staff (Poffenberger eds. 1996, Gregerson, Draper, Elz, eds. 1989, Arnold and Campbell 1986, Bromely and Chapagain 1984) hindered government's smooth functioning in forest management.

Common property regime is defined as the property regime with a defined user group to exclude non-members and regulate the use of the natural resources in a sustainable manner (NAS/NRC 1986).

Jodha (1985) defines common property resource as a resource used by a specific community without any exclusive individual ownership or access rights. Others (Ostrom 1990, Berkes eds. 1989, Oakerson 1986, and Bromley 1986) define CPR as the presence of indigenous management. Nevertheless, Runge (1992) defines CPRs as a complex system of norms and conventions to regulate individual rights to use a variety of resources. Mckean and Ostrom (1995) use the terms as common pool resources to distinguish it from common property. To these authors, the term common pool resource refers to the "physical qualities of resource system and not to the social institution that human beings have attached with them". According to these authors, common property regime refers to property rights arrangements in which a group of resource users share rights and duties towards a resource.

According to Stevenson (1991), the distinguishing features of common property include the following:

1. There are defined boundaries of the resource and users; legal and physical (Mckean and Ostrom 1995, Dani eds., 1987 and Ciriacy-Wantrup and Bishop 1975),
2. There are two or more than two persons to serve their common interest to fulfil their economic needs.
3. It contains rules of harvest and distribution of produce, and rules of investment for the protection and improvement of the resource. It consists of a definite group of users who are entitled to use and invest for the protection of the resource. However, use right may not mean the right to equal amount of resource (for example, Ciriacy-Wantrup and Bishop 1975). Furthermore, there is a higher authority to construct and implement the rules and apply punitive measures on rule breakers.
4. There is a joint, nonexclusive entitlement condition under common property. Alternatively, users of common property have simultaneous claims on any particular unit of produce of resources (which is often called prior to capture right); and the resource unit (say forest products) after withdrawal is converted into sole ownership.
5. Competitive user conditions: multiple users who compete for the resource. Competition, here, implies co-operation among the users for the withdrawal of the produce as well as for the protection of the resource system. Users cooperate because of the commonality of interests for the forest produce and protection of the forest for the future.
6. Resource owners and resource users need not be the same under common property. For example, in Community Forestry, the state is the owner of the forest and the government creates a Community Forest User Group by handing over a forest to it.

Consequently, CFUG works as the producer/manager of the forest and the consumer of the forest products.

Financial Viability

Whether the members can solve the problem of monitoring of forest use, and help to develop and strengthen a sustainable and useful organisation influence the financial viability of CFUG. The pre-conditions that can make a CFUG financially viable are as follows. First, if village peoples' involvement does not require heavy investment, particularly for the operation of the group work and protection of the forest (Ostrom 2001 and 1999), then they may be encouraged to be involved in the group activity. The users invest their leisure time in the group activity and pay membership fee. Thus, users' involvement in Community Forestry may not cause relatively heavy costs and they may be more willing to further their common interests. CFUG members can serve as close watchdogs of each other, against the misuse of the forest. It employs local forest guard at a lower wage than the prevailing wage at the local level. Second, if a group has autonomy for the use of the money raised, and has the rights to mobilise resources, then it will be financially viable. However, Dahal (1994), from the case studies of CFUG in eastern Nepal, finds that inability to raise funds from among the user members makes the CFUG externally dependent and thus it is difficult for it to attain viability.

According to Ostrom E. (2001 and 1999), possibility of improvement, predictable flow of resource units, and accuracy of information about the resource, boundaries, and status of forest, provide sufficient incentive for the village people in the group. Thus, CFUG becomes a viable option. The assessment of financial benefits of community forest is beyond the scope of this study because of the time and resource constraints.

Management Activism or the Effectiveness of CFUG

One of the crucial element of organisational effectiveness is the institutions or rules-in-use. According to North (1990), institutions are defined as rules, norms, formal hierarchies, monitoring, and sanctioning, which define situations and determine the terms of interactions. Ostrom, Gardner, and Walker, eds. (1997) mention that individuals in empirical setting should select rules that are a) already known to them, either by experience or reputation, b) easy to learn, follow, and monitor, c) likely to reduce the complexity of the situation, and d) perceived as likely to improve the joint outcome. According to Bates (1997), institutions or rules are based in a micro-foundation. The admixture of rules, norms, and enforcement characteristics determine the economic performance of an institution. The communities shape economic performance because they define and enforce the rules of interaction. Sewell (1989) argues that the locally controlled development projects and the co-evolution of appropriate social structures and sustained increases in per capita incomes are necessary for social progress and even for long-term environmental protection. The implication is that the rules do not operate automatically. Individuals should be able to apply the rules in field setting. If rules are strictly followed, they are effectively formulated and enforced. In addition, Sarin (1996) mentions that the viability of the committee should be assessed in term of its capability to design and enforce rules through regular debates, common understanding, and consensus.

In this study, the effectiveness or the management activism of the CFUG consists of three aspects as follows: a) process of decision-making, b) enforcement of property rights, and c) monitoring of the implementation of the decisions.

- *Effectiveness of the Process of Decision-Making*

A number of writings on common property mention that institutions to be credible should be self-reliant and independent, to adopt internalised and institutionalised norms and conventions, bargaining, negotiations and persuasion (Wade 1994 and 1988, Nugent 1993, and Bardhan 1993). In this study, the process of decision-making refers to the procedures making a CFUG representative of concerns and working effectively. Thus, a local organisation like a CFUG should adopt a number of principles to be a credible institution. First, the group should be accountable in accordance with the common interests of its members. According to Besley and Case (2003), the political representation determines the outcomes of a policy process. For this, the group should select the leaders, who are popular and liked by the members. CFUG can forward common interests if it represents castes and women. Therefore, in this study, the representation of at least one household from each of the castes of the general members is one of the components of the index of the process of decision-making.

Similarly, women are the real users of the forest products. Women have better knowledge about the forest species than men. They are involved in household activities, agricultural production, and forest product collection (Acharya and Bennet 1983). Hotchkiss and Kumar (1988) mention that women use over seventy five percent of the total time of their household activities in forestry related work.

Khadka Manohara (2000), in a case study of women's access to resources and participation in decision-making, finds that women have been benefited in a number of ways through their participation in Community Forestry. The women perceived that they were able to improve their decision-making power at the community level, leadership and social status. However, this author documents that lack of understanding of the need for equal participation of men and women in decision-making, lack of reflection on the women's right in the CFUGs' constitution, influential role of the local elite in the committee meetings, unequal access to information between genders, little awareness of women in Community Forestry Policies and processes, low representation of women in the executive committees and the formal practices in meetings and assemblies are the major obstacles preventing women from participating in decision-making.

Therefore, women's participation in the executive committees may be more important. They can help formulate a suitable forest product harvest and distribution policy. Since women are the real collectors and users of the forest produce, their involvement in the executive committee may facilitate effective monitoring of the forest use. For example, Varughese (1999) finds that in 3 of the 18 CFUGs where women were actively involved, they were effectively able to maintain the forest in a better condition. If women's participation in the decision-making is not given due recognition, they may not show their co-operation in the effective enforcement of rules pertaining to the harvest of produce and protection of the forest. If women are the rule breakers, it is essential that they be involved in decision-making; otherwise monitoring cost will be higher. Furthermore, their participation in the executive committee meetings may help them to enhance their knowledge about the critical role of the hill forests. Similarly, women's involvement in the executive committee will facilitate sharing of the decisions of the meetings with all the other women of the community. Therefore, involvement of women in the executive committee is one of the components of the index of the process of decision-making for this study.

Similarly, for a CFUG to be democratic, the process of selection of executive committee members should be transparent. If this condition is met, a CFUG can represent the interests of all the general members. Furthermore, the group should define the positions of each of the executive committee members. A position rule has a number of advantages. It offers viability of the co-ordinated activities. Since position is determined in terms of the rights and duties of the members, position rules ensure that the obligations of the members regarding their rights and duties in the group are met. If each member follows rules and works in accordance with his or her rights and responsibilities, the CFUGs will function smoothly.

Furthermore, accountability of the CFUG requires that it function as per its tasks. In other words, it should organise meetings regularly. Regular meetings may indicate increase in conflict with reference to the protection of the forest, and harvest and distribution of forest products. However, the thesis is that regular meetings facilitate the education of user members regarding the critical role of the hill forests, and the harvest and distribution rules of the CFUG. The meetings provide fora to inform members about the activities of the group. Similarly, members can express any disenchantment or resentment so that CFUG may be able to correct it in future. If CFUG conducts meetings and works as per the rules, it improves its accountability among the general members in the sense that it is functioning smoothly and effectively. Regular meetings further group interests for the protection of the forest for the future. Thus, four years' average of the total of the monthly and annual meetings is another index of the process of decision-making.

Members should be responsible to make the CFUG function effectively, so that they attend the meetings and arrive at a consensus in decision making. Furthermore, user members should be committed to work as per the rules: attend and conduct the meetings as per the scheduled time and date, devise and enforce rules in consensus so that the shared understanding among the members is enhanced. If members do not attend the meeting, the meeting is postponed and hence no decision making, and formulation, and enforcement of rules is possible. Then, there is no management activism; no compliance with the rules. Therefore, four years' average attendance of the executive committee members is one of the components of the index of the process of decision-making.

According to North (1990), the political process is the key to the performance of countries. Alternatively, if CFUG relies on the political decisions on the harvest and distribution of forest products, it can be accountable. Therefore, this study takes decision-making by the executive committee, or assembly, or both, as one of the components of the index of the process of decision making.

- *Effectiveness of the Enforcement of Property Rights*

Enforcement means exacting compliance of rule-breakers. If enforcement of rules pertaining to membership fee, harvest and distribution of forest produce is effective, the individual members tend to co-operate under the assurance that others will also co-operate (Runge 1981 and 1986). Enforcement is essential because a CFUG faces the problem of opportunistic behaviour or moral hazard even from its members. Alternatively, CFUG members intend to contribute less in the upkeep of the forest, and even steal the products thus violating the harvest and distribution related rules. There is the problem of reputable compliance under common pool forest resource management if the rules are not enforced. In other words, a CFUG to be able to maintain its high index of management activism must enforce rules. If rules are enforced, potential rule breakers may not attempt to breach the rules.

First, a CFUG should enforce the boundary rules. The literature on common property states that a group of users with its defined resource area, user members (Lam 1998), and legal recognition (Ostrom 1992a), can judiciously use forest resources

(Ostrom 1999b, Bromley 1992a, and Runge 1992 and 1986). Boundary rules define conditions for the entry into, and exit from the group, and the boundary of the resource. The eligibility criteria for membership may include residence, ownership of land within the jurisdiction (or defined area of wards or panchayat) of the CFUG, payment of membership fee, and households using the forest by tradition (Ostrom, Gardner, and Walker, eds. 1997). Effective specification of the membership fee is one of the components of the index of the enforcement of property rights for this study. In fact, a defined number of members limits the number of users of the resource (Schlager and Ostrom 1992). Furthermore, groups are likely to be stronger if their membership is defined, because it is easier to forward common interests in the group. Effective enforcement of membership rules enables a CFUG to control members entering the forest outside of the defined area. The defined membership size makes it easier to plan for voluntary labour mobilisation for the harvest and distribution of forest products, and monitoring of the forest use.

However, the definition of membership harms the village people outside of the group on equity grounds. Exclusion of some forest dependent people creates inequality in the rights, responsibilities, and representation of the resource users. Furthermore, it also reduces the pool of the human resources that can be used for the protection of the forest and for the growth of the CFUG as a village level organisation. A CFUG can improve equity if it includes all the traditional user households including those located at a distance, but interested in joining in the group. In fact, the District Forest Office provides for the village people to select members independently of the CFUG, irrespective of the Village Development Committee boundary.

Second, a CFUG, to be effective, should specify and enforce harvest and distribution rules of forest products. Rules for taking forest products specify who can withdraw products, how many products can be extracted, how much of each product can be harvested, what technology of harvesting should be used and what obligations the users must fulfil to remain as beneficiaries. Harvest rules deal with the flow of forest products (Heltberg Rasmus 2001). In principle, effective working of a CFUG requires that it formulate the annual plan and implements it. The annual plan should determine the number of standing trees and the quantity of forest produce for withdrawal. Effectiveness of the annual plan requires that annual withdrawal of forest produce and standing biomass should be metered. This makes it easier to determine the condition of the forest. If these conditions are met, a CFUG can assess the potential forest produce that can be withdrawn annually, and the future growth potential of the community forest can be assessed based on that. However, assessment of the existing stock of the forest is beyond the scope of this study because of the time and financial constraints.

Effective enforcement of harvest rules can maintain the stock of biomass intact. If biomass is kept intact, the users are assured of forest products in future. In the words of Runge (1981) conservation rules imply coming out of the assurance problem. It means that co-ordinated strategy will evolve rather than independent strategies of using the resource, if village people realise that they are interdependent on forest resource and social norms. Alternatively, villagers will adopt co-ordination norms solving the co-ordination or assurance problem. Thus, effective enforcement of conservation rules ensures users' stake in community forestry. Effective conservation rules require convincing users to restrain themselves from unauthorised use of the forest. Moreover, for conservation rules to be effective, the maximum limit of aggregate forest produce, that can be withdrawn should be defined and investment for the protection of the forest should be organised. Therefore, specification of the product (that is, fuel wood, sita, grass, tree fodder, and leaf litter) is one of the components of the index of enforcement of property rights.

Next, the day/date, time of entry into and exit from the forest should be determined. If a CFUG determines day, fixed times for entry into and exit from the forest, members will be able to monitor forest use effectively. Similarly, the formulation of the rules in accordance with the seasonal variation of products is also most essential. For example, a CFUG may have to devise and enforce strict rules during periods of seasonal shortages of products. Furthermore, it may have to devise harvest and distribution rules favouring members with relatively less access to forest products during shortages. Members with better access to forest products may require more vigilance by monitors. Therefore, specification of the day/date is one of the components of the index of the enforcement of property rights. Similarly, time of harvest of forest produce is another component of the index of the enforcement of property rights for this study

Furthermore, the quantity of the products that can be harvested should be predetermined. As discussed above, the forest is characterised by common-pool resource. Alternatively, withdrawal of more produce by one person reduces the availability of the same for others. In this study, specification of the quantity of produce for harvesting is one of the components of the index of the enforcement of the property rights.

Furthermore, effective distribution rules are essential for the smooth working of the CFUG. Therefore, if forest products are weighed, the distribution rule is effective. Therefore, weighing of produce is one of the components of the index of the enforcement of property rights.

- *Effectiveness of the Monitoring of Implementation of the Decisions*

Management activism in terms of effective monitoring is necessary to assure the users that rules are obeyed. Consequently, a CFUG will be able to implement efficient and reliable harvest and distribution rules of forest produce and protect the forest for the future. Thus, effectiveness of service provision can serve as a long-lasting incentive to ensure stability of the CFUG. Therefore, it is the task of the management to ensure that the interests of its members are well taken care of, and that all receive a fair amount of the products.

A CFUG can monitor forest use through hired forest guard or voluntary group patrol. The monitoring of forest use may differ in terms of the size and location of the forest, technology of harvest and systems of distribution and harvest of forest products. For a large forest, more monitoring of forest use may be required. If a forest is located in the middle of the village, the villagers can monitor; or, it may require less effort for the monitoring of forest use. However, in this study the system of forest guard or group patrol is one of the components of the index of the monitoring of implementation of the decisions.

Second, effectiveness of the monitoring depends upon the application of the rules of fines and punishments; or punitive measures for the rule breakers. Furthermore, fines for breaking rules should be predictably and significantly higher than the benefit of rule violation so that the rule breaker does not repeat the breach (Seabright 1993). Since a CFUG has its own monitoring mechanism, it can enforce punishments effectively (Bardhan 1993). Still, a CFUG should adopt a system of graduated sanctions, depending upon the severity of the crime. If rule is breached for the first time, and the breaker has stolen just a basket of litter, he/she should be punished with a small punitive measure: either a warning or a fine. If the rule breaker is caught repeatedly, then the fine should be increased so that he/she may not repeat the same mistake the next time. In fact, detection of breaches of credible commitment requires an effective resource use metering or monitoring mechanism. If a CFUG effectively imposes high and severe punishment on the rule breakers, users may obey the rules rather than breach the rules (Seabright 1993). In such a situation, it is likely that commitment may be credible. The capability of the monitors to apply punitive measures on the rule breakers depends upon the power given to the monitors. If the guard or group patrol is given the power to fine the rule breaker, it will strengthen the effectiveness of the monitors. However, if the power of sanction is with the leaders, then rule breakers will attempt to escape. Similarly, the capability of the monitors to impose punitive measures on rule breakers depends on the natural setting of a community. If a community has a compact settlement and is near the forest, then it is easier to detect rule breaking for such a community. In such a community, if one assumes that there is frequent interaction among members, then rule breaking becomes a prestige issue. If community people detect rule-breaking in such a community, disagreement by community members may be sufficient as punishment for rule breaking. However, if a community is scattered and the forest is far away from the community, it may be more difficult to detect rule breaking. The amount of fines collected from rule breakers is one of the components of the index of the monitoring of the implementation of the decisions for this study.

Next, Ostrom (1990) states that the factors that enhance the capacity of the users to see or hear one another as they are engaged in appropriation activities tend to lower monitoring costs. Alternatively, if a CFUG adopts group harvesting of forest produce, then the members can be watchdogs of one another. Another advantage of group harvesting is that it lowers monitoring costs: less time involved in contrast to monitoring of harvest and distribution on an individual basis. In principle, the establishment of credible commitment requires that each individual act according to the group interest. Thus, the set of rules has equilibrating mechanisms built in, so that it can sustain and reinforce itself by strengthening individuals' interest, mutual understanding and agreement pertaining to the viability of the rules (Lam 1998). In group harvesting, appropriators return to the same location at the end of their activities, one can inspect the quantity of forest produce or resource units each has acquired, and thus make monitoring effective. Therefore, group harvesting is one of the components of the index of the monitoring of implementation of the decisions for this study.

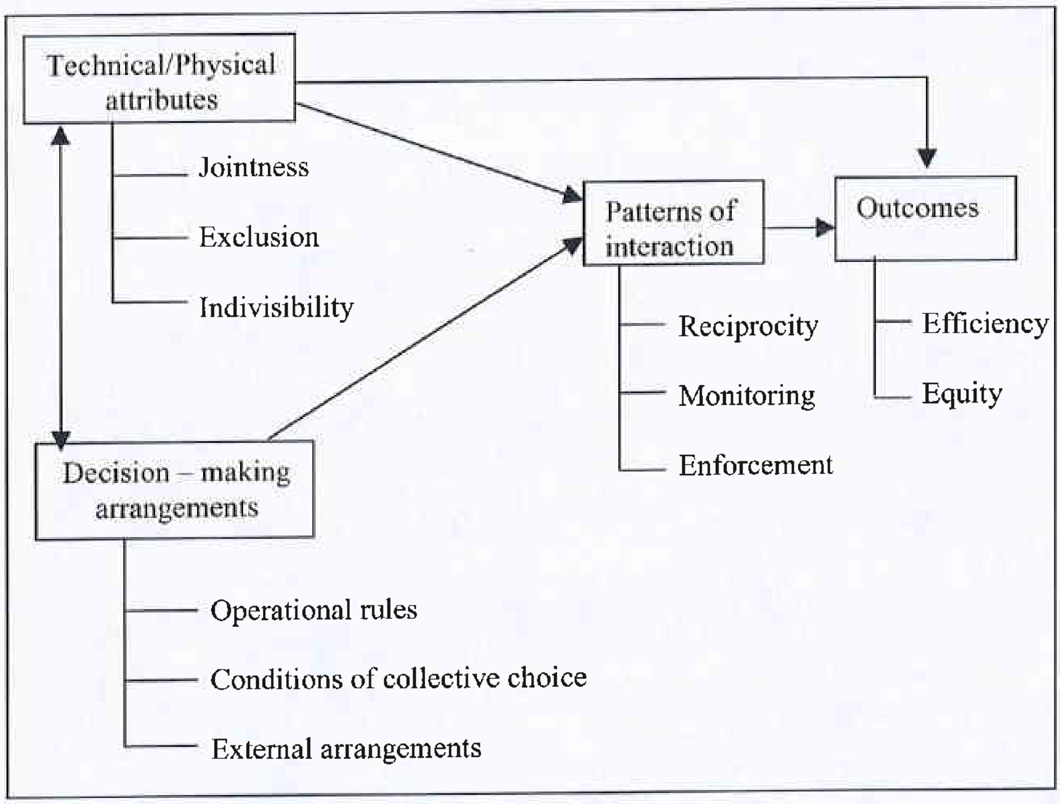
Furthermore, for a CFUG to be credible, requires that it take care of the development activities and mobilises its fund in village development. Therefore, the amount of funds mobilised in village development activities is one of the components of the index of the monitoring of implementation of the decisions.

3.6. THEORETICAL INDICATORS OF PERFORMANCE OF THE CFUG

Oakerson's Analytical Framework

Oakerson (1992 and 1986) has developed an analytical framework for the study of the performance of common property resources. His framework consists of four subheads: attributes of the resource, decision-making arrangements, patterns of interaction, and outcomes. The first two subsets are exogenous. The interaction of users together with the technical and physical attributes of the resource, and decision-making arrangements, brings outcome. Outcome is also influenced by the technical and physical attributes associated with the common property resource. The figure 3.2 demonstrates this framework.

Figure 3.2
The Oakerson's Framework for Studying Common Property Resources.



Source: Oakerson (1986)

Jointness, exclusion, and indivisibility characterise technical and physical aspects of the common property resource. Jointness refers to the partial subtractability of the use of the common property resource. Exclusion is the ease of limiting the use of the resource. Indivisibility refers to the limited possibility of dividing a forest into parcels.

Decision-making arrangements structure the relationship between individuals and collective choice rules in relation to the resource. The decision-making arrangements consist of three aspects: operational rules, conditions of collective choice and external arrangements. However, Ostrom (1990) considers multiple levels of analysis: constitutional rules, collective choice rules and operational rules. The word "constitution" refers to both the laws determining the fundamental principles of government; as well as the way in which something is composed or formed

(Shivakumar 1999). The Forest Act of His Majesty's Government of Nepal that aims establishing the capabilities of forest users is a constitutional rule. Rules that allow individuals to control access to and use of the resource are called collective choice rules. The constitution and operational plan of the CFUG, which are prepared by District Forest Staff in consultation with the user members, are the collective choice rules. These are the rules that define incentives and disincentives in participation. The following four elements condition collective choice rules:

1. the capacity of the individuals to make decisions solely on the basis of personal discretion in matters of concern to others,
2. the availability of potential sources of remedy to individuals adversely affected by others,
3. the capacity of the unaffected population to relax the market rules, willing by consent, and make a collective decision binding on all relevant individuals, and
4. the presence of potential veto positions in any process of collective decision-making opportunities for any one individual or group to say no.

Working rules that limit the use of a common property resource are called operational rules. The rules that link forest user members with the forest in day-to day activities are called operational rules (Ostrom, Gardner, and Walker, eds., 1997). According to Tang (1992), the operational rules define who can participate in which situations, what the participants may, must or must not do, and how the participants will be rewarded and punished. An operational rule consists of a) position rules, b) boundary rules, c) authority rules of forest product allocation (or harvest and distribution rules), d) input rules, e) penalty rules. Position rules specify the set of positions and how many participants are to hold each position. For example, in Community Forestry, the group can adopt position rules at four levels, namely, a) general assembly of members, b) executive committee, c) forest guard or group patrol and d) common product distributor. Boundary rules define the jurisdictional boundaries including resource, villages covered, and user members.

Authority rules of forest product allocation specify who can benefit from the forest, how much of what type of products can be extracted, the manner in which the products can be extracted, and the obligations users must fulfil to remain beneficiaries. Similarly, the authority rules relating to the allocation of forest products include whether members can acquire products in fixed or flexible proportion, the method of measuring products, and the distribution of products in fixed or flexible time slots. According to Tang (1992) input rules defines the types and amounts of resources required of each member. In Community Forestry, user members contribute labour in group activity, and membership fee for the group fund. Penalty rules prescribe the punitive measures (like warning, fines, confiscation of tools, community shunning) for the rule breakers.

The external decision-making arrangements consists of four forms: a) constitutionally provided groups, b) bureaucratic, or groups working in accordance with the law and enforcement of operational rules, c) courts of law as third party arrangements to settle the disputes over the use of the resource, and d) market arrangements external to the commons.

Interaction is associated with the behaviour of the users. In fact, the character of the resource and the structure of decision-making arrangements shape the patterns of interaction with the individuals. Reciprocity, monitoring, and, the enforcement mechanism determine the patterns of interaction. Reciprocity is the mutual expectation of behaviour by individuals. If there was an atmosphere of positive reciprocity, the interaction of individuals with reference to the resource and decision-making arrangements would lead to a better outcome. If one follows the rules, others will do the same, and in consequence, better outcomes would result. If mutual expectation erodes, the interaction leads to bad outcomes. Furthermore, if there is an effective monitoring mechanism, and sanctions are imposed on the deviator, the interaction would lead to a better outcome.

The interaction of the attributes associated with the users, the resource, and the decision-making arrangements, leads to an outcome or performance. Performance can be studied under two heads: efficiency and equity.

- *Efficiency*

Efficiency refers to the rate of optimal use of the resource. It denotes the optimal use rate of the community forest, that it is neither used above the maximum biological yield, nor under-utilised (see figure 3.1 of this chapter). In other words, if existing data shows that forest use is to the levels of the maximum carrying capacity of the resource, then it can satisfy the optimal criteria of forest use. A measure of optimal use of forest may require the determination of the maximum stock of theoretical biomass and then measurement of total standing biomass. Then, determination of whether the forest satisfies the maximum carrying capacity is possible. This is beyond the scope of this study because of the time, financial constraints and lack of necessary information and technical skills required.

The second measure of performance is economic efficiency. It is the measure of the net flow of benefits resulting from the allocation or reallocation of resources. Efficiency is attained when further reallocation is not possible without making someone else worse off. Efficiency is attained when the net flow of benefit is maximised. Alternatively, when the difference between revenue and cost is maximum, efficiency is attained. This can be expressed as $\pi = TR - TC$, where π = profit, TR = total revenue, TC = total cost. However, this study assesses the performance of the CFUGs only in terms of the distribution of forest products among the user members.

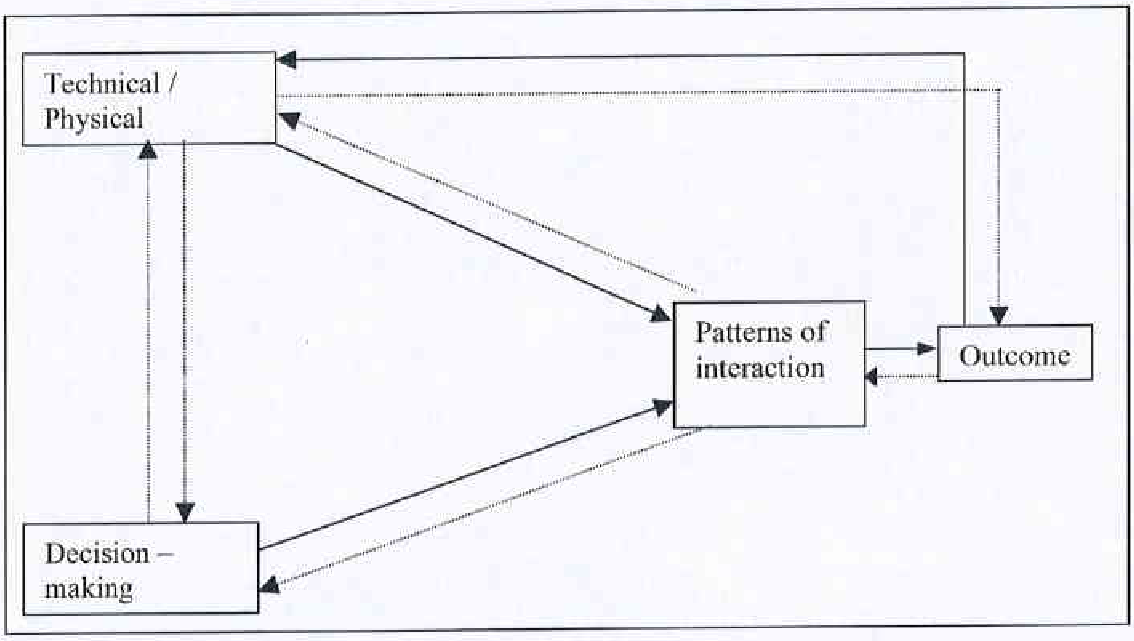
- *Equity*

The equal treatment of all participants irrespective of their caste and asset ownership is of crucial importance in Participatory Forestry. In principle, equity refers to fairness. It can be studied in terms of the two criteria: equality of the contribution and returns therefrom and differential abilities to pay. The first criterion is associated with the notion that those using the facility should be made responsible to pay the costs for the use of the facility. However, such criteria may effect the poor badly. In other words, the poor who are not able to pay for the services may not be able to access the benefits from the resource. Hence, this principle deprives the poor and favours the rich. Second, in most of the Community Forestry Projects, distribution of forest products is one of the major goals. However, caution should be taken to see whether poor farmers benefit from such distribution policy. Another aspect of the equity is the participation of the user members in decision-making. A member can participate in a meeting simply because he is a member. Mere representation of the poor member in the meetings does not give a clue as to whether his voice is heard. Equity in terms of the participation of the poor household in the meeting is attained when his ideas are shared among the members. Furthermore, equity can be attained with the representation of poor members in the decision making body. However, mere representation in decision making is not the solution. To attain equity his voice must be shared equally to that of the other members from rich families.

Oakerson (1992) in his revised framework concerning the study of common property resource, considers the two-way relationships between technical and physical characteristics of the resource, and decision-making arrangements and patterns of interaction. Similarly, outcome influences the characteristics of the resource, and the resource itself influences the outcome.

Figure 3. 3:

The Oakerson's Revised Framework.



Source : Oakerson (1992)

Ostrom's Institutional Criteria

Ostrom (1990), in her case studies, examines self-governing local institutions. She addresses whether and how common-pool resource can be organised to avoid both excessive consumption and administrative expenses. She argues that stable institutions of self-government can be created if certain problems of supply, credibility, and monitoring are solved. She finds that a number of such institutions are capable of devising access and use rules of the resources and enforcing them for the sustainable use of the resources. In her studies, she covered both successful as well as unsuccessful local institutions of common pool resource management. The success of the institutions depended on their capability to devise rules in congruence with the local situation. They designed basic operational rules to undertake operational management of their CPRs.

The local institutions modified rules following the provisions of the collective choice and constitutional choice rules (or laws determining the fundamental principle of governance). From the successful cases, she draws upon features of long enduring local institutions applicable to the accounting of the success of such organisation. The eight-design principles as suggested by Ostrom (1992 and 1990) are given in table 3.2. Her focus is on the rules that make an institution long lasting.

Table 3.2.
Design Principles of Long-enduring CPR Institutions

Boundary condition	Boundaries for the user households and resource units from the CPR must be clearly defined.
Congruence between appropriation and provision rules and local conditions	Rules for appropriation and provision should be in accord with the local conditions.
Collective-choice arrangements	Users can participate in modifying the operational rules
Monitoring	Monitors are accountable to the appropriators or are the appropriators.
Graduated sanctions	There should be graduated sanctions to the appropriators who violate operational rules
Conflict- resolution mechanisms	Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts.
Minimal recognition of rights to organise	Appropriators have rights to devise their own institutions
Nested enterprise	Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organised in multiple layers of nested enterprises

Source: Adapted from Ostrom (1992a, and 1990)

To answer the question: "what determines the presence or absence of the "design principles", Ostrom (1990), relying on the notion of "self-interest", says that such individuals will make "contingent commitments" to participate in and abide by the rules of common pool resources (CPR) or common property resources so long as they expect that a) other similarly situated individuals will do like wise, and b) the long-term benefits from participation and compliance exceed the long term benefits from adopting a deviant, individualistic strategy. If however, individual members of the ownership group expect that they can maximise their individual net benefits by deviating from group ownership rules, the CPR will tend to fail. However, Ostrom's framework does not explain why and how groups and individuals sometimes fail in overcoming the collective action problems associated with the establishing and maintaining CPR.

Basing her analysis in the conventional theory of collective action, she says that a common property regime is likely when the total number of resource users/decision makers is small, but not so small as to make agreement between them ineffective for resource management; the individuals apply relatively low discount rates in resource management decision-making; the individuals are relatively homogeneous in culture and attitude; and a sufficient number of individuals possesses requisite leadership attributes.

Furthermore, Ostrom bases her analysis on transaction cost of co-operation and says that co-operation is likely to be found when

a) most individuals in the group share a common perception that they are better off co-operating than not co-operating in resource ownership and management;
b) most of them would be similarly affected by common management rules or rule changes;
c) most of them employ low discount rates;
d) transaction costs are relatively low, that is, the costs associated with gathering information about the resource and those who use it are low, and so are the costs of enforcing or changing ownership/management rules;
e) social norms of reciprocity and trust predominate within the group; and
f) the group of resource users is relatively small and stable.

Social norms of reciprocity and trust tend to be significant because they can improve the monitoring and enforcement. In this study, we argue that common understanding resulting from norms of reciprocity and trust improves the effectiveness or the management activism of the CFUG.

3.7 THE BROAD TRENDS OF RESEARCH IN COMMUNITY FORESTRY

The broad trends of research in Community Forestry are as follows.

Chhetri and Pandey (1992), Barnet (1992), Fisher (1991), Tamang (1990), Acharya (1989), Arnold and Campbell (1986) and Messerschmidt (1986) document about indigenous forest management. The major conclusion of these studies is that the indigenous system was effective in managing the supply of forest products over a period of time without damaging the resource base.

Neupane (2000) finds that firewood from community forest met 0.4 to 31% of the over all demand. Fodder from CFUG met 1 to 7% of the total fodder requirement. The supply of leaf litter from community forest met 24% to 48% of the household demand.

Recently, Dongol (1999) focused on the CFUG's role in capital formation and sustainability. This author concluded that a high level of income (revenue from the sale of forest products) is dependent on high levels of people's participation, and feeling of ownership; which voluntarily contributes to the protection of forest.

Varughese (1999) finds that the local forms of collective action - arrangements for identifying users, determining harvest amounts and timing, and active monitoring by users influences the changes in the forest condition.

Lam (1998), in a study of 150 irrigation systems in Nepal, measures performance of farmer managed irrigation in three dimensions: physical condition of the irrigation system, delivery of water, and productivity of crops. Farmers tend to emphasise on problem solving, reciprocity, and active rule designing. Farmer-managed irrigation systems are likely to be associated with productive working relationships in terms of high degree of mutual trust, active participation in the crafting and monitoring of rules, and a high level of rule conformance.

Pokharel (1997), in a case study, assessed the effectiveness of Ramche CFUG in terms of the institutional criteria (for example, size, boundaries, power of sub-group, culture of collective action, mutual obligation, enforceable rules, consensus, distribution of rights, forest users location, users' demands, resource capacity, users' knowledge, investment in the group, flexibility of the group, enforceable sanctions, collective choice, monitoring, the state-group relationships, conflict resolution and nested enterprise), equity aspects (that is, distribution of forest products, participation and decision-making and allocation and share of group funds) and resource aspect (that is, working plan, resource capacity, natural regeneration, forest protection, silvicultural operation, management of timber and non-timber forest products, soil conservation and income generation). Effectiveness was measured on three scales: fully satisfied or met, partially met, and not satisfied at all. He found Ramche CFUG fully met 12 (that is, boundaries, power of sub-group, mutual obligation, enforceable rules, consensus, distribution of rights, forest user location, users' demands, resource capacity, users' knowledge, enforceable sanctions, conflict resolution and nested enterprise) out of the above mentioned 20 institutional criteria. The CFUG could not satisfy at all two out of the three criteria of equity (that is, participation and decision-making and allocation and share of group funds). The effectiveness of the CFUG was partially satisfactory in terms of the distribution of the forest products. The CFUG performed satisfactorily in following the working plan and protecting the forest. However, the natural regeneration of the forest and silvicultural operation were found partly satisfactory. The CFUG could effectively function in increasing the resource capacity, management of timber and non timber forest products, soil conservation and income generation activities. He found that the CFUG was not able to enhance the condition of the resource. The merit of this study is that it bases on the theoretical institutional criteria developed by Ostrom

(1990) and verifies the same with the empirical findings. However, this study does not investigate the influence of the effectiveness of the CFUG on the distribution of forest products.

Chakraborty, Freier, Kegel, and Mascher (1997), in a survey study of the contribution of the Community Forestry to sustainable forest use and poverty alleviation in the two districts of terai, find that user groups are able to protect the forest effectively. Consequently, there is a substantial regeneration of degraded forests. The user groups are able to achieve credible commitment (that is, a user complies with the rule and the commitment is credible in the eyes of others). The influence of the local leaders is strong and as a result, the communities followed the rules even though the interests of the poor in forest product diverged from the rich. However, they do not show the influence of the monitoring and enforcement of fine on the distribution of forest products. Households are allowed to collect dead wood but the quantity of fuel wood obtained by the households is unaddressed in this study.

Dahal (1994), in case studies, assesses the structure and functioning of nine CFUGs of Dhankuta, Sankhuwasabha and Ilam Districts of Eastern Nepal. His focus was on the socio-economic characteristics of the users (such as, age, sex, education, occupation of the user), operational rules of the CFUG, and stock of different kinds of trees. He found that most of the users followed the operational rules of membership fee and harvesting of forest products. He concluded that the leadership is the most important factor influencing the effectiveness of the CFUG.

Karki, Karki, and Karki (1994), in case studies of Palpa District and Phewa watershed, find that the effectiveness of the CFUG is highly associated with the quality and quantity of forest resources. CFUGs were able to achieve a higher per capita forest area. Users received the cut/pruned branches and fallen wood only.

Soussan, Shrestha, and Uprety (1995), in their case studies of "The Social Dynamics of Deforestation" from six hill (that is, Rasuwa, Nuwakot, Dhankuta, Terhathum, Sankhuwasabha and Bhojpur) and 2 terai (Kailali and Dhanusha) districts of Nepal mention that the effectiveness of a CFUG depends on the relationships between the condition of the forest resource and the needs of the community. Further, they recommend that the forest management tasks should be tied with the needs and priorities of the communities. If these conditions are met, forest resource can be effectively protected at the local level.

Gilmour and Fisher (1991), based on their experiences of the implementation of Community Forestry in Nepal, suggest that CFUG's effectiveness should be assessed in terms of the immediate wood, fodder and leaf litter benefits to local communities and the protection of the forest. They suggest that research should focus on institutional and organisational aspects of the CFUG.

Some of the studies in India document that the Common Property Resources (CPRs) are critical to the sustenance of poor. Beck and Ghosh (2000) based on the survey of seven villages from across the agro-ecological zones of West-Bengal find that CPRs contributed between 10% to 15% in poor household's income.

Iyenger and Shukla (1999) from survey of 15 villages in Gujarat reported that CPRs made up 0.1 to 11% of the consumption expenditure of farm and between one and 22% of non-farm households.

Singh, Singh and Singh (1996) in their study of eight villages in the semi arid region of India find that CPRs contributed about 27% to the total gross income of the landless and 22% to the income of cultivating households. Pasha (1992), in his studies of the three villages of Karnataka, reports that CPRs contributed approximately 10% in the gross income of the poor households.

Jodha (1986) from survey of 82 villages in 7 states in dry tropical west and south India found that CPRs constitute between 15% and 23% of poor people's income.

In addition, some studies in India deal with the effective protection of forest. For example, Agrawal (2001), in his case studies of forests managed by village councils and Forest Department, finds that forests managed by the village people are comparatively well protected as compared to the forest managed and governed by the Forest Department. Further, Agrawal (1995), in his survey studies of 279 Forest Protection Councils of Kumaun, India, identified the major factors influencing the conditions of forest resource at the local level. He mentions that forest condition is influenced by local institutions, the social and cultural context, state policy, technological change, change in market pressure and demographic change. In his study, forest guard is one of the indicators of the institutional effectiveness. The logistic regression predicted that the forest condition will improve if the forest council hires forest guard. The condition of the forest remains good if guards monitor forest use and the village forest councils apply punitive measures against rule breakers.

Pattnaik and Dutta (1997), in their case studies of the six villages from three districts in south-west Bengal, found that the Forest Protection Committee organised regular meetings of the general assembly and the executive committee, and concluded that the committee is participatory. Perception survey among the local people revealed that Joint Forest Management is successful in protecting forest and thus improves the ecological benefits of the forest (that is, soil protection).

Naik (1997) uses a labour supply model to assess the factors influencing households' participation in Joint Forest Management (JFM). The labour supply function holds that labour supply to JFM is influenced by the expected levels of variations in the marginal profit to labour from JFM and alternative activities, covariance in their profit, expected share of households in the profit from JFM, risk averseness of the households, interest rate prevailing in the village and total labour available with the households. From the two case studies from Gujarat, he found households do not use all the labour input in agriculture and animal husbandry. Therefore, households were able to use part of their time in JFM. He concluded that forest products such as firewood and small timber are essential for households' subsistence. Households could get a reasonable return for their labour in JFM from firewood, timber and other products. The limitation of this study is that Mr. Naik does not empirically test the labour supply model. However, he concludes that the model is validated by the findings of the case study.

3.8. CONCLUSION

Forests in hills have strategic importance for people's subsistence as well as for the protection of the natural system. However, a forest has a limited yield capacity. Alternatively, it has a limited reproductive capacity. If forest is used above this capacity, forest biomass cannot grow. Consequently, supply of the forest good is curtailed and the natural system may face irreversible losses. Forests include common pool resources, which are characterised by excludability and subtractability. Forests are also characterised by public goods: indivisibility and non-excludability. There is a lack of an accurate framework to assess the performance of local organisation in terms of the maintenance of the reproductive capacity of the forests, and the common pool and the public good aspects of the forest. A controlled supply of products for current needs is essential to maintain these productive potentials and supply forest products for people's need in future. Therefore, to get continued supply of forest goods and its services, the regeneration condition of the forest should be well maintained. The CFUG is responsible for the distribution of products among the user members for the current needs and the protection of the forest for the future. If a CFUG politically determines the quantities of forest products for withdrawal in the current period through a representative political mechanism, the future is taken care of so that the regeneration condition of the forest is well maintained. CFUG improves its effectiveness, if it improves its process of decision-making, enforcement of property rights and the monitoring of the implementation. Furthermore, protection of the forest for the future requires that the forest users have a long time horizon. A long time horizon can further common interests for the protection of the forest while providing forest products for the current needs. However, to what extent the forest users are future conscious about the protection of the forest for the future is unclear. Therefore, this study contributes along this line by measuring/quantifying the future consciousness of the forest users through a field study and by examining the impact on the distribution of forest produce for the current consumption, of CFUGs taking decisions through participatory/representative political mechanism.

Second, the implications of the repeated game theory for this study are as follows. If CFUG organises meetings, members attend the meetings, formulate and enforces rules of membership, forest product harvest and distribution, and distributes forest products among user members, then CFUG functions effectively. Furthermore, if a CFUG effectively maintains co-ordination of its activities, then it functions effectively. CFUG is effective if it distributes a smaller amount of forest produce for the current needs so that more fresh fuel wood and foliage is protected for a better regeneration of the forest in the future, thus reflecting the future consciousness of the forest user participants. However, the influence of the CFUG's effectiveness on the distribution of forest products for current needs has not yet been studied. The present study is an attempt to fill in this gap.

Third, it is accepted in the common property literature that salience, common understanding, group size, heterogeneity, financial viability and proximity to the resource determine the performance of Community Forestry. In this study, we argue that salience, common understanding, group size and proximity to the resource makes a CFUG perform better.

Fourth, the typical hill household's choice-theoretic problem is to determine the simultaneous choice of optimal current consumption of forest produce from group, labour input in the group and alternative activities and expenditure on the monitoring of group forest so that he/she is in equilibrium over time. However, the current literature on Community Forestry is not based on the fundamental choice problem of a typical hill household. This study empirically investigates the influence of the management activism or effectiveness of the CFUG, and its user members' future consciousness, on the distribution of fuel wood, fodder, and leaf litter for the current needs.

Finally, ours is also the first study of this kind of Nepal's hill forest economy.

The next chapter (chapter IV) deals with the methodology of this study.

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1 A Forest as production activity gives multiple outputs: some of which are private, some purely public, and some impurely public. These multiple outputs are called as joint products because private and public goods from forest are jointly produced (Price 1990, and Cornes and Sandler 1986).

2 According to Buchanan (1965), a club is a group sharing a particular type of impure public good, characterised by excludable benefits. He argued that goods whose benefits are simultaneously received by more than one individual could be allocated privately through a sharing group (or club). The cost of exclusion depends on the mechanism (guard, a fence or a ticket) involved in the exclusion. Thus, if exclusion mechanism is adopted private collectives could be involved in the provision of toll or club goods (Cornes and Sandler 1986).

3 Economic value of public goods can be assessed using four methods: a) hedonic price method- The value of a property (or house) is determined in terms of its situational or environmental characteristics (the value of a house located near a national park and in other area). The variables that influence the price of a house (that is, neighbour hood, accessibility, and environment) have to be taken account. Following this, one requires to estimate the inverse demand function to get an imputed value of a property in relation to the environmental quality. b) Travel cost method: It is a method of valuing particular recreation site in terms of the concept of consumer's surplus. The method assumes that demand for visit is the function of the cost of visit. The cost per visit to a particular recreation site varies with distance (more cost to the people residing far distant and lower cost to the people residing near the site). Hence, this method takes variation in the cost of travel as a proxy of variation in the cost per visit. The components of cost include foregone income of the visitor, transportation cost, and travel time cost and on site cost including fee for the use of the site. The value of a particular recreation spot is estimated following two approaches. In the first approach, a step demand function for travel cost is estimated using notation as: Ave $pv_{xl} = f_x$ (Ave vc_{xt}, ave vc $_{xs}$, ave $income_x$, ave $socio\text{-}econh_x$)

Where, $avepv_{xt}$ = average per capita visit from x^{th} distance zone to t^{th} site.
fx = function of x^{th} distance zone (or depend upon)
ave vc_{xs} = average visit cost from x^{th} distance zone to s^{th} substitute site
Ave $income_{ix}$ = average income of the ith household from x^{th} distance zone
ave socio-$econ_{ix}$ = average socio economic characteristics of the ith household from x^{th} distance zone. Following the above step, the travel cost demand curve for a particular site is derived using notation as: ave $vc_{xt} = f^{-1}$ (ave pv_{xt}), where, f^{-1} = inverse demand function or average visit or travel cost from x^{th} distance zone to the t^{th} site is inversely related to average per capita visit from x^{th} distance zone to the t^{th} site. It means per capita visit reduces at higher average travel cost per visit and increases at lower average travel cost per visit. The total area under the demand curve is a measure of consumer's surplus, which depicts the approximate value for a recreational site. The total area is the measure of consumer's surplus because actual expenditure on visit is considered under the travel cost method. c) Replacement cost method: cost for similar service is taken into account, and based on that, value for replacement is derived. For example, hill forests control downstream floods, then the value of forest as a public good can be determined based on the cost of construction of dams to control the floods. Thus, the avoidance of dam construction cost for flood control because of presence of the forests is the economic value for the particular forest. d) Contingent valuation method: The direct non-market method is called the contingent valuation (CVM). A hypothetical or contingent market is established under this survey technique and the respondents are explained and sensitised about the resource to be valued. Then the respondents are asked about their maximum willingness to pay (WTP) for a resource. CVM involves inferred WTP estimates in monetary units.
(Garrot and Willis, 1999, Prato 1998, Kramer, Healy, and Mendelsohn 1992, and Pearce and Turner 1990).

[4] The Coase Theorem assumes that 1. Property rights are well defined, 2. Costless negotiation is possible if individuals who de-forest and those who are effected from the appropriation of forest products can be identified, 3. Redistribution does not affect the marginal values to each affecting and affected agent. If these conditions are satisfied, the final allocation of resources will be Pareto Efficient and independent of the initial allocation of legal rights (Swanson 1996).

CHAPTER IV

METHODOLOGY OF DATA COLLECTION

4.1 INTRODUCTION

The aim of this chapter is to describe the methodology of this study including the choice of the district, Community Forest User Groups (CFUGs), member households, and methods used for data collection, data editing, processing and analysis.

4.2 SELECTION OF THE DISTRICT

Nepal is endowed with diverse geography and peoples of different socio-economic and cultural backgrounds. Since Community Forest User Groups (CFUGs, hereafter referred as CFUG) are built in such existing conditions, such variation may result in the differences concerning management activism of the group and future consciousness of the user members that may mediate the performance of the CFUG differently. Keeping this argument in mind, the researcher had a plan of selecting at least one district representing each terai, hill, and mountain area. However, because of the time and budget constraints, the researcher had to drop this idea. Instead, broad criteria for the selection of a typical district were developed. These criteria included the following:

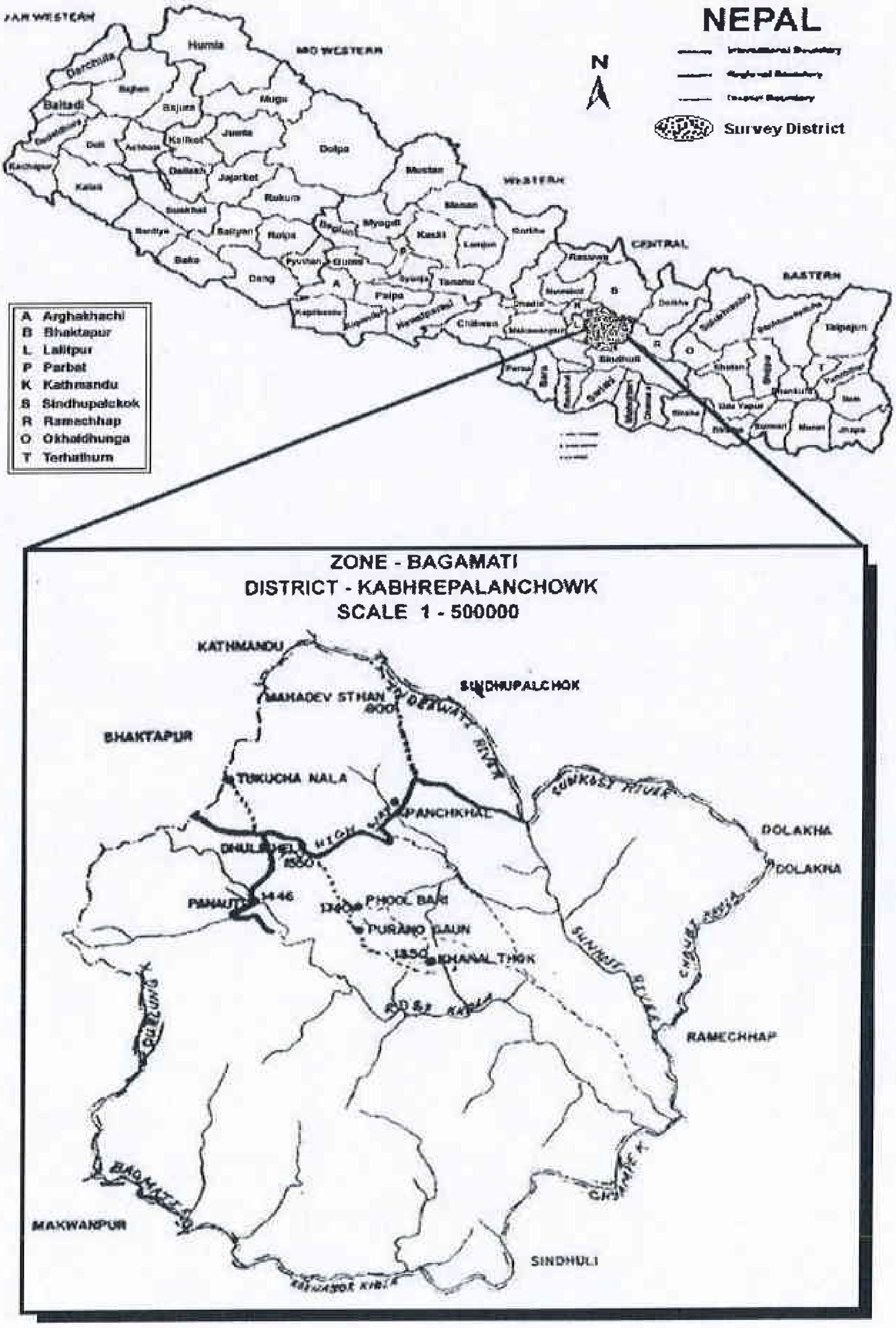
- The district should be located in the mid-hills of central development region.
- The selected district should be accessible within 1 day of travel from access road.
- The selected district should be having Community Forestry program since the first year of its implementation (1978), so that the community forest is in production stage and households share the forest produce among themselves. The Community Forestry Program was initiated in 1978 in kabhrepalanchowk district.
- The selected district should have no data base concerning the influence of the effectiveness of CFUGs and user members' future consciousness on the

performance of CFUG in terms of the distribution of fuel wood, fodder and leaf litter among the user members.

- The selected district should be having a considerable database in terms of the numbers of CFUG formed, community forest area handed over to the groups, and member households covered. For example, kabhrepalanchowk district falls in the fifth rank (with 374 CFUG) next to the palpa (398), sindhupalanchowk (384), bhojpur (383) and kaski (with 381 CFUG) districts. Compared to the other districts, kabhrepalanchowk district ranks 23rd in terms of the area of the community forest handed over to the user groups. Kabhrepalanchowk District ranks ninth (with 32,228 households) in terms of the number of households in the CFUG (HMGN 2002b).

These criteria were developed after a thorough study of the documents pertaining to the Community Forestry in Nepal. Following this, informal discussions with the staff of the Community and Private Forest Division (CPFD), Department of Forest (DOF), and Nepal Australia Community Resource Management Project (NACRMP) were held. These attempts helped the researcher to pinpoint the suitable district for a detailed field survey and the kabhrepalanchowk district was selected along this line. The location of the kabhrepalanchowk district in the map of Nepal is given in figure 4.1 below

Figure 4.1
Location of Survey District in the Map of Nepal



4.3 SELECTION OF THE COMMUNITY FOREST USER GROUPS (CFUGs)

Community Forest User Group is an organised body of user members using a national forest of government ownership. User Committee is the executive body of the Community Forest User Group comprising 7 to 15 members. The District Forest Officer (DFO), after approving the constitution and operational plan of the CFUG, hands over a national forest to it. Thus, these documents form contractual agreements between the District Forest Office (DFOf) and the CFUG. This agreement provides usufruct rights over the use of the forest for an initial period of five years. This agreement is renewed if CFUG submits its revised operation plan for the next five years and the same is approved by the DFO.

The CFUGs, which are the first units in the sample, for this study, were selected following two approaches. First, CFUGs were selected representing the altitude classification (700 metres to 2000 metres) of the district, year of the establishment of the CFUG, so that performance of CFUG can be compared according to the altitude and the year of establishment. In the following section, we discuss how the selected sample is in line with these requirements.

Before the selection of CFUG, two lists namely: i) containing the registered CFUGs under DFO and ii) the heights of forest located in the district were collected. CFUGs were categorised into three strata based on the height of the forest: less than 1000 metres, 1000-1500 metres, and more than 1500 metres. The Community Forest User Groups formed before 1994/95, and between 1994/95 and 1998/99 were identified, and were categorised representing each of these ecological belts. Then, required samples of CFUGs (19) were selected representing each of these strata. The distribution of CFUGs in the district and number of selected CFUGs from each of such units are presented in table 4.1.

Table 4.1
Distribution of Forest User Group (CFUG) by Altitude Range and Year of Establishment and Selection of the Sample CFUG

Altitude (in metres)	CFUG formed Before 1994/95		CFUG/ formed between 94/95-98/99		Total CFUG	Total sample
	Total	Number of sample CFUG	Total	Sampl e CFUG		
<1000	20	1	53	4	73	5
1000-1500	44	3	53	4	97	7
> 1500	45	3	54	4	99	7
Total	109	7	160	12	269	19

Source: District Forest Office, 1999

In the above table 4.1, the sample CFUGs are selected based on the approximate multiple of 15. Four CFUGs are selected from each of the belts having more than 50 but less than 60 CFUGs. Thus, 19 CFUGs were randomly selected using the gold fish bowl technique (Hoshmand 1998). Under this technique, a number is given to each unit of the sub-population of a stratum. Then, the numbers are mixed in a box. A number is drawn each time from the box until the required sample size is obtained.

The field research team (consisting of one assistant along with the main researcher, after the preparation of this sample design, after reaching the sample village sometimes, found that the CFUG was not functioning. We have set a workable definition of a functioning CFUG that can be stated thus: "A CFUG distributing fuel wood (fresh fuel wood plus sita) among its members, for the fiscal years of 1996/97, 1997/98 and 1998/99 is considered to be a functioning one". Fuel wood was considered the indicator of functioning CFUG because it is a consumption good. Fodder and leaf litter are available sometimes in the early years of the establishment of plantation or forest, but fresh fuel wood can be obtained after the adequate growth of the branches that can be pruned. However, the first sample CFUG (jayamangaltar CFUG) located in ward 5 of khanalthok VDC was found not distributing fuel wood among its member households. Such an absence of functioning CFUGs compelled us to revise the above stated sample design based on stratification. Thus, the revised criterion of selecting CFUG was mainly based on the above stated definition of the functioning CFUG.

Since the data on functional CFUG was not known, we had to visit inquiring with the peoples/members of the CFUG on whether functioning CFUG existed. The following description shows how we identified and selected functioning CFUG based on this approach.

CFUGs are located in 73 of the 89 Village Development Committees (or VDC; it is an electoral unit of political unit, similar to a Panchayat) and the three municipalities of the district. 295 CFUGs were registered as per the record of 1999, of the District Forest Office. Table 4.2 shows the distribution of CFUGs by various Range Post, VDC and municipalities of the district.

Table 4.2
Distribution of CFUGs in Kabhrepalanchowk District and Number of the Selected CFUGs

Range Post			CFUG/VDC[2]				CFUGs/Municipality[2]				Total CFUGs
	VDC	Municipality	Known		Not Known	Sub Total	Known		Not Known	Sub Total	
			F	NF			F	NF			
Janagal	10	2	4	23	21	48	1		4	5	53
Salme	8				20	20					20
Mahadevsthan	13		6	20	43	69					69
Daraunepokhari	7		7	24		31					31
Chaubas	10				26	26					26
Katunjebesi	8				15	15					15
Narayansthan	8				25	25					25
Khopasi	9	1		12	20	32	3	21		24	56
Total	73 (89)	3	17*	79	170	266	4 (2)*	21	4	29	295

Source: 1. District Forest Office, 1999.2. Field Survey, 1999-2000.
Note: 1. 89 =total number of VDCs in the district. According to the DFOf record, CFUG are located in 73 of the 89 VDCs. 2. * Denotes the number of selected CFUG (19). 3. The term known means the field research team had the information about the functioning and non-functioning CFUGs. 4. Not known means the field research team does not know whether the CFUGs were functioning or not.

As shown in table 4.2 above, Mahadevsthan Range post stands first in terms of the number of CFUGs (69). Of this 69, we visited inquiring the people of 26 CFUGs. Of this, 6 were functioning and the remaining 20 were not functioning. We could not visit the villages of the remaining 43 CFUGs because of their remoteness, and security reasons, and we do not know whether these CFUGs are functioning or not. Khopasi Range post has the second largest number of CFUGs (56) in this district. Khopase Range Post covers CFUG of 9 Village Development Committees and 1 municipality. Of these, we visited 36 CFUGs including 12 in VDC and 24 in municipality. Only 3 of the 24 CFUGs of the municipality area were functioning and the 12 CFUGs of the VDCs were not functioning. We selected 2 out of the 3 CFUGs. We could not cover 1 CFUG because we could not meet the executive member responsible to keep office records of that unit. Janagal Range Post ranks third in terms of the number of CFUGs (53) under it. We met the people of 28 CFUGs. We selected 4 out of the 5 functioning CFUGs under Janagal Range Post. We could not visit the people of 1 functioning CFUG, and the rest 25 not known CFUGs of this range post, because we were short of time.

Daraunepokhari Range Post covers 31 CFUGs, ranking fourth in terms of the number of CFUGs. Of this, 24 CFUGs were not functioning as per our criteria because they were not supplying fuel wood among the user members as per the criteria stated above. We covered the remaining 7 CFUGs for this study.

Thus, we visited inquiring the people of 121 (or 41% of the 295) CFUGs located in 20 VDCs and two municipalities. We could not visit the remaining 174 (or 59% of the 295) CFUGs because of remoteness, security reasons and lack of time. Twenty-one of the 121 CFUGs were distributing fuel wood among their member households for the fiscal years of 1996/97, 1997/98, 1998/99, and were identified as functioning CFUG.

Of the 21 functioning CFUGs, we selected 19 for our study. We could not select the remaining 2 functioning CFUGs because records were not available (for 1) and we were short of time (for the other). We could not visit the people of 86 CFUGs located under salme (20), chaubas (26), katunjebesi (15) and narayansthan (25) Range Posts because of remoteness and security reasons.

Furthermore, one can think of whether such a selection represented density of population in the district. The 19 CFUGs selected for this study are mostly located within the altitude range of 800-2000 metres. However, this range in the study district (as well as in the other districts located in central hills), perhaps, covers most of the population of the central hills.

4.4 SELECTION OF HOUSEHOLDS

The second unit of sample/population is the member households of CFUG. A household can be defined as a member of CFUG in two ways:

i) a household is a member because its name is in the register of CFUG; and

ii) a household is a member because its dues for the current year on account of membership have been cleared by a date preceding the survey.

We attempted to collect the lists of households with the record of membership charges cleared for the current year. However, for only two of the 19 CFUGs (that is, Thuliban and Vasmepakha) it was possible to acquire such lists. A discussion with the executive members of each of the 17 CFUGs revealed that members pay fee at their convenience. Therefore, we collected the lists of households whose names were entered in the records/register of the CFUG. This latter type of household is known as member of CFUG in this study.

From the collected lists, 306 households (that is, 16 households from each 17, and 17 households from the rest 2 CFUGs) were selected from each of the 19 CFUGs following the procedure of systematic random sampling. We selected two additional households one each from Banskhark ka and Vasmepakha because of the reasons to be explained presently. Each of the selected household's names was marked following the random sampling methodology. However, some two household heads were not available at that time. Therefore, we selected the households next to the marked household. After a week, the two household heads selected in the first stage approached us along with an executive committee member and made a request that they wanted to provide information. Therefore, we interviewed these two households.

According to the sampling methodology adopted, the households were to be categorised into two family size classes (households with less than 6 and those with 6 and more family members) from the collected lists. The total number of households with the family size of less than 6 members is divided by 8 and the household falling under this number is marked. For example, Thuli CFUG has 387 member households. The households are categorised into two groups with 185 from family size of less than 6 members and 202 from the family size class of six and above members. Then 185/8 = 23.13. Thus, every 23rd household is marked in the lists. Then, the locations of the households are identified with the help of local field assistants and other local villagers if required. Similar procedure is followed in selecting households from the family size class of six and more members. The head of the selected household (i. e., the households falling under the mark) was approached and interviewed. The table 4.3 shows the distribution of sample households by VDC/municipality and CFUG.

Table 4.3
Number of VDC and their Wards covered by the CFUG and the Total Number of Member Households and Sample Households

VDC/Municipality	CFUG	Wards	Total number of households	Total number of sample households
Khanalthok	Vakundebesi	6[a] and 7	101	16
Mahadevsthan	Naubisegeruwapakha	3	73	16
	Ratmatejhagarpur	9	134	16
	Sallenibaguwa	7	271	16
Panchkhal	Khawakoratmate	1[b], 2, 3, 4 & 7	291	16
	Thuliban	3, 4 & 7	387	16
	Vasmepakha	7	101	17
Phoolbari	Banskhark ka	8	62	17
	Banskhark kha	3 & 7	58	16
	Belakholapakha	6[c], 7 & 8	238	16
	Dharapanikhareti	4, 5 & 8	91	16
	Voltasethulipokhari	7 & 8	74	16
Puranogaun	Baserithuloban	3 & 4	58	16
Tukucha	Byangdhungathulopakha	2	34	16
	Sanobanamaldol	2	59	16
	Sanobandandal	2	33	16
	Thulopakha	3	56	16
Panauti	Indresworthalpu ka	12	291	16
Municipality	Jyalachiti	4	225	16
	Total		2637	306 (12%)

Field Survey, 1999-2000.
Note: a) ward 6 of Vakundebesi belongs to Phoolbari VDC
b) ward 1 of Khawakoratmate belongs to Rabiopi VDC.
c) ward 6 of Belakholapakha belongs to Belakhola VDC.

4.5 INSTRUMENTS AND PRE-TESTING

Keeping the analytical issues of this study in mind, this study uses two types of data collection instruments: the i***nterview schedule,*** and the ***checklist***. The interview schedule (see appendix G) for collecting information from randomly selected member households consisted of open-ended as well as closed-ended questions. This schedule asks how much backloads of fuel wood, fodder and leaf litter each child and adult of the household received from the community and government forest and own farmlands. Next, this schedule asks, "do you agree that the forest should be protected for the future", and personal characteristics (that is, sex, literacy and number of members in the family). In addition, the schedule collects information about the number of livestock and area of khet (or lowland) and bari (upland) land owned by the respondents and the quantities of the major crops produced from cultivated land.

Second, the checklist or discussion guidelines (see appendix H) for the members of the CFUGC has five sections. Section 1 focuses on each of the three aspects of the management activism (that is, the process of decision-making, enforcement of the property rights and the monitoring of the implementation) of the CFUG. Section two deals with the official positions of the executive committee members, their education, and criteria for the selection of the executive committee members and their tenure, renewability and roles, responsibilities of the executive committee and general assembly and rules on fines and punishment. Section three collects information about the quantities of fuel wood, fodder and leaf litter distributed by the CFUG among member households. Similarly, information about the calendar for fuel wood, fodder, and leaf litter supply for the survey villages, and the average weight of a backloads of fuel wood, fodder and leaf litter is collected, using section three of the checklist.

The information about the forest area and its types is collected using section four of the checklist. Section five focuses on the information about the prices of input of crop production, crops, and by-products of paddy, maize, and wheat.

The above mentioned data collection instruments were developed at the Gokhale Institute of Politics and Economics in consultation with the supervisor of this thesis and Prof. Nilkanth Rath, the ex director of this deemed university. The instruments were designed in English and then translated into Nepali, the Devnagari script. This made it convenient for the researcher to use the instruments, and for respondents to understand the questions. The instruments were pre-tested with a view to finding out missing questions, inappropriate, inadequate, confusing response categories in the interview schedule. The instruments were pre-tested in the same survey district but in CFUG with the similar characteristics. It was pre-tested at the Dapcha VDC, ward 7, Kabhre district, among the 15 members of the Adhikariko ban, CFUG and its executive committee. In this regard, Bailey Kenneth D. (1982) says that pre-testing "can be administered to a few respondents so that flaws can be identified and corrected". After the pre-testing of the questionnaire, necessary adjustments were made in the questionnaire and in this way, the questionnaire was finalised.

4.6 DATA COLLECTION TECHNIQUE

FieldWork: Fieldwork was carried out in two phases:

First Phase: The fieldwork of this phase initiated on 6 December 1999 and ended in August 2000. At the outset, functioning CFUGs were identified. Then information about the quantity of fuel wood supply among user members was noted down from the office records of the CFUG. Name lists of the member households were noted down from the office records. Then, households were randomly selected and interviews with the respondents were conducted. One local field assistant was hired and was given an orientation on the purpose of the fieldwork. The task of the field assistant was to assist the main researcher to locate the house of the respondents, and build a rapport with the respondents, that the field study was meant for collecting information for academic study. Rapport building was essential to convince the village people that fieldwork was solely meant for research purpose.

Since the fieldwork started in winter and ended in summer, working hours for data collection were different in the two seasons. In winter, the working hour initiated by 7 am and ended at 7 p.m. However, during the summer, farmers used to be out from their homes during the day. This required meeting with the selected respondents in the morning before 8 am and in the evening after 6 p.m. The researcher was provided accommodation at the residence of the executive committee members of each of the villages of the 19 CFUGs.

Second Phase: This phase initiated on 1 January 2001 and ended in March, 2001. The information about each of the aspects of the management activism of the CFUG and observation of forest use were gathered during this phase. The researcher visited for four days in each of the 19 CFUGs from Kathmandu during this phase. The researcher was unable to stay in the survey villages because of security reasons.

The following methods were applied to collect the primary data for this study.

Interview Method

To verify the quantities of fresh fuel wood, fodder and leaf litter received by the randomly selected member household from CFUG, personal interview was conducted. This schedule asks interview respondents how many backloads of fuel wood, fodder and leaf litter the child and adult members of the household received from community and government forests and own farmlands. Furthermore, the information about the number of livestock and land owned by the household, and output of crops of the household and respondent's sex and literacy was gathered using the interview schedule.

Records and Statistics

Forest products like fuel wood (fuel wood and sita), fodder (grass and tree fodder) and leaf litter are basic to hill forest economy. Therefore, these three products are selected in order to make a performance analysis of the Community Forestry. The information about the supply of fresh fuel wood (in kilogram and bundles as well) for the fiscal years of 1996/1997, 1997/1998 and 1998/1999 was noted down from the office records of each of the 19 CFUGs. The dharapanikhareti CFUG did not launch cutting/pruning in 1998/1999 and did not distribute fresh fuel wood. This is because user members were provided with the 5,000 kg of fuel wood in 1997/98. However, interviewed households told that they harvest sita and thus, fuel wood for this CFUG contains sita for 1998/99. For thuliban and vasmepakha CFUG, the information about the backloads of sita, grass, and leaf litter supplies was noted down from the office records. Similarly, the information about the number of meetings and the members' attendance at the committee meetings, caste and female representation in the committee, membership fee, fines, funds mobilised in the village development activities was noted down from the office records. Furthermore, names of the user members of each of the 19 CFUGs and CFUGC were noted down from the office records.

Group Discussion

Group discussion was conducted at two levels. One, the CFUG chief or secretary was requested to call a gathering of executive committee members. This gathering at a time has the advantage that members could correct when the disagreement arises on the information they provide. Executive committee members were asked how many backloads of sita, fodder, and leaf litter users received from community forest for the fiscal years of 1996/1997, 1997/98 and 1998/99. Similarly, the information about the educational qualifications of the executive committee members, selection, renew-ability, and tenure of executive members, prices of crops and inputs (that is, seeds, bullock pair, manure, fertiliser and pesticides) was obtained through discussion with the executive committee members

Second, teashops and the gathering for the social functions (of the user members) were the most preferred place for group discussion. In such gatherings, the forest user members were consulted and provoked on the issues regarding the enforcement of property rights and effectiveness of the monitors to keep vigil on forest use.

Observation

The purpose of observation is to attain completeness and consistency of the information. For this, the main researcher attended 5 executive committee meetings (3 in vakundebebesi, 1 in thuliban, and 1 in dharapanikhareti CFUG) and two general assembly meetings (1 in belakhola and the other in dharapanikhareti CFUG). Similarly, the researcher visited 18 community forests (except Khawakoratmate) to verify the information about the enforcement of harvest rules (that is, specification of produce, and quantity) and harvest of forest produce in group. Another purpose of the forest visit was to verify the interview responses regarding future consciousness about the protection of the forest for the future.

The information about record and statistics, group discussion and observation was gathered using the checklist.

4.7 DATA PROCESSING AND ANALYSIS

The responses were reviewed in the same night of the interview/discussion date. In case of inconsistent/doubtful answers, the executive members and respondents were requested to provide clarifications on the next day. The questionnaires were manually coded and prepared, ready for computer entry. The steps adopted in data processing and analysis are as follows.

Conversion of bundle of fresh fuel wood and sita

The bundle of fresh fuel wood is called dori. In principle, a bundle is measured with a rope of approximately 1-meter length and the length of the fresh fuel wood branch is approximately 1.5-meter. Two CFUGs (that is, Thuliban and Vasmepakha) supply weighed fuel wood among their members. The rest 17 CFUGs make fuel wood available among their members in measured bundles. This study uses two methods (that is, weighing and recall, Godoy, Lubuwski, and Markandya 1993) to get the conversion of measured bundles of fresh fuel wood into kilograms for these 17 CFUGs.

The average conversion factor for a bundle of fresh fuel wood is derived using spring balance of 50 kg for four CFUGs (that is, vakundebesi, voltase, banskhark ka and sallenibaguwa). The average weight of fresh fuel wood derived using this method is given in appendix table B1.

However, weighing of fresh fuel wood was not possible in the rest 13 CFUG. The pruning/cutting of branches was already over when the field research team reached and some of the user members had already used half of the fuel wood received from the CFUG. Therefore, this study uses recall method to get the average conversion factor of a bundle of fresh fuel wood into kilogram. Thus, the checklists asks the executive members how much a bundle of fresh fuel wood weighs. Table 4. 4 shows the data of bundles of fresh fuel wood and their equivalents in kilogram for the fiscal years of 1996/97, 1997/98, and 1998/99 received by the member households of the 19 CFUGs of the Kabhre district.

Table 4. 4

Year wise Supply of Bundles of Fresh Fuel Wood and its Equivalent Weight

VDC/municipality	CFUG	1996/97[a]	1997/98[a]	1998/1999[a]	Kg/bundle
Khanalthok	Vakundebesi	3	3	2.5	136 #
Mahadevsthan	Naubisegeruwapakha	1	1	1	300***
	Ratmatejhagarpur	10	10	10	100***
	Sallenibaguwa	20	20	20	50 #
Panchkhal	Khawakoratmate	5.8	3.3	3.3	181***
	Thuliban	412	508	300	Kg**
	Vasmepakha	622	561	629	Kg**
Phoolbari	Banskhark ka	6	4	2	200 #
	Banskhark kha	1.6	4	4	200***
	Belakholapakha	5	3	1.5	150***
	Dharapanikhareti	5	50	Nd	100***
	Voltase	4	2.2	2.5	150 #
Puranogaun	Baserithuloban	10.5	1.5	2.4	200***
Tukucha	Byangdhunga	3	3	2.7	150***
	Sanobanamaldol	1.2	3.1	2.2	100***
	Sanobandandal	15.6	5	15.6	80***
	Thulopakha	7.7	3.6	5.9	200***
Panauti Municipality	Indresworthalpu ka	8.3	8.3	5	150***
	Jyalachiti	1	1	1	300***

Source: CFUG Survey, 1999-2000.

Note: nd = no distribution of fresh fuel wood. a. Bundle of fresh fuel wood is called a dori. In principle, a bundle of fresh fuel wood, which is made of fuel wood branches of approximately 1.5 metre length, is measured with a rope of approximately 1-meter length. # refers to the average kilogram/bundle weighed using a spring balance of 50 kilograms. * * refers to the average kilogram of weighed bundles based on committee records. * * * refers to the average kilogram/bundle based on the interview with the executive members (or recall method).

The quantity of fresh fuel wood received by the randomly selected member household from CFUG is verified using household interview schedule of appendix G to ensure the completeness and consistency of the information. The household interview schedule asks respondents as to how many backloads of fresh fuel wood the adult (16-59 years) and child (10-15 years) members of the household receive from CFUG. The interview schedule intended to collect information about the backloads of fuel wood, fodder and leaf litter received by the respondents from the CFUGs for the fiscal years of 1996/97, 1997/98 and 1998/99. However, it was not possible to memorise such information for the households. Therefore, information about the backloads of fuel wood, fodder and leaf litter received by the household from the CFUG was collected for 1998/99. The check list or discussion guideline in appendix H for CFUG asks executive members how much a bundle of fuel wood carried by adult and child weighs.

Forest users receive sita in backloads. This study uses recall method to get conversion factor of the backloads of sita into kilograms. The checklist asks how many backloads of sita the CFUG supplied among the member households during the fiscal years of 1996/97, 1997/98 and 1998/99. To verify the quantity of sita received by the user members from the CFUG, the interview respondents were asked how many back-loads of sita the child and adult members of the family obtain during the seasons. The backloads of fresh fuel wood and sita carried by adult are converted into kilogram using an average conversion factor of 40 kg, while the backloads of sita carried by a child, using a factor of 20 kg.

Conversion of the quantity of fresh fuel wood and sita into dry kilograms

Aggregate quantity of fuel wood in this study includes fresh fuel wood (including branches plus wood obtained from singling/thinning of trees) plus fresh sita or twigs. Fresh fuel wood and twigs contain varying proportion of moisture. Therefore, fresh fuel wood and sita are added together after correcting moisture contents in them. The moisture content of fresh fuel wood and twigs is corrected following the method adopted by Levension (1979) and Bajracharya (1981). Bajracharya (1981) following Levension (1979) suggests that fresh fuel wood contains 75% moisture (that is, 0.74 g/ml) compared with that of the oven dry wood. He assumes that sita has 40% (that is, 0.61 g/ml) moisture content compared to that of the oven dry wood. This study adopts this approach.

Households obtain fodder and leaf litter in backloads. The information about the quantity of fodder and leaf litter received by the member households from CFUG for the fiscal years of 1996/97, 1997/98 and 1998/99 is collected using checklist of appendix H.

The backloads of grass and leaf litter received by the adults of the thuliban and vasmepakha CFUGs are converted into kilograms using a factor of 50 kg backload following the suggestion of the executives of these CFUGs. According to the executives, children are not allowed to collect grass and leaf litter from the Thuliban and Vasmepakha community forests. As per the suggestions of the executives, this study takes 40 kg as the conversion factor, of a bundle of leaf litter carried by the adults, for the 17 CFUGs. The backloads of grass of adults are converted into kilogram using a factor of 50 kg per backload. The backloads of grass and leaf litter obtained by the child are converted into kilogram using a factor of 20 kg per backload.

Furthermore, a discussion with the executive committee members revealed that a household obtains one backload of tree fodder (weighing 30 kg) per day. Our observation also detected that households use tree leaves to feed goats and milch animals (that is, cows and buffaloes). The quantity of grass and tree leaves (in kilograms) is added together to get the quantity of fodder received by the households from their respective CFUGs and own farmlands and government forest.

Pairwise computation of Karl Pearson's Correlation Coefficient Method was used to determine the preliminary relationship between performance related (like three years' average quantities of fuel wood, fodder and leaf litter) and other variables (one at a time), namely, the index of the process of decision-making, enforcement of property rights, monitoring of implementation of CFUG, primary education of the leaders, community forest area and forest types, and household's future consciousness, the caste and literacy status of the household head, family size, livestock in standard units and net crop income. The Karl Pearson's Correlation Coefficient determines the magnitude and significant relationship between dependent and independent variables. If the relationship between the dependent and the independent variables is negative, then an increase in the magnitude of the independent variable causes a reduction in the dependent variable. Alternatively, if the relationship between the dependent and the independent variable is positive, an increase in the magnitude of the independent variable causes an increase in the dependent variable.

Next, linear multiple regression is estimated to find out the overall influence of the independent variables on the performance or dependent variables. The overall fitness of the linear multiple regression model is assessed using coefficient of determination and the F test. Decision rule of the Durbin-Watson statistics is applied to detect the serial or auto correlation problem of the residuals in the model. The significance of the individual independent variables is assessed using Fisher's t-test, and thus conclusions towards the contribution of independent variables on dependent variable were derived.

The data analysis of this study was done in the computer centre of the Gokhale Institute of Politics and Economics using Statistical Package for Social Sciences (SPSS, PC +3) computer software.

The next chapter V deals with the analytical framework and hypotheses of this study. Chapters VI, VII and VIII focus on the multiple regression analysis and interpretations of fuel wood, fodder, and leaf litter models.

CHAPTER V

ANALYTICAL FRAMEWORK

5.1 INTRODUCTION

The major analytical issue of this study is that high (index of) management activism of the Community Forest User Group (CFUG) and its members' high future consciousness make it perform better, which is reflected in the distribution of a smaller amount of fuel wood, fodder and leaf litter in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

A CFUG is an autonomous non-salaried body of general as well as executive members. General assembly and executive committee further the common interests of its members through a political process involving bargaining, negotiation, and persuasion. These fora are the mechanisms for harmonising the concerns for future safety net (through protected forest) with the provision of forest produce for the current needs. *Therefore, the central proposition of this thesis is that the social choices/social actions, resulting from the decisions of the meetings of the User Groups, leads to the withdrawal of just enough quantities of forest products for the current needs in such a way that the future of the community forest is taken care of, well. Household preferences for the withdrawal of the forest products for the current needs, in this context, are reflected in the social choices/actions or political decision-making by the CFUGs. The political decision-making process of the CFUGs has to decide upon the withdrawal of smaller quantities of fuel wood, fodder and leaf litter among the users in the current period if it has to reflect the concern of the user member households about taking care of the regeneration of the forest for the future.*

This chapter is organised as follows. Section 5.2 presents the theoretical framework or the choice-theoretic problem of this study. Section 5.3 presents the implications of the theoretical model followed by testable principal hypotheses and additional analytical issues and hypotheses in section 5. 4. This chapter concludes with section 5.5.

5.2 THEORETICAL FRAMEWORK: UNDERLYING CHOICE-THEORETIC PROBLEM

Hill households are assumed to maximise a utility function given by:

$$U = u\,(C_t, C_{t+1}, L_t) \qquad (1)$$

where, C_t = current consumption, C_{t+1} = future consumption, and, L_t = current leisure time. One can include future leisure (L_{t+1}) in the above equation (1). However, this variable is dropped to simplify the model.

Current consumption (C_t) includes forest produce from the group activities (P_{Gt}) and produce from alternative activities (P_{at}).

$$C_t = P_{Gt} + P_{at} \qquad (1a)$$

Here, we have taken the alternative produce / crop also to be the same as forest produce. Otherwise, we shall need to use separate prices for forest produce and crop output. Alternatively, we can take the two prices to be both equal to unity by arbitrarily adjusting the units of measurement of the two products appropriately.

Similarly, for future period,

$$C_{t+1} = P_{Gt+1} + P_{at+1} \qquad (1b)$$

where, P_{Gt+1} = forest produce from group activities in future, and P_{at+1} = produce from alternative activities in future.

$$P_{Gt+1} = F\,(P_{Gt}, T_{Gt}, M_{Gt}) \qquad (1c)$$

where, P_{Gt} = produce from group activities, T_{Gt} = labour input to group activities for the future, and M_{Gt} = membership fee collected and expended on group activities.

Equation (1c) gives the technical production relation showing the transformation of current produce (P_{Gt}), current labour input (T_{Gt}) and expenditure of the membership fee in real terms (M_{Gt}) into future forest produce (P_{Gt+1}). Forest produce from group activities in future may depend upon the level of forest biomass in the current period. If households get more produce from group activities (P_{Gt}) at present, less may be available for the future. The level of current time devoted to the monitoring of the forest use (T_{Gt}) may determine the forest produce in the future. Forest user members may participate in meetings. Consequently, they can share information relevant for the judicious use of the community forest. Users' participation in meetings may also make them more conscious about the protection of the forest for the future.

Forest produce in future may also depend upon the level of membership fee invested for the protection of the forest in the current period. The group may establish a fund and mobilise it for the protection of the forest through a hired forest guard. The regeneration condition of community forest may improve in future because of the effective monitoring of the forest use by the hired forest guard. Thus, users may receive more produce from the community forest in the future.

Households may pay membership fee for the group (M_{Gt}) out of the current produce from the time spent in alternative activities (T_{at}). Therefore,

$$P_{at} = f(T_{at}) - M_{Gt} \qquad (1d)$$

Substituting by 1 a), 1 c), and 1 d), into (1) and introducing time allocation by households, a typical hill household is assumed to maximise utility

$$U = u((P_{Gt} + f(T_{at}) - M_{Gt}, F(P_{Gt}, T_{Gt}, M_{Gt}) + P_{at+1}, (T - T_{Gt} - T_{at})), \qquad (2)$$

with respect to P_{Gt} , T_{Gt}, T_{at}, and M_{Gt} where, T = total time.

For hill households, total time (say 24 hours) is given. Total time may be allocated for leisure time, group activities, and alternative activities. If households use part of their leisure time and time for alternative activities in monitoring of forest use and participation in meetings, the forest may be protected for the future. Consequently, more fresh fuel wood and foliage may be preserved for a better regeneration of the forest in the future.

Substituting F (P_{Gt}, T_{Gt}, M_{Gt}) by P_{Gt+1}, household's utility maximisation problem is to maximise:

$$U = u\,(P_{Gt} + f\,(T_{at}) - M_{Gt},\ P_{Gt+1} + P_{at+1},\ (T - T_{Gt} - T_{at})) \qquad (3)$$

subject to $P_{Gt+1} = F\,(P_{Gt}, T_{Gt}, M_{Gt})$.

In the above equations (2 and 3), a typical hill household can choose the levels of the following four variables.

a) current consumption of forest products from group activities (P_{Gt});
b) current expenditure of labour time in group activities (T_{Gt});
c) current produce from alternative activities devoted to the monitoring of forest use through the payment of membership fee (M_{Gt}); and
d) current expenditure of labour time (T_{at}) in alternative activities.

Therefore, we need to examine the first-order conditions for maximising the utility function represented in equation (2) with respect to each of these four choice variables (or P_{Gt}, T_{Gt}, T_{at}, M_{Gt}). These conditions are:

$$u_1 + u_2 F_1 = 0 \qquad (4)$$

$$u_2 F_2 - u_3 = 0 \qquad (5)$$

$$-u_1 + u_2 F_3 = 0 \qquad (6)$$

$$u_1 f' - u_3 = 0 \qquad (7)$$

First, u_1 and u_2 in equation (4) are the partial derivatives of utility with respect to the first and the second terms of u (or current and future consumption of forest produce). u_1/u_2 is the rate of time preference of the households or the marginal rate of substitution between the current and future consumption of forest produce. F_1 is the marginal rate of transformation of the current forest produce into future forest produce. Therefore,

$$u_1/u_2 = -F_1 \qquad (4a)$$

This implies, MRS C_t C_{t+1} = MRT P_{Gt} P_{Gt+1}

where, MRS C_t C_{t+1} = marginal rate of substitution between the current and future consumption of forest produce, and MRT P_{Gt} P_{Gt+1} = marginal rate of transformation between the current and future forest produce from group activities.

MRS C_t C_{t+1} (or $\partial C_{t+1}/\partial C_t$) shows the quantity of future consumption (or C_{t+1}) that must be given up per unit of current consumption (C_t) if the typical household is to continue to derive the same level of utility. Alternatively, it shows the typical household's time preference or preference for current consumption relative to future consumption. If $\partial C_{t+1} / \partial C_t$ is high in absolute value, the typical household has a high time preference or a high preference for current consumption relative to future consumption. Then, more of the produce that can be consumed in future (or P_{Gt+1}) is withdrawn for current consumption. Similarly, MRT P_{Gt} P_{Gt+1} (or $\partial P_{GT+1} / \partial P_{GT}$) shows the quantity of future forest produce (P_{Gt+1}) that results from the transformation of a unit of current forest produce which is not consumed in the current period. Furthermore, if $\partial P_{Gt+1} / \partial P_{Gt}$ is high large future produce results from a small sacrifice of current consumption of forest produce.

As forest is a renewable natural resource, a certain level of forest stock should be well maintained for the growth of forest biomass. In this sense, forest produce in future is an increasing function of forest biomass (that is, P_{Gt+1} = f (forest biomass). If current withdrawal of forest good crosses the threshold level of the forest biomass, the supply of forest good in the future will reduce. Consequently, future consumption of forest produce will be curtailed. Forest is protected for the future if the current withdrawal of produce takes care of the protection of the forest for the future and hence, of the growth of the regenerating plants or growing trees. Therefore, households need to be future conscious about the protection of the forest for the future.

Second, u_2 and u_3 in equation (5) are the partial derivatives of the utility with respect to the second and the third terms of u. (or future consumption of forest produce and current consumption of leisure time respectively. F_2 is the rate of transformation (or marginal productivity) of current labour input devoted to the monitoring of the community forest use for the protection of the forest for the future. Therefore,

$$u_3/u_2 = F_2 \tag{5a}$$

Implies, MRS C_{t+1} L_t = MRT P_{Gt+1} L_t

where, MRS C_{t+1} L_t = marginal rate of substitution between the future consumption of forest produce and the current consumption of leisure time, and MRT P_{Gt+1} L_t = marginal rate of transformation between the future forest produce and the current expenditure/application of labour in the group activity.

Similarly, MRS C_{t+1} L_t ($\partial C_{t+1} / \partial L_t$) gives the change in the future consumption of forest produce of a typical household for a change in the use of current leisure time in the group activity. MRT P_{Gt+1} L_t (or $\partial P_{Gt+1}/\partial L_t$) shows the future forest produce that will result from additional application of current labour input in the group activity.

For hill households, leisure is an enjoyment that gives utility. Thus, a unit use of leisure time in other activities causes a reduction in leisure time with a consequent loss in utility (Barrow 1997). Therefore, use of leisure time for work should be compensated by more consumption so that utility from consumption is equal to the loss of utility from the use of leisure time in work. The use of current labour input in the monitoring of forest use can improve the regeneration condition of the forest, thus making more forest produce available in the future.

Third, u_1 and u_2 in equation (6) are the partial derivatives of the utility with respect to the first and the second terms of u (or the current and future consumption of forest produce). F_3 shows the rate of transformation of current produce from alternative activities devoted to the monitoring of forest use through payment of membership fee into future forest produce from group activities. Alternatively, F3 is the marginal productivity of membership fee expended on monitoring. Therefore,

$$u_1/u_2 = F_3 \qquad (6a)$$

The marginal rate of substitution between the current and future consumption equals the marginal productivity of expenditure on monitoring of the forest use for the future.

That is, MRS $M_{Gt} P_{Gt+1}$ = MRT $M_{Gt} P_{Gt+1}$

where, MRS $M_{Gt} P_{Gt+1}$ = marginal rate of substitution between current produce from alternative activities devoted to the monitoring of forest use through payment of membership fee and future produce from group activity, and MRT $M_{Gt} P_{Gt+1}$ = marginal rate of transformation of current produce in alternative activities devoted to the monitoring of forest use through payment of membership fee into future forest produce in group activity.

Note that investment of membership fee in the group activity requires that the typical hill household should have high preference for the protection of the forest for the future. MRT $M_{Gt} P_{Gt+1}$ (or $\partial P_{Gt+1}/\partial M_{Gt}$) shows the marginal productivity of expenditure on monitoring of forest use. Thus, a typical household is in equilibrium if the following three conditions hold good.

a) MRS $C_t C_{t+1}$ = MRT $P_{Gt} P_{Gt+1}$ (1)

This implies that marginal rate of substitution (MRS) between the current consumption (C_t) and future consumption (C_{t+1}) of forest produce equals marginal rate of transformation (MRT) between current produce (P_{Gt}) and future forest produce (P_{Gt+1}) from group activities.

b) MRS C_{t+1} L_t = MRT P_{Gt+1} L_t (2)

Or, the marginal rate of substitution between the current application of labour input and the future consumption of forest produce equals the marginal productivity of labour input for monitoring of the forest use.

c) MRS M_{Gt} P_{Gt+1} = MRT M_{Gt} P_{Gt+1} (3)

That is, the marginal rate of substitution between the current produce from alternative activities (that is, M_{Gt} or membership fee) devoted to the monitoring of forest use and the future forest produce equals the marginal productivity of expenditure on monitoring of the forest use.

Fourth, u_1 and u_3 in equation (7) are the partial derivatives of utility with respect to the first and the third terms of u (that is, current consumption and leisure). f' is the marginal productivity of labour in alternative activities.

Rewriting equation (7), we have:

$$f' = u_3 / u_1 \qquad (7a)$$

That is, the marginal productivity of labour in alternative activities (f') equals the marginal rate of substitution between the current consumption of produce from alternative activities and leisure.

In section 5.3 below, we state the implications of the above-mentioned choice problem. Then, we state our testable hypotheses.

5.3 IMPLICATIONS OF THE CHOICE-THEORETIC PROBLEM: THE PRINCIPAL HYPOTHESES

The principal hypotheses of this study are as follows.

a) A Community Forest User Group's high index of management activism makes it perform better in terms of the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

b) A future conscious user member intends to receive a smaller amount of fuel wood, fodder and leaf litter from the CFUG. Thus, the user members' high future consciousness makes a CFUG perform better in terms of the distribution of a smaller amount of fuel wood, fodder and leaf litter among them in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

The implications of the choice-theoretic problem for each of these principal hypotheses are described below.

Management Activism

Equation (4) indicates that if a typical hill household's time preference for current forest produce from group is low relative to the future produce from the same, or if the household intends to protect the forest for the future, then it would withdraw a smaller amount of produce for the current needs.

The implication of equation (5) is that if households possess high time preference for forest produce for the future they use their current leisure time in collectivity. In Community Forestry, households use their current labour in group activities for the selection of general members for the assembly. Households select the male and female representatives for the executive committee. Similarly, households formulate and enforce rules of harvest and distribution of forest produce. They settle the withdrawal of forest produce for the current needs in meetings. Furthermore, households use their leisure time in the monitoring of forest use for the protection of the forest for the future and settlement of disputes in relation to forest use. Thus, the effectiveness of group can improve if households expend their time in these group activities. Consequently, the group can protect the forest for the future while providing a smaller amount of fuel wood, fodder and leaf litter for the current needs.

In this study, the effectiveness or management activism of a CFUG can be characterised to include the following three dimensions/aspects: a) process of decision-making, b) quality of decision making, which gets reflected mainly in a clear definition and a strict enforcement of property rights, and c) monitoring of implementation of the decisions. (The roles and responsibilities of general members/assembly and executive committee are given in appendix table A1). In the subsequent paragraphs, we define each of the components of the management activism. The paragraphs following this deal with the methodology followed in deriving the index of each of the components of management activism. Then, we analyse the theoretical underpinnings of each of the components of management activism relevant for the study of the performance of the user groups in Community Forestry and present testable theoretical propositions of this study.

Process of Decision Making

The average index of the process of decision making is the aggregate index of the a) representation of at least i) one household from each of the castes of general members, and ii) one woman in the executive committee, b) four years' average of the total of the monthly and annual meetings of 6 and above, c) four years' average attendance of at least 50% and above of the total executive members in the committee meetings, and d) decision making for the harvest and distribution of fuel wood, fodder, and leaf litter by the executive committee or assembly or both , divided by the total number of items, namely, five.

The Forest Act (1993) and its bylaws (1995) provide that villagers can form an autonomous body of their own with the provision of selecting members by themselves. Thus, the process of decision-making (hereafter, referred to as process) refers to the procedures for making Community Forest User Group Committee (CFUGC) representative so as to reflect the members' concerns and for functioning effectively. The procedure involves time for the selection of general and executive members. A gathering of households prepares name lists of potential general members. Eligible households can be members on payment of registration charge for the group, with due clearing of membership fee after tendering an application of interest to join in the group. Then, the group selects its chief and members for the executive committee. A group becomes an autonomous body after it is registered with the District Forest Office and a national forest is handed over to it. In principle, the tenure of the executive committee is for two years. Consequently, as forest users spend their time in the day to day affairs of the group, they may get more benefit out of that (following equation 5). A better process should make CFUG a representative organisation, which will be the case if all the traditional forest users are recognised as members from the very beginning of its establishment. Consequently, the group may be able to further common interests among all members.

In this study, representation of at least one household from each of the castes of the general member population in the Community Forest User Group Committee is one of the indicators of a mechanism to reflect their concerns, and thus a component of the index of process. The names of the executive members were noted down from the office records of the sample CFUG. From this list, the castes of each of the executive members is identified as hill people write their castes as surname (for example, Binod Satyal, Satyal is a Brahmin). Then, one mark was given if CFUGC represented at least one household from each of the castes of the general members, otherwise 0.

Second, women are the real users of forest products in the hills. Thus, if a woman is represented in the executive committee, she can be instrumental in providing information about forest product use. The genders of the executive members were identified from the name lists. Then, CFUG with representation of at least one woman in its executive committee was given one mark, otherwise zero while deriving the index of the process of decision-making.

Third, the constitution mandates CFUG to convene its assembly meeting once in a year; and executive committee meetings once in a month (for some) and once in two months (for others). If CFUG conducts meetings as per the mandates, it can improve the process. The information about the numbers of monthly and annual meetings for the fiscal years of 1995/96, 1996/97, 1997/98 and 1998/99 preceding the survey was noted down from the minutes of the selected CFUG. Then, four years' average number of monthly meetings of the executive committee was obtained dividing the four years' aggregates of the monthly meetings by the total number of months. Similarly, dividing the aggregates of the annual number of the assembly meetings by four, four years' average number of meetings was obtained. By adding up four years' averages of monthly and annual meetings, aggregate of the four years' average was obtained. Then, CFUG with 6 and above four years' average numbers of annual meetings was given one mark, otherwise 0.

Fourth, the attendance of members is crucial to the conduct of executive committee meetings. Quorum rules require presence of at least 50% of the committee members. If the number of members' attendance is less than the quorum rule, then scheduled meeting is postponed till the next time. Thus, in principle, executive committee meeting is held until the required numbers of members attend the meeting. The information about the number of members who attended in the monthly meetings for the fiscal years of 1995/96, 1996/97, 1997/98 and 1998/99 was noted down from the minutes of the meetings of each of the 19 CFUGs. Four years' average of members who attended in the monthly meetings was obtained by dividing aggregates of such number of members by the total number of meetings. Next, four years' average attendance of members was converted into percentage by dividing this average figure by the total number of executive committee members of the corresponding CFUG, and multiplying by 100. Then, CFUG with four years' average of the members' attendance of 50% and above of the total number of executive members in the monthly meetings was given one mark, otherwise 0.

Fifth, decision-making for the harvest and distribution of each fresh fuel wood, sita, grass, tree fodder and leaf litter by the executive committee/assembly or both is one of the yardsticks of an index of the process of decision-making. The information about decision making with reference to these products was collected from the records of the CFUGs and through discussion with the executive members. Then, 1 mark was given if CFUG committee/assembly or both made decision for the harvest and distribution of each of the above-mentioned produce, otherwise 0.

In sum, process requires that the forest users spend their time to participate in meetings to make CFUG a representative of the members, involving political decision-making, bargaining, and consensus or compromise. Thus, an improvement in process can make communication with all the caste groups and women easier. Note that hill households' membership in a group is subject to accessible distance to the community forest. In principle, households irrespective of a caste background using the forest by tradition are included in a group. Therefore, if a group has households of five castes, if at least one household from each of the castes of the general members is selected as an executive committee member, then minorities of the group are represented. It means such a representation makes communication with all the general members easier. In consequence, it may facilitate sharing of information with all the members about the critical role of hill forest and rules of forest product harvest and distribution. Thus, a better process can develop better common understanding among the members resulting in trust in the group activity. Thus, following equation (4) households may intend to receive a smaller amount of produce, if CFUG improves its index of the process of decision-making.

Thus, our thesis is that a high index of the process of decision-making of a CFUG makes it perform better, which is reflected in the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

Enforcement of Property Rights

The average index of the enforcement of property rights equals the aggregate index of the membership fee, produce, day/date, time and quantity (harvest rules) and weighing of produce (distribution rules), divided by the total number of items, namely, six.

From equation (6), we concluded that if a typical household's time preference for the current produce from alternative activities is low, then he/ she should invest in the group as membership fee (in real terms). High time preference means impatience. The implication is that if households invest in group in the form of membership fee (in real terms), they can get more forest produce in the future. Furthermore, households can produce more from alternative activities if they use part of their leisure time in alternative activities (following equation 7). Consequently, households may be able to pay membership fee for the group activities.

Next, equation (5) shows the marginal rate of transformation between future consumption of forest produce and current consumption of leisure. The implication is that if households use their current leisure time in group activity, CFUG can improve its index of enforcement of property rights. The enforcement of property rights include the following three aspects: a) rules for membership fee, b) harvest rules: produce, day/date, time of entry into and exit from forest, and quantity, and c) distribution rules: weighing or measurement of produce.

Membership fee, if effectively enforced may serve as a measure of restricting non-paying villagers from the use of the community forest. However, it may be unethical on equity ground. Those unable to afford, and hardly surviving, may be deprived. Thus, the normative requirement is that very poor households should not be charged any membership fee. However, in this study, the specification of membership irrespective of members of rich or poor categories is one of the yardsticks of the enforcement of property rights. The information about membership fee (in NRs. /annum) was collected from office records of each of the 19 CFUGs. In the data set, 1 mark was given to the CFUG if it specified the membership fee (NRs/annum), otherwise 0.

Next, if CFUGs specify and implement harvest rules, users cannot appropriate in excess of the politically decided amounts of fuel wood, fodder, and leaf litter. Consequently, CFUG may be able to store more fresh wood, fodder, and leaf litter in the forest. Lastly, if CFUG distributes weighed fuel wood, fodder and leaf litter members can receive a fair amount in proportion to the membership fee paid and voluntary labour contributed for the same. Thus, if property rights for the use of the community forest are strictly enforced, CFUG can establish its credibility across its members. The information about each of the aspects of harvest and distribution rules was collected through discussion with the executive committee members and verified through observation by the field research team. Then, 1 mark was given if CFUG specified each of the aspects of harvest (namely, produce, day/date, time and quantity) and distribution (that is, weighing) rules, otherwise 0.

Thus, if CFUG improves its index of enforcement of property rights in accordance with the above stated yardsticks, it can protect the forest for the future with the provision of a smaller amount of produce in the current period.

Therefore, we attempt to understand whether a high index of the enforcement of property rights influences the distribution of fuel wood, fodder and leaf litter from the CFUGs among the user members.

Monitoring of Implementation of the Decisions

The average index of the monitoring of the implementation is the aggregate index of the forest guard/group patrol, fines from rule breakers, harvest of produce in group and amount of money spent in village development activities, divided by the total number of items, namely, four.

The implication of equation (5) of section 5.2 is as follows. If user members use part of their leisure time in matters concerning the monitoring of implementation of the decisions, then CFUG improves its index of the monitoring of implementation. Consequently, CFUG may be able to preserve more fresh fuel wood and foliage in the current period for a better regeneration of the forest in the future. From equation (7), we concluded that the marginal productivity of labour in alternative activities equals the marginal rate of substitution between the current consumption of produce from alternative activities and leisure. Intuitively, households can pay as membership fee for the group out of the increased produce of alternative activities. CFUG can establish fund of its own from membership fee. It can hire a forest guard for monitoring of forest use to protect the forest for the future.

By monitoring of the implementation (hereafter referred to as monitoring), we mean the mechanisms of making CFUG a credible institution. In principle, human beings behave strategically. Thus, in the absence of supervision of forest use, the community forest is over-exploited. The crucial role of forest monitors lies in hired forest guard or voluntary group patrol. The information about the system of forest guard or group patrol was obtained through discussion with the executive members and verified with the observation by the field research team. Then, CFUG with forest guard or voluntary group patrol was given 1 mark, otherwise 0.

Furthermore, CFUG improves an index of its monitoring, if it introduces punitive measures on rule breakers or collects fines from those collecting produce illegally. The information about the fines in rupees collected from rule breakers was noted down from the office records of each of the 19 CFUGs. Then, CFUG with a record of fines collected from rule-breakers in rupees was given 1 mark, otherwise 0.

Third, an index of monitoring improves, if monitors strictly control individual access to forest produce. Alternatively, if monitors allow group harvesting of produce, then users can be watchdogs against each other's forest use behaviour. Thus, group harvesting can ensure effectiveness of monitoring of the forest use behaviour of users. The information regarding harvest of fuel wood, fodder and leaf litter in group or otherwise was collected through discussion with the executive committee members followed by forest visit by the field research team. In the data set, CFUG with group harvesting of fuel wood, fodder and leaf litter was coded as 1, otherwise (for individual harvesting of each one of these) 0.

Next, the Forest Act (1993) and its byelaws (1995) stipulate that CFUG can mobilise 25% of its income for the protection and development of the forest and the rest (or 75%) in village development activities. If CFUG mobilises some of its fund in village development activities, then it can be instrumental in cementing the relationship among its members. CFUG can establish itself to be complementary to governmental organisation. The information about the funds mobilised (in rupees) in village development activities was noted down from the office records of the 19 CFUGs. Then, the CFUG with a record of fund mobilised in village development activities was given 1 mark, otherwise 0.

Thus, if households use part of their leisure time for the monitoring of forest use and adopt punitive measure, CFUG may be able to protect more produce in the community forest (following equation, 5). *Therefore, we intend to understand whether a high index of the monitoring of the implementation of the decisions influences the distribution of fuel wood, fodder, and leaf litter from the CFUG among the user members.*

In sum, our thesis is that a high index of the management activism of a CFUG (or sum of the average index of the process, enforcement and monitoring) makes it perform better, which is reflected in the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

Future Consciousness of the User Members

By future consciousness, we mean the alertness for the protection of the community forest for the future or long time horizon of a typical household. Equation

(4) of the above mentioned choice-theoretic problem (section 5.2) indicates that a typical hill household's time preference for the current forest produce relative to the forest produce in future is low. It implies that households should give priority for the protection of the forest for the future with the provision for a smaller amount of produce for the current needs. Forests protect hill natural system: protect water source and soil, thus rejuvenating downstream farmlands and barricading upstream floods. Similarly, hill forests complement the household economy by providing basic products for human sustenance, livestock keeping and farming.

Furthermore, the implication of equation (5) is that if user members are more future conscious, they invest their current leisure time for the promotion of knowledge about the benefits of the protected community forest among themselves.

Thus, our theoretical premise is as follows. A future conscious household intends to receive a smaller quantity of fuel wood, fodder and leaf litter from the CFUGs in the current period so as to preserve more fresh fuel wood, fodder and leaf litter for a better regeneration of forest in the future. Thus, a high future consciousness of a typical household makes a CFUG perform better in terms of the current distribution of a smaller amount of fuel wood, fodder and leaf litter among its members while protecting the community forest for the future.

5.4. ADDITIONAL ANALYTICAL ISSUES AND HYPOTHESES

i) Whether there is a significant statistical relationship between the percentage of executive members educated at least with some primary education (any grade from the 1^{st} to the 5^{th} grade), and three years average quantity of fuel wood, fodder, and leaf litter received by ith household from CFUG.

ii) CFUGs with a larger area of forest supply a smaller amount of fuel wood and leaf litter among the user members.

iii) Whether an increase in the community forest area increases fodder from the CFUGs.

iv) A typical household receives a smaller amount of fuel wood from the natural forest.

v) Whether there is a significant statistical relationship between the plantation plus natural forest, and the quantities of fodder and leaf litter received by the user members from the CFUG,

vi) Whether there is a significant statistical relationship between the natural forest, and the quantities of fodder and leaf litter received by the user members from the CFUG.

vii) The caste Brahmin/Chhetri plan to receive a smaller amount of fuel wood, fodder and leaf litter from the community forest.

viii) Whether there is a significant statistical relationship between the literacy of the household head and the average quantity of the fuel wood, fodder and leaf litter received from the community forest.

ix) The user members with a larger family size plan to receive larger quantities of fuel wood, fodder and leaf litter from the community forests.

x) The user members with a larger size of livestock in standard units intend to receive larger quantities of fuel wood, fodder, and leaf litter from the community forest.

xi) A typical household with a high net income from crops receives a smaller amount of fuel wood, fodder and leaf litter from the community forest.

xii) A typical household obtaining larger quantities of fuel wood, fodder and leaf litter from its own farmlands receives smaller quantities of the same from the community forests.

xiii) A typical household obtaining larger quantities of fuel wood, fodder and leaf litter from the government forest would want to receive smaller quantities of the same from the community forests.

5.5 CONCLUSION

This study finds that the determination of the typical hill household's equilibrium requires simultaneous choice of optimal current and future consumption of produce (including the produce from forest user group and alternative activities), investment of labour input for future produce in the group and alternative activities and investment of real produce through payment of membership fee devoted to the monitoring for the protection of the forest for the future.

The principal hypotheses formulated following the implications of choice-theoretic problem are as follows. A high management activism of the Community Forest User Group and its members' high future consciousness makes it perform better, which is reflected in the distribution of a smaller amount of fuel wood, fodder and leaf litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

In the next three chapters (that is, VI, VII, and VIII) after this, we aim at verifying the choice-theoretic problem using linear multiple regression. We analyse and interpret the results of the linear multiple regression of fuel wood, fodder and leaf litter models in each of these chapters. We assess the fitness of each of these models using R^2 and Durbin-Watson statistics. Similarly, we assess the significance of the coefficients of the explanatory variables using Fisher's t-statistics and derive conclusions whether the principal hypotheses and additional analytical issues and hypotheses are empirically valid.

CHAPTER VI

EMPIRICAL FINDINGS FROM THE FUEL WOOD MODEL

6.1 INTRODUCTION

In chapter V, it was brought out that the determination of the typical household's equilibrium requires simultaneous optimal choice of consumption of forest produce from group, labour input in the group and alternative activities, and expenditure on monitoring of group forest over time. The major conclusions derived in that chapter are as follows. First, equation (4) of that chapter shows that the marginal rate of time preference or the marginal rate of substitution between current consumption and future consumption of forest produce equals the marginal rate of transformation between current and future consumption of forest produce from group activities. Therefore, the choice problem is to choose that level of forest produce for the current consumption, which maximises utility of the typical household with safe regeneration condition of forest over time. Therefore, hill households need to be future conscious about the protection of the forest for the future. Thus, the thesis is that the future conscious household intends to receive a smaller amount of forest produce from group activity in the current period so as to preserve more fresh fuel wood for a better regeneration of the forest in the future. Second, the marginal rate of substitution between the future consumption of forest produce and the current consumption of leisure time equals the marginal rate of transformation of current labour input in group activity into future forest produce (equation 5 of chapter V). Intuitively, the typical household should choose a level of current labour input for the effective monitoring of forest use so that the current leisure is transformed into a higher level of protected community forest over time. If user members spend part of their leisure time in matters concerning management activism of the group, the Community Forest User Group (CFUG) improves its index of management activism. The thesis is that households intend to receive a smaller amount of fuel wood from the CFUG in the current period, if it improves its index of management activism. Third, the marginal rate of substitution between the current consumption of produce from alternative activities devoted to the monitoring of forest use through payment of membership fee and future consumption of forest produce from group activity equals the marginal rate of transformation of current produce from alternative activities devoted to monitoring through payment of membership fee into future forest produce in group activities (equation 6 of chapter V). Intuitively, the typical household should choose a level of produce from alternative activities to invest as membership fee in group so that the payment of the same is transformed into a higher level of protected forest produce through effective monitoring over time. If households pay membership fee for the group, the group can hire a forest guard to monitor forest use effectively. Lastly, the marginal rate of substitution between the current and the future consumption of labour input in alternative activities equals the marginal productivity of labour in alternative activities (equation 7 of chapter V). Thus, the choice problem for a typical household is to choose that level of current labour input that maximises utility with the increase of production in future. The implication is that if households use their leisure time in making labour input in alternative activities, they can maximise their utility through augmenting more produce since they can pay part of the produce from alternative activities as membership fee for the group. CFUG can mobilise part of the membership fee in village development activities to cement its relationship with all the user members.

In this chapter, we provide the answers to the questions as to why a higher value of the index of management activism of the CFUG and its user members' future consciousness make it perform better, which is reflected in the distribution of a smaller amount of fuel wood among its members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. Then, we see whether the above stated conclusions of choice-theoretic problem and their implications are validated by the empirical results of the linear multiple regression fuel wood model.

This chapter is organised as follows. Section 6.2 presents the definitions of the dependent and independent variables. Section 6. 3 deals with the testing of hypotheses. The average statistics of the dependent and independent variables are given in section 6.4. In section 6.5, we discuss the methodology of the selection of estimable linear multiple regression fuel wood model. Section 6.6 presents the estimable equation for the fuel wood model. The estimated linear multiple regression for the fuel wood model and the interpretations of these results are given in section 6.7. This chapter concludes with section 6.8.

6.2 DEFINITIONS OF THE DEPENDENT AND INDEPENDENT VARIABLES OF THE MODEL

The definitions of the dependent and independent variables used in the present model are given in table 6.1 below.

Table 6.1

Dependent and Independent Variables of the Fuel Wood Model and Their Definitions

Variables	Description
Dependent variable Fuel wood (P_{ik})	Three years' average fuel wood received (in thousand kgs) by the ith household from the kth CFUG consisting of fresh fuel wood and twigs added together after correction of moisture contents [1].
Independent Variables	
PROCESS	Average index of the process of decision-making. It is the aggregate of the index of a) representation of caste (1 for representation of at least one household from each of the castes of general members, otherwise 0), and b) woman (1 for representation of at least one woman, otherwise 0) representative in the executive committee, c) decision-making for the harvest and distribution of fuel wood (1 for decision making by the committee/assembly or both, otherwise 0), d) decision making for the harvest and distribution of sita (1 for decision-making by the committee/assembly or both, otherwise 0), e) number of annual meetings (1 for four years' average of the total of the monthly executive committee and annual general assembly meetings of 6 and above, otherwise 0), and f) attendance of executive committee members in the meetings (1 for four years' average attendance of the 50% and above number of members of the total committee members in the executive meetings, otherwise 0), divided by the total number of items (or 6).
ENFORCE-MENT	Average index of the enforcement of property rights. It includes aggregate index of a) membership fee (1 if membership fee is specified, otherwise 0), b) harvest rules of fuel wood (1 if each I) produce, ii) day/date, iii) time and iv) quantity is specified, otherwise 0), c) sita (1 if each i) produce, ii) day/date, iii) time, and iv) quantity is specified, otherwise 0), d) distribution of fuel wood (1 if fuel wood is weighed, otherwise 0), e) distribution of sita (1 if sita is weighed, otherwise 0) divided by the total number of items (or 11).
MONI-TORING	Average index of the monitoring of implementation. It is the aggregate index of a) forest guard or group patrol (1 if hired forest guard/group patrol, otherwise 0), b) harvest of fuel wood in group (1 for group harvest, otherwise 0), c) harvest of sita in group (1 for group harvest, otherwise 0), d) amounts of fines from rule breakers (1 for fines in rupees collected from the rule breakers, otherwise 0), e) mobilisation of fund (1 for mobilisation of fund in village development activities in rupees, otherwise 0) divided by the total number of items (or 5).
LEAD P ED	Percentage of the members of the executive committee educated at least with some primary education (that is, any grade from the 1st to the 5th grade). By leaders, we mean the members of the executive committee of the Community Forest User Groups.
FOREST	Forest area in hectares
NATURAL	Natural forest of mixed species of trees without plantation (1 for natural forest, otherwise 0).
FUT CONSC	Dummy variable taking the value 1 if household head claims to be future conscious about the protection of the community forest, zero otherwise.
FAM SIZE	Number of members in the family of the ith household
LU	Livestock including cattle, buffalo and goat in standard units.
CROP	Net income of the Ith household from crops in NRs. 1000.
FARM FUEL	Quantity of fuel wood (in thousand kgs) obtained by the ith household from own farmlands consisting of fresh fuel wood and sita added together after the correction of moisture content. (1 for household collecting fuel wood from own farm lands, otherwise 0).
GOVERN-MENT FUEL	Quantity of fuel wood (in thousand kgs) obtained by the ith household from government forest consisting of fresh fuel wood and sita added together after the correction of moisture content (1 for household collecting fuel wood from the government forest, otherwise 0).
CFUG 3	Shift dummy or dummy for ratmatejhagarpur CFUG, (CFUG 3). (1 for CFUG 3, otherwise 0).
CFUG 9	Shift dummy or dummy for banskhark kha CFUG, (CFUG 9). (1 for CFUG 9, otherwise 0).
CFUG 14	Shift dummy or dummy for byangdhungathulopakha CFUG, (CFUG 14). (1 for CFUG 14, otherwise 0).
CFUG 1 FUT	Slope dummy or dummy for the responses of the future consciousness of the households of vakundebesi, (CFUG 1). CFUG 1 * future consciousness of the ith household of CFUG 1.
CFUG 2 FUT	Slope dummy or dummy for the responses of the future consciousness of the households of naubise, (CFUG 2). CFUG 2 * future consciousness of the ith households of CFUG 2.
CFUG 6 FUT	Slope dummy or dummy for the responses of the future consciousness of the households of thuliban, (CFUG 6). CFUG 6 * future consciousness of the ith households of CFUG 6.
CFUG 10 FUT	Slope dummy or dummy for the responses of the future consciousness of the households of belakhola, (CFUG 10). CFUG 10 * future consciousness of the ith households of CFUG 10.
CFUG 11 FUT	Slope dummy or dummy for the responses of the future consciousness of the households of dharapanikhareti, (CFUG 11). CFUG 11 * future consciousness of the ith households of CFUG 11.
CFUG 15 FUT	Slope dummy or dummy for the responses of the future consciousness of the households of sanobanamaldol, (CFUG 15). CFUG 15 * future consciousness of the ith households of CFUG 15.

6.3 TESTING OF HYPOTHESES

The above-mentioned principal hypotheses are tested preliminarily using Karl Pearson's Correlation Coefficient Method. The Karl Pearson's Correlation coefficient between three years' average quantity of fuel wood received (in thousand kgs) by ith household and the index of the PROCESS (-0.25), ENFORCEMENT (-0.58) and MONITORING (-0.26) and FUT CONSC (-0.20) have negative signs. Each of these coefficients is significant at the 1% level. Thus, these coefficients indicate that at a high index of PROCESS, ENFORCEMENT, and MONITORING of the group reduces the current distribution of fuel wood from CFUG. Similarly, the significant statistics of the negative coefficient of the future consciousness indicate that a future conscious household intends to receive a smaller quantity of fuel wood from the CFUG. Table 6.2 shows the Karl Pearson's Correlation Coefficient matrix of the dependent and independent variables.

Table 6.2

Karl Pearson's Correlation Coefficients Between Dependent (CFUG fuel wood) and Independent Variables of Fuel Wood Model

	Cfug Fuel	Process	Enforce-ment	Moni-toring	Lead p edu	Forest	Natu-ral forest	Fut Consc	Fam Size	Lu	Crop	Farm Fuel	Govern-ment fuel
Cfug fuel	1.00	-0. 25**	-0.58**	-0.26**	0.15**	0.18**	-0.05	-0.20**	0.02	0.07	0.03	-0.07	-0.09
Process	-0.25**	1.0	0.54**	0.72**	0.50**	0.20**	-0.06	0.33**	-0.01	0.10*	0.04	0.23**	-0.58**
Enforcement	-0.58**	0.54**	1.00	0.44**	0.06	-0.13*	-0.20**	0.33**	0.03	0.05	0.06	0.17**	-0.13*
Monitoring	-0.26**	0.72**	0.44**	1.00	0.32**	-0.02	-0.04	0.30**	0.07	0.21**	0.16**	0.23**	-0.04
Lead p edu	0.15**	0.50**	0.06	0.32**	1.00	-0.16**	0.24**	0.11*	0.05	0.01	0.05	0.19**	-0.26**
Forest	0.18**	0.20**	-0.13*	-0.02	-0.16**	1.0	-0.37**	-0.22**	-0.02	0.13**	0.23*	0.20**	-0.29**
Natural forest	-0.05	-0.06	-0.20**	-0.04	0.24**	-0.37**	1.00	0.21**	-0.07	-0.11*	-0.09	-0.07	0.18**
Fut consc	-0.20**	0.33**	0.33**	0.30**	0.11*	-0.22**	0.21**	1.00	-0.05	0.01	0.01	0.12*	-0.15**
Fam size	0.02	-0.01	0.03	0.07	0.05	-0.02	-0.07	-0.05	1.0	0.40**	0.49**	0.001	0.16**
LU	0.07	0.10*	0.05	0.21**	0.01	0.23**	-0.11*	0.01	0.40**	1.00	0.61**	0.26**	0.21**
Crop	0.03	0.04	0.06	0.16**	0.05	0.23*	-0.09	0.01	0.49**	0.61**	1.00	0.16**	0.25**
Farm Fuel	-0.07	0.23**	0.17**	0.23**	0.19**	0.20**	-0.07	0.12*	0.001	0.26**	0.18**	1.00	-0.01
Government fuel	-0.09	-0.59**	-0.13*	-0.04	-0.26**	-0.29**	0.18**	-0.15**	0.16**	0.21**	0.25**	-0.01	1.00

Source: table 6.3.

Note: ** Karl Pearson's correlation coefficient significant at the 1% level.

* Karl Pearson's Correlation coefficient significant at the 5% level.

N = 256

6.4 SELECTION OF ESTIMABLE FUEL WOOD MODEL

The estimable equation of fuel wood model is selected following a number of trial and error processes as given below. First, the data about PROCESS, ENFORCEMENT and MONITORING, LEAD P EDU, FOREST, and NATURAL forest are entered as continuous variables across the household level data. Then, household level data is placed by sources of origin of fuel wood: single community forests plus own farmlands (208 households), single community forest, own farmland plus government forest (48 households), and single community forest, own farmlands plus additional community forest (50 households). Then, separate fuel wood models of linear multiple regression are developed for the households of each of these categories. However, linear multiple regressions performed for each of these models using SPSS did not show the expected signs of the coefficients of PROCESS, ENFORCEMENT, MONITORING and FUT CONSC.

Next, by clubbing the household level data on households depending for fuel wood on a community forest, own farmlands, plus government forests for fuel wood, we created a fuel wood model for 256 households. Furthermore, by clubbing the household level data on households depending on a single forest, own farmlands, and an additional community forests for fuel wood, we created another fuel wood model for 258 households. However, the results of the multiple linear regression showed very poor R^2, and insignificant Durbin-Watson statistics.

Similarly, dummies of the CFUG are created following the approach as mentioned in table 6.1. Then, multiple regression exercises are carried out separately for each of these models. The t-statistics for predictors (as management activism, future consciousness) were not significant.

Next, two more dummy variables are added, one being the ith household's future consciousness (like CFUG 1 Fut, CFUG 2 Fut, CFUG 6 Fut, CFUG 10 Fut, CFUG 11 Fut and CFUG 15 Fut) and another, being the satisfaction with the current produce received from the CFUG. The dummy for future consciousness is obtained following the approach as mentioned in table 6.1 above. Then, regression exercises run for the 256 households yielded significant Durbin-Watson statistics and t-statistics for the coefficients of PROCESS, ENFORCEMENT, MONITORING and FUT CONSC. Thus, 256 (or 16 CFUG) out of the 306 households (or 19 CFUG) are selected for linear multiple regression fuel wood model. The satisfaction[2] with the current produce received by ith household is dropped from this model. In this model, satisfaction with the current produce received was taken as an independent variable, not associated with the future consciousness. However, satisfaction is the performance variable and it may be directly associated with the future consciousness. Therefore, this satisfaction variable is dropped. The symbols used to predict and analyse the statistical relationship between dependent variable and independent variables are given in section 6.5.

6.5 THE FUEL WOOD MODEL

$$P_{ik} = \beta_0 + \beta_1\,(\text{PROCESS})_k + \beta_2\,(\text{ENFORCEMENT})_k + \beta_3\,(\text{MONITORING})_k + \beta_4\,(\text{LEAD P EDU})_k + \beta_5\,(\text{FOREST})_k + \beta_6\,(\text{NATURAL})_k + \beta_7\,(\text{FUT CONSC})_i + \beta_8\,(\text{FAM SIZE})_i + \beta_9\,(\text{LU})_i + \beta_{10}\,(\text{CROP})_i + \beta_{11}\,(\text{FARM FUEL})_i + \beta_{12}\,(\text{GOVT FUEL})_i + \beta_{13}\,(\text{CFUG 3}) + \beta_{14}\,(\text{CFUG 9}) + \beta_{15}\,\text{CFUG 14}) + \beta_{16}\,(\text{CFUG 1 Fut})_i + \beta_{17}\,(\text{CFUG 2 Fut})_i + \beta_{18}\,(\text{CFUG 6 Fut})_i + \beta_{19}\,(\text{CFUG 10 Fut})_i + \beta_{20}\,(\text{CFUG 11 Fut})_i + \beta_{21}\,(\text{CFUG 15 Fut})_i \qquad (1)$$

where, subscript i refers to the ith household and k to kth CFUG. β_0 refers to the intercept. $\beta_1 - \beta_{21}$ refer to the slope coefficients. These slope coefficients refer to the predicted change in the left-hand side variable (or dependent variable) which can be attributed to the corresponding right-hand side (or independent variables), with the rest of the independent variables remaining constant.

6.6 AVERAGE STATISTICS OF THE DEPENDENT AND INDEPENDENT VARIABLES AND DATA SOURCES

Dependent Variable

On an average, a household receives three years' average of 1,373 kgs of fuel wood from CFUG per annum. Fuel wood consists of aggregate kilograms of fuel wood and sita added together, after correcting moisture contents of fresh fuel wood and sita. The chapter IV presents the methodology used to get the moisture contents corrected fuel wood and sita of fresh fuel wood and fresh sita. The data on the supply of fresh fuel wood for the three fiscal years of 1996/1997, 1997/1998 and 1998/1999 was noted down from the office records of each of the 19 CFUGs. The data on fresh sita for these three years was obtained through discussion with the executive committee members of each of the 19 CFUGs. In addition, the quantity of fuel wood received by the member households from each of the 19 CFUGs was verified through interviews using household interview schedule (Appendix G). The chapter IV presents the methodology applied in the data collection for fresh fuel wood and sita. The approach adopted to convert fuel wood and sita bundles into kilograms is given in chapter IV.

Independent Variables

Management Activism

The average index of PROCESS, ENFORCEMENT, and MONITORING are respectively 0.53, 0.48 and 0.63. Section 5.3 of chapter IV discusses the methodology applied for the data collection of each of these aspects of management activism. The approach followed to derive the index of each of these aspects of management activism is given in table 6.1 above.

About 55% of the executive committee members have at least some primary education (any grade from the 1st to the 5th grade).

Forest Related Attributes

The CFUGs in the survey villages own 40.2 hectare of community forest (on average). About 19% of the 256 households own natural forest of mixed tree species. The methodology of data collection for each of these aspects is discussed in chapter IV.

The above-mentioned six independent variables (that is, PROCESS, ENFORCEMENT, MONITORING, LEAD P EDU, FOREST and NATURAL) are the group level data for this study. Each of these data was placed as continuous series in the spreadsheet of household level data (following Adhikari, 2001).

Household Related Attributes

In response to the question: "Do you agree that the community forest should be protected for the future?" 59% of the total 256 households replied positively. We refer to this variable as user members' future consciousness or alertness about the protection of the forest for the future.

Similarly, a household has 6.9 family members on an average. A household owns 3.7 livestock (including, cattle, buffalo and goat) in standard units. Furthermore, a sample household earns a net crop income of NRs. 3,515 per annum. It is the aggregate of the net income of the major three cereal crops (like rice, wheat and maize) and other minor crops (mustard, potato, tomato and green vegetables). A household obtains 637 kgs of fuel wood from own farmlands, and 188 kgs of fuel wood from the government forests. Of the total 356 households 48 obtain fuel wood from the government forest. While slightly over two thirds of 306 (or 206) households obtain fuel wood from own farmlands. The methodology of data collection for each of the above-mentioned household related variables is given in chapter IV. Table 6.3 shows the average statistics of dependent and independent variables of the fuel wood model.

Table 6.3

Average statistics of the Dependent and Independent Variables of the Fuel Wood Model

Variables	Unit	Mean	Std. Deviation
Fuel wood (3 year's average)	000 kgs	1.373	0.938
PROCESS	Index	0.53	0.252
ENFORCEMENT	Index	0.48	0.204
MONITORING	Index	0.63	0.273
LEAD P EDU	%	55.09	18.186
FOREST	Hectare	40.22	40.696
NATURAL	1 or 0.	0.19	0.391
FUT CONSC	1 or 0	0.59	0.492
FAM SIZE	Number	6.93	2.843
LU	In standard unit	3.66	2.064
CROP	NRs. 000	35.15	28.507
FARM FUEL	000 kgs	0.637	0.482
GOVERNMENT FUEL	000 kgs	0.188	0.391
CFUG 3		0.063	0.241
CFUG 9		0.063	0.243
CFUG 14		0.063	0.243
CFUG 1 FUT		0.047	0.212
CFUG 2 FUT		0.063	0.243
CFUG 6 FUT		0.063	0.243
CFUG 10 FUT		0.017	0.108
CFUG 11 FUT		0.027	0.163
CFUG 15 FUT		0.059	0.235

Note: N = 256. LU = average livestock in standard unit.

1 LU = 0.8 buffalo = 1.0 cattle = 5.0 goats (The University of Reading 2001).

Source: the information about household related variables was collected during 1999 to 2000. The information about the CFUG related variables was gathered during 2001.

The above table 6.3 depicts that the statistics of the standard deviation of each of the above mentioned independent variables are smaller than that of their corresponding averages except for the community forest area. This means that there is not much variability in these data. However, the statistics of the standard deviation of the community forest area is marginally greater (that is, by 0.476). It implies that there is slight variation in the community forest area owned by the CFUGs.

6.7 INTERPRETATIONS

Overall Fit of the Model

The coefficient of the constant or the intercept depicts the average or mean effect on the dependent variable of all the variables omitted from the regression model (Gujarati, 2003). The coefficient of multiple regression is positive (0. 983). It indicates that the dependent variable has a high positive correlation with the regressors keeping the other variables constant. The coefficient of multiple regression determination (or

R^2) is 0.967. It means that about 97 % of the variation in the dependent variable is explained by the 21 explanatory variables, keeping the other factors constant. Since the estimate of R^2 is near to unity, it suggests that sample regression line explains the data fairly well. The multiple correlation coefficient obtained by the prediction by the 21 independent variables is tested for significance using F statistics. The F statistics (that is, 322.987 at degrees of freedom of df1 = 21 and df2 = 234) is significant at the 1% level ($p = 0.000$).

To detect the autocorrelation problem in the model, the Durbin-Watson Statistics is used. The estimated Durbin-Watson statistic is 2.194. The significant level of Durbin-Watson is assessed using the standard decision rule (Gujarati 2003). The estimated Durbin-Watson statistic (2.194) is greater than its table value (that is, 4-du or 1.991) at the 5% level of significance. Therefore, the decision rule states that there is no positive or negative autocorrelation in the model. Table 6.4 presents the coefficients, standard errors, and t-statistics and their significance levels for the linear multiple regression fuel wood model.

Table 6.4

Estimated Coefficients, Standard Errors, t- Statistics and Their Significance Levels for the Fuel wood Model

Explanatory variables	Coefficients	Standard errors	t-statistics
Constant	4.539	0.152	29.894*
PROCESS	-8.790	0.297	-29.641*
ENFORCEMENT	-5.627	0.178	-31.688*
MONITORING	4.966	0.186	26.639*
LEAD P EDU	0.036	0.002	16.916*
FOREST	-0.0048	0.001	-7.673*
NATURAL	-2.328	0.073	-31.909*
FUT CONSC	-0.061	0.031	-1.987**
FAM SIZE	0.012	0.005	2.516*
LU	0.032	0.008	-4.275**
CROP	-0.0015	-0.001	-2.784*
FARM FUEL	-0.066	0.027	-2.468*
GOVERNMENT FUEL	1.010	0.085	11.899*
CFUG 3	-4.981	0.174	-28.626*
CFUG 9	-6.629	0.167	-39.724*
CFUG 14	-0.989	0.080	-12.379*
CFUG 1 FUT	0.256	0.070	3.649*
CFUG 2 FUT	0.231	0.063	3.641*
CFUG 6 FUT	3.502	0.106	33.127*
CFUG 10 FUT	0.199	0.116	1.710***
CFUG 11 FUT	0.136	0.094	1.443
CFUG 15 FUT	0.188	0.070	2.708*

$R = 0.983$ $R^2 = 0.967$ Adjusted $R^2 = 0.964$ Standard error of estimate = 0.179
Regression F = 322.987 (significant at the 1% level, $p = 0.000$) df 1 = 21 and df 2 = 234

Durbin- Watson = 2.194 (significant at the 5% level). N = 256

Note: * t-statistics significant at the 1% level (p = 0. 000). ** t -statistics significant at the 5% level (p = 0.048). *** t -statistics significant at the 10% level (p = 0.089).
Source: table 6.3.

Significance of the Coefficients of the Explanatory Variables

In this study, Fisher's t-test[3] is applied to determine if the partial coefficients (β that contributed to the performance variable or 1000 kgs of three years' average fuel wood received by the ith household from CFUG) are significant. If each partial coefficient is significant then it contributes to the prediction of the performance of CFUG independently of the chance variation.

The above table 6.4 depicts that the t-statistics of coefficients of PROCESS (p = 0.000), ENFORCEMENT (p = 0.000), MONITORING (p = 0.000) are significant at the 1% level. The t-statistic of the coefficient of FUT CONSC (p = 0.048) is significant at the 5% level. Therefore, we accept the hypotheses that a high actual statistics of PROCESS, ENFORCEMENT, MONITORING, make a CFUG perform better in terms of the distribution of a smaller amount of fuel wood among the user members in the current period to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. The significance statistic of the coefficient of future consciousness provides support to the hypothesis that the future conscious households intend to receive a smaller amount of fuel wood from the CFUGs in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

The coefficients of FOREST (p = 0.000) and NATURAL FOREST (p = 0.000) are significant at the 1% level. However, the t-statistics of the coefficients of plantation, and plantation plus natural forest or natural forest with plantation of pines were not significant. Therefore, these two variables were dropped from this model.

The coefficients of LEAD P EDU (p = 0.000) & FAM SIZE (p = 0.013) are significant at the 1% level. We accept the alternate hypotheses that the partial coefficients of these explanatory variables predict the changes in the dependent variable. We dropped the coefficient of the percentage of the leaders up to secondary education (up to any grade from 6 to 10 grade) because the t- statistic of this coefficient was not significant.

The t-statistics of the coefficients of the literacy status of the household head and the caste Brahmin/Chhetri were not significant. Therefore, these variables are dropped from this model. The t-statistics of the coefficient of net crop income is significant at the 1% level. Therefore, we accept the hypothesis that a typical household with a high net income from crops receives a smaller quantity of fuel wood from the CFUGs.

The t-statistics of the coefficients of FARM FUEL (p = 0.014) is significant at the 1% level. Therefore, we accept the hypothesis that households obtaining a larger average quantity of fuel wood from own farmlands receive a smaller quantity of the same from the community forest. However, we assumed that a typical household receiving a large quantity of fuel wood from the government forest receives a smaller quantity of fuel wood from the community forest. We expected a negative coefficient of the average quantity of fuel wood from the government forest. Therefore, this hypothesis is not borne out.

Similarly, the t-statistics of the coefficients of the dummies for CFUG 3 (p = 0.000), 9 (p = 0.000) and 14 (p = 0.000) are significant at the 1% level. Therefore, these coefficients capture the variation from common intercept term for the 16 CFUGs. The coefficients of dummy for the responses to future consciousness of CFUG 1 (p = 0.000), 2 (p = 0.000), 6 (p = 0.000) and 15 (p = 0.007) are significant at the 1% level.

The t statistic of the coefficient of the dummy for the responses to future consciousness of the households of CFUG 10 (p = 0.089) is significant at the 10% level. Therefore, these dummies capture the variation in the responses to the future consciousness among the 256 households. However, the t-statistic of the coefficient of the dummy for the future consciousness of the households from CFUG 11 (p = 0.150) is not significant. We used this dummy as a control variable to achieve significant Durbin-Watson statistic.

Interpretations of the Coefficients of Explanatory Variables

Management Activism

The implication of equation (5) of the choice-theoretic problem of section 5.2 of chapter V is that if forest user members use their leisure time in matters concerning PROCESS, ENFORCEMENT, and MONITORING of the group, the group improves indices of each of these aspects. Furthermore, equation (4) of chapter V shows the typical hill household's time preference between current consumption and future consumption of forest produce from group activities. The implication of this statement is that if households are future conscious, they intend to receive a smaller amount of fuel wood from CFUG in the current period to preserve more fresh fuel wood and foliage for a better regeneration of the forest for the future. For example, the coefficient of the average index of PROCESS is negative (that is, -8.790). It implies that one unit increases in the average index of PROCESS reduces the current distribution of fuel wood from CFUG by 8,790 kgs per annum per household. PROCESS improves, if members use part of their leisure time to conduct and participate in the meetings. CFUG improves its index of PROCESS, if it decides harvesting and distribution of fuel wood in meetings, represent at least one household from each of the castes of general members and at least one woman in the executive committee, and organises meetings as per its mandates. Attendance of the executive committee members as per the quorum rules enables the CFUG to hold meetings and thus improves PROCESS.

In chapter III, we argued that if forest user members develop a common understanding in terms of the dependence on forest products and social relations, CFUG performs better. The implication is that CFUG meetings provide opportunity for the user members to enrich knowledge about the intimate linkage between the forest and the user members' livelihood. Consequently, user members develop common understanding among each other, that forest is essential for the hill economy and the development of the vision of reciprocity (or functioning in a co-operative manner, following the rule of the game). This common understanding enables CFUG to arrive at consensus in decision-making to withdraw forest products for the current needs so that the future of the forest is taken care of, well.

Similarly, the coefficient of ENFORCEMENT is negative (that is, -5.627). It indicates that an increase in the average index of ENFORCEMENT reduces the current distribution of fuel wood from CFUG by 5,627 kgs per annum per household. The possible reasons are as follows. An index of ENFORCEMENT improves if households spend their leisure time to determine the membership fee, formulate, and enforce rules of harvest and distribution of fuel wood. Intuitively, membership fee improves an index of ENFORCEMENT (following equation 6 of section 5.2 of chapter V). Similarly, households can augment more produce if they use part of their leisure time in alternative activities (following equation 7 of chapter V, section 5.2), out of which they pay membership fee for the group. Thus, an improvement in the index of ENFORCEMENT ensures users' stake in community forestry.

In sum, if CFUG improves its indices of PROCESS and ENFORCEMENT, households intend to receive a smaller amount of fuel wood in the current period to preserve more fresh fuel wood for a better regeneration of the forest in the future.

However, the coefficient of MONITORING is positive (that is, 4. 966). It indicates that an increase in the average index of monitoring increases the current distribution of fuel wood from CFUG by 4,966 kgs per annum per household. The possible reasons are as follows. Following equation (6), if households pay membership fee for the group, the group may be able to hire forest guard. Forest guard can effectively keep vigil at the forest use behaviour of the user members. Thus, effective monitoring enables CFUG to apply punitive measures on the user members harvesting fuel wood illegally. If fuel wood is harvested in group, each user member works as a watchdog of the other. Consequently, the group management may be able to preserve more fuel wood in the forest at present. The group management can make a larger quantity of fuel wood available to the user members in the current period without reducing the stock of trees available in future.

Nevertheless, the aggregate of the negative coefficients of PROCESS and ENFORCEMENT (that is, -14.417) is greater than the value of the positive coefficient of MONITORING (4.966) by -9.451. The implication is as follows. If hill households work in collectivity, CFUG improves its index of management activism (or the index of PROCESS, ENFORCEMENT, and MONITORING), as per the implications of the above-mentioned choice-theoretic problem. In consequence, the CFUG is able to distribute a smaller amount of fuel wood among the user members in the current period to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. Two implications follow. Forest has a regeneration rate. Withdrawal of the fresh fuel wood beyond its regeneration rate causes extinction of the stock of trees after some time. Therefore, CFUGs need to maintain a high management activism to protect the forest for the future. According to Ostrom (1992), if the boundary of the resource is defined, users will be able to protect the forest effectively. Fixed boundary of the forest enables user members to monitor the forest use effectively to protect it for the future. Second, households residing in proximity to the forest can enforce rules of harvest, distribution, and monitor forest use effectively. Users residing near the forest can be watchdogs of each other. Consequently, users develop an attitude of positive reciprocity. In other words, if one deviates from the rules, others can watch deviant behaviour; if one follows the rules others will do the same. This latter reciprocal behaviour of the forest improves the effectiveness of the CFUG. Furthermore, if user members share information about the decisions of the meetings with others, CFUG can improve its management activism (following Baland and Platteau, 1996). The commonality of interests for the forest produce for the current period and to get the protected service benefit from the community forest may encourage households to follow the rules of the CFUGs. As a result, the CFUGs improve their effectiveness.

Leaders' Primary Education

The coefficient of LEAD P EDU is positive (that is, 0. 036). This coefficient implies that one percentage point increase in the leaders with primary education increases fuel wood from CFUG by 36 kgs per annum per household. The possible reasons are as follows. Leaders may be more concerned about the improvement of the livelihood of the forest user members in the current period. Thus, they may intend to distribute a larger quantity of fuel wood in the current period. However, it may not mean that leaders with primary education are not future conscious. If leaders enforce, maintain close monitoring of forest use, they can supply a larger amount of fuel wood among the user members in the current period while keeping the forest stock intact for the future.

Forest Related Attributes

The coefficient of FOREST area in hectare is negative (that is, - 0.0048) implying that an increase in one hectare of forest reduces fuel wood supply from community forest by 4.8 kgs per annum per household (in absolute quantity). The possible reasons are as follows. The community forests are categorised into 3- 6 blocks. Fresh fuel wood and fresh sita is obtained once in a year from a block of the total community forest area. Forest can supply a smaller quantity of fuel wood if the blocks of a community forest are of the same size. Similarly, if the density of trees is poor the community forest may supply a smaller amount of fuel wood (see chapter I). The number of members is proportionately larger for a larger forest, so that the quantity distributed per household is smaller for a larger forest.

The coefficient of NATURAL forest is negative (that is, -2.328). It indicates that if Community Forest User Group owns natural forest, the household intends to receive a smaller amount of fuel wood from such forest by 2,328 kgs per annum. The possible reasons behind this are as follows. One, natural forest is the source of timber for agricultural tools and other purposes. Second, natural forest provides tree fodder and litter throughout the year. Third, protected natural forest is the source of spring water. For example, the executive committee members of indresworthalpu ka told us that farmers get larger amount of water for crop cultivation and domestic use from indresworthalpu, ka, kha, and ga. Therefore, households may intend to receive a smaller amount of fuel wood from natural forest in the current period to protect it for more regeneration so that its services are well-maintained.

Household Related Attributes

FUT CONSC (Future Consciousness)

Equation (4) of section 5.2 (chapter V) shows the marginal rate of time preference between the current consumption and the future consumption of forest produce. Intuitively, if households consider that the forest can supply a finite amount of fuel wood because of its maximum carrying capacity, they may have low time preference for the withdrawal of fuel wood in the current period. If household has high time preference for the current consumption relative to the future consumption, then more of the produce that can be consumed in the future is withdrawn. The implication is that a typical household should be future conscious for the protection of forest for future. Following equation (5) of chapter V, we concluded that future conscious households use their current labour input for the promotion of knowledge about the protected benefits of community forest. Note that if a typical household is future conscious, he/she intends to receive a smaller amount of produce in the current period to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. For example, the coefficient of FUT CONSC is negative (that is, -0.061). It indicates that a future conscious household intends to receive a smaller amount of fuel wood from CFUG by 61 kgs per annum. Note that the household head was asked the question as "Do you agree that the community forest should be protected for future?" The response was noted down as one for yes, otherwise 0. Thus, the negative coefficient of future consciousness empirically provides support to the above-mentioned choice-theoretic problem. Furthermore, in chapter III, we concluded that interdependencies in terms of the dependence on forest products, hill forest economy and social system could instil a feeling of common understanding among the user members that the protection of community forest for the future is essential to maintain these interdependencies. Consequently, user members may intend to receive a smaller amount of fuel wood in the current period.

FAM SIZE (Family Size)

In chapter III, following Paul Ehrlich (1971 and 1991), we concluded that the impact on environment will be more severe as population increases. In other words, population growth causes increase in the demand for natural resources. The implication is that increase in the population of the user members increases demand of fuel wood. For example, the coefficient of FAM SIZE is positive (that is, 0.012). This coefficient indicates that an increase in family members of a household by one person increases fuel wood from CFUG by 12 kgs per annum per household. The possible reasons behind this are as follows. Larger family size may require larger amount of meal and consequently more fuel wood to cook the same. Second, if the CFUG do not enforce property rights for the harvest of sita, the coefficient of family size may have a positive sign. That is, households with larger number of members in the family may obtain more sita for the community forest.

LU (Livestock in Standard Unit)

In chapter II, we concluded that an increase in livestock population might require larger quantity of fuel wood. For example, the coefficient of LU is positive (that is, 0.032). This coefficient indicates that a unit increase in the size of livestock increases fuel wood from CFUG by 32 kgs per annum per household. Hill households use fuel wood for cooking livestock feed or kholay (or a boiled or heated mixture of water and maize/wheat/millet/mustard cake). Dairy buffalo and cattle are given cooked fodder almost throughout the year. Thus, as the size of the livestock (in standard unit) increases, households may require more fuel wood from CFUG thus depicting a positive coefficient of the livestock size in standard units.

CROP

In chapter III, we argued that heterogeneity in terms of economic asset might determine the performance of CFUG. In other words, households may be encouraged to perform better at their high net crop income. Households of a larger net income from crops may receive less from the community forest. For example, the coefficient of the net CROP income is negative (that is, - 0. 0015). It implies that an increase in the household's net income from crop by NRs. 1000 reduces fuel wood from CFUG by 1.5 kgs per annum. The thesis is that the political decision-makings of the CFUG to distribute less reflect household members' preference and choice to receive less. The possible reasons are as follows. The user members can use their increased income from crops to purchase alternative sources of fuel wood (as kerosene, LPG etc). Consequently, they may require less fuel wood from CFUG. Furthermore, the user members with more crop income may own more land and thus a larger number of farm trees. Therefore, they may collect more fuel wood from own farmlands and less from the community forest.

FARM FUEL

The coefficient of the quantity of fuel wood (in thousand kgs) from own farmlands is negative (that is, -0.066). This coefficient implies that the ith household receiving a larger quantity of fuel wood (in thousand kgs) from own farmlands intends to receive a smaller amount of fuel wood from CFUG by 66 kgs per annum. The possible reasons are as follows. Fuel wood of community forest is a group's property. Each member of the group has equal right for the produce of community forest. However, user members cannot obtain fuel wood from the community forest unless they are permitted to do so. In contrast, farm fuel wood is an immediate asset for households because they can harvest/use it whenever they want. Law protects farm fuel wood of every household. Therefore, households intend to receive larger quantity of fuel wood from own farmlands compared with the fuel wood from the community forest.

GOVERNMENT FUEL

The coefficient of the quantity of fuel wood (in thousand kgs) from government forest is positive (that is, 1.010). It indicates that the ith household receiving average quantity kgs of fuel wood (in thousand kgs) from government forest intends to receive a larger amount of fuel wood from community forest by 10 kgs per annum. We expected a negative sign for this coefficient. Therefore, this hypothesis is not borne out. This result is also in contrary to the findings of Edmonds (2002). He found that households using government forest, extracted more fuel wood than those of the households using the community forest did (see chapter I).

CFUG Dummies

The coefficient of the CFUG dummy tells about how it differs from the coefficient of constant (Gujarati, 2002). If the coefficient of the dummy for the CFUG under reference is positive, the fuel wood regression function shifts upward. If the coefficient of the dummy for a CFUG is negative, fuel wood regression function shifts downward. The coefficients of the dummies for CFUG 3 or ratmatejhagarpur (that is, -4.981) and CFUG 9 or banskhark kha (that is, - 6.629) are negative. The coefficients of ratmatejharpur and banskhark kha indicate that the households of these CFUGs intend to receive a smaller amount of fuel wood by 4,981 kgs and 6,629 kgs per annum per household (that is, smaller average quantities of 442 and 2,090 kgs per annum, per household), the values of the other explanatory variables remaining the same, that is, compared with the similarly placed households in other CFUGs with similar attributes of the management activism.

Location differences may cause current withdrawal of fuel wood to be smaller. For example, banskhark kha community forest is 2-3 kilometres from the settlement of the user members. User members told that very few of them visit forest for sita. Further, the purpose of the use of tree products may determine the extent of the current withdrawal of fuel wood. For example, the user members of the banskhark kha community forest told us that they have been using the forest for their social/ family ceremony, that is, marriage. The executive committee provides 1000 kgs of fuel wood for the same. The user members told us that the forest area is small and they intend to use this forest for the ceremony and obtain fuel wood from alternative sources as own farm and public lands.

The coefficient of the dummy for CFUG 14 or byangdhungathulopakha (that is, -0.989) indicates that ith household of this group intends to receive a smaller average quantity of fuel wood by 989 kgs per annum as compared with similarly placed households in other similar CFUGs. The possible reasons for this are as follows. Byangdhungatholopakha has well-matured pine trees. The user members intend to receive a smaller quantity of the fuel wood in the current period with a hope receiving timber of commercial importance in the future. Further, fuel wood supply from this CFUG may be smaller because very less sita is available from this forest.

Future Consciousness Dummies

The coefficients of dummies for the responses to future consciousness of the households of vakundebesis or CFUG 1 (0.256), naubisegeruwapakha or CFUG 2 (0.231), thuliban or 6 (3.502), belakholapakha or 10 (or belakholapakha; 0.199), 11 (or dharapanikhareti; 0.136) and 15 (or sanobanamaldol; 0.188) are positive. These coefficients indicate that the future conscious households of these CFUG are willing to receive a larger quantity of the fuel wood from CFUG by 195 kgs (256 kgs-61 kgs), 170 kgs, 3,441 kgs, 138 kgs, 75 kgs and 127 kgs respectively in contrast with similar future conscious households, from the CFUGs in general, which are willing to receive a smaller quantity by 61 kgs per annum. The possible reasons for this are as follows. The field research team could not properly explain the interviewee about the meaning of future consciousness. Consequently, respondents misunderstood it for the CFUG under reference. Second, interviewee responded positively due to the fear that if they reported otherwise their rights of community forest use could be taken away by the government.

Third, if the amount of fuel wood received by the typical household is not adequate, it may intend to receive more even if it is future consciousness. For example, some of the households of vakundebesi, naubisegeruwapakha and thuliban told us that the amount of fuel wood received from these respective CFUGs is inadequate. Next, if households own relatively fewer numbers of farm trees and obtain less fuel wood from own farmlands they may intend to receive more from community forest even though they are future conscious. For example, households of sanobanamaldol, naubisegeruwapakha, belakholapakha and dharapanikhareti told us that they have very few trees on their farmlands, and consequently, they have to depend on community forest for fuel wood.

6.8 CONCLUSION

The coefficient of management activism (sum of the three aspects of management activism) has a negative sign. It indicates that the ith household intends to receive a smaller amount of fuel wood if CFUG improves its index of management activism. This empirical finding provides support to the choice-theoretic problem that if households use part of their leisure time, pay membership fee in-group activities, CFUG improves its index of management activism. The implication is that at higher management activism, CFUG can protect the forest for the future while providing a smaller amount of fuel wood for the current needs. The coefficient of FUT CONSC has a negative sign. It indicates that the future conscious households intend to receive a smaller amount of fuel wood from CFUG in the current period to preserve more fresh fuel wood for a better regeneration of the forest in the future.

The forest area and natural forest have negative coefficients. These coefficients indicate that fuel wood from the CFUG reduces, if it owns small area of forest, and the forest is of natural type of mixed tree species, respectively. Similarly, the negative coefficient of the net crop income indicates that ith household intends to receive a smaller amount of fuel wood with a NRs. 1000 increase in net income from crops. Furthermore, the negative coefficient of the average quantity of farm fuel wood indicates households obtaining a larger quantity of fuel wood from own farmlands intend to receive a smaller amount of fuel wood from the community forest. However, the positive coefficient of the government fuel wood indicate that a household obtaining a larger quantity of fuel wood from the government forest intend to receive a larger amount of fuel wood from the community forest. The positive coefficients of family size and livestock unit pose constraints in the attainment of the household's goal of future consciousness.

The negative coefficients of the CFUG dummies for ratmatejhagarpur, banskhark kha and byangdhungathulopakha indicate that households of these CFUGs intend to receive smaller quantities of fuel wood, the values of the other explanatory variables remaining the same. The positive coefficients of the dummies for the responses to future consciousness of the households of vakundebesi, naubisegeruwa, thuliban, belakholapakha, dharapanikhareti and sanobanamaldol indicate that future conscious households are willing to receive larger quantities of fuel wood from the

CFUGs, as their respective positive coefficients outweigh the negative coefficients of future consciousness in general.

The next chapter (chapter VII) deals with the interpretations of the fodder model.

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1 Fuel wood contains officially distributed amounts of fresh fuel wood. However, sita fuel wood contains officially distributed plus self-collection by households. One can argue that this later part of sita is not an indicator of performance. However, households of 17 CFUG collect sita without any restriction of the CFUG management (except in thuliban and vasmepakha). Prohibiting households to collect sita may mean curtailment of their rights of livelihood. Therefore, this study takes the three years' average of the aggregate quantity of fuel wood and sita as one of the indicators of the performance of the CFUG.

2 The fuel wood model with satisfaction variable included 22 explanatory variables. The coefficients and t-statistics of the variable are PROCESS = 0.359 (3.380 *), ENFORCEMENT = -1.052 (-12.042*), MONITORING = -1.987 (-16.635*), LEAD P EDU = -0.011 (-9.147*), FOREST = 0.008 (12.744*), FOREST TYPES = -0.135 (- 3.952*), FUT CONSC = -0.068 (- 2.361* *) , SATISFACTION = -0.051 (- 1.753 * * *), FAM SIZE = -0.036 (-3.755 *), LU = 0.026 (3.434 *), CROP = -0.001 (2.278 * *), FUEL CONSUMPTION = 0.108 (5.642*), FARM FUEL = -0.072 (-2.676*), GOVERNMENT FUEL = 0.009 (0.184), CFUG 10 = -1.185 (-8.158*), CFUG 11 = 3.006 (26.505*), CFUG 14 = -1.273 (-13.289*), CFUG 1 FUT = 0.065 (0.856), CFUG 4 FUT = 0.302 (4.056*), CFUG 2 SATISFACTION = 0.229 (3.609*), CFUG 4 SATISFACTION = 0.213 (2.647*) and CFUG 16 SATISFACTION = 0.480 (6.719*) .(Figures in parentheses are t-statistics. * significant at the 1%, * * 5% and * * * 10% level).

R = 0.983. R^2 = 0.967. Adjusted R^2 = 0.964. Standard error = 0.179. Regression F = 303.23 (significant at the 0% level. Durbin- Watson statistic = 2.014 (significant at the 1% level).

N = 256.

CFUG = Dummy for the Community Forest User Group.

CFUG Fut = Dummy for the future consciousness of the ith household.

CFUG SATISFACTION = Dummy for the satisfaction with the current produce received by the ith household from CFUG.

In this model, satisfaction with the current produce received from the CFUG is independent variable. However, satisfaction with the current produce received from the CFUG is a performance variable. Therefore, this variable is dropped from fuel wood model.

3 One tailed test is used if the effect of the independent variable on the dependent variable is expected for one direction. If it is decided to use 5% level of significance for a one tailed test the null hypothesis would be rejected if the value of testing statistic is greater than + 1.645. Two tailed test is used if no directional effect of independent variable on the dependent variable is suggested. H_0 or the null hypothesis will be rejected at the 5% level of significance if the testing statistic is equal or less than –2.58 and greater than or equal to +2.58. H_0 will be rejected at the 1% level if the testing statistic is equal or less than –1.96 and greater than or equal to +1.96. The degree of freedom = n-2.

CHAPTER VII

EMPIRICAL FINDINGS FROM THE FODDER MODEL

7.1 INTRODUCTION

In chapter VI, this study focused on the analysis and interpretations of the results of the linear multiple regression of fuel wood model. That chapter concluded that a typical household intends to receive a smaller quantity of fuel wood from community forest given a high index of management activism of the group and its members' high future consciousness for the protection of the forest for the future. Thus, the choice-theoretic problem is verified by the empirical results of the fuel wood model. The present chapter adopts the same analytical framework of chapter V and intends to see whether empirical results of the linear multiple regression of fodder model corroborate the implications of the choice-theoretic problem.

In this chapter, we intend to understand why high management activism of the Community Forest User Group (CFUG) and its user members' high future consciousness make it perform better, which is reflected in the distribution of a smaller amount of fodder among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future. This chapter is organised as follows. Section 7.2 presents the definitions of the dependent and independent variables. Section 7.3 deals with the testing of the hypotheses. In section 7.4, we present the average statistics of the dependent and the independent variables. The estimable equation of fodder model is given in section 7.5. The interpretations of the results of the linear multiple regression fodder model are given in section 7.6. This chapter concludes with section 7.7.

7.2 DEFINITIONS OF THE DEPENDENT AND INDEPENDENT VARIABLES OF THE MODEL

The following table 7.1 presents the definitions of the dependent and independent variables used in the present model.

Table 7.1:
Dependent and Independent Variables of Fodder Model and Their Definitions.

Variables	Description
Dependant variable Fodder (P_{ik})	Average quantity of fodder including grass and tree-leaves (in thousand kgs) received by the ith household from the kth CFUG[1], during the past three years.
Independent variables	
PROCESS	Average index of the process of decision-making. It is the aggregate of the index of a) representation of caste (1 for representation of at least one household from each of the castes of the general members, otherwise 0), and b) woman (1 for representation of at least one woman, otherwise 0) in the executive committee, c) decision-making for the harvest and distribution of grass (1 for decision-making by the executive committee/assembly or both, otherwise 0), d) decision making for the harvest and distribution of tree leaves (1 for decision making by the executive committee/assembly or both, otherwise 0), e) number of annual meetings (1 for four years' average of the total of the monthly executive committee and annual general assembly meetings of 6 and above, otherwise 0), and f) attendance of the executive committee members in the meetings (1 for four years' average attendance of the 50% and above number of members of the total executive committee members in the executive committee meetings, otherwise 0) divided by the total number of items (or 6).
ENFORCEMENT	Average index of the enforcement of property rights. It is defined as an aggregate index of a) membership fee (1 if membership fee is specified, otherwise 0), b) harvest rules of grass (1 if each i) produce, ii) day/date, iii) time and iv) quantity is specified, otherwise 0), c) harvest rules of tree fodder (1 if each i) produce, ii) day/date, iii) time, and iv) quantity is specified, otherwise 0), and d) distribution of grass (1 if grass is weighed, otherwise 0), e) distribution of tree fodder (1 if tree fodder is weighed, otherwise 0) divided by the total number of items (or 11).
MONITORING	Average index of the monitoring of the implementation of the decisions. It is the aggregate index of a) hired forest guard/group patrol (1 if forest guard/group patrol, otherwise 0), b) harvest of grass in group (1 for harvest of grass in group, otherwise 0), c) harvest of tree fodder in group (1 for harvest of tree fodder in group, otherwise 0), d) fines from the rule breakers (1 for fines from the rule breakers in rupees, otherwise 0), e) mobilisation of group fund (1 for mobilisation of fund in village development activities in rupees, otherwise 0) divided by the total number of items (or 5).
LEAD P EDU	Percentage of the members of the executive committee educated at least with some primary education (that is, any grade from the 1st to the 5th grade).
FOREST	Forest area in hectares
PLANTATION PLUS	Natural forest (of mixed species of trees) with plantation of pines (1 for plantation plus, otherwise 0).
NATURAL	Natural forest of mixed species of trees without plantation of pines (1 for natural forest, otherwise 0).
FUT CONSC	Dummy variable taking the value 1 if the household head claims to be future conscious about the protection of the community forest, zero otherwise.
CAST BRAHMIN	Dummy variable taking the value 1 if the ith household head belongs to the caste Brahmin/Chhetri, zero otherwise.
FAM SIZE	Number of members in the family of the ith household
LU	Livestock including cattle, buffalo, and goat in standard units.
CROP	Net income of the household from crops in NRs. 1000.
FARM FODDER	Quantities of fodder including grass and tree leaves obtained by the ith household from own farmlands. (1 for fodder from own farmlands, otherwise 0).
GOVERNMENT FODDER	Quantities of fodder (including grass and tree leaves) obtained by the ith household from government forest (1 for fodder from government forest, otherwise 0).
CFUG 4	Shift dummy or dummy for sallenibaguwa CFUG, (CFUG 4). 1 for CFUG 4, otherwise 0.
CFUG 9	Shift dummy or dummy for banskhark kha CFUG, (CFUG 9). 1 for CFUG 9, otherwise 0.
CFUG 11	Shift dummy or dummy for dharapanikhareti CFUG, (CFUG 11). 1 for CFUG 11, otherwise 0
CFUG 16	Shift dummy or dummy for sanobandandal CFUG, (CFUG 16). 1 for CFUG 16, otherwise 0.
CFUG 17	Shift dummy or dummy for thulopakha CFUG, (CFUG 17). 1 for CFUG 17, otherwise 0.
CFUG 1 FUT	Slope dummy or dummy for the future consciousness of the ith household of vakundebesi, (CFUG 1). CFUG 1 * future consciousness of the ith household of CFUG 1.
CFUG 3 FUT	Slope dummy or dummy for the future consciousness of the ith household of ratmatejhagarpur, (CFUG 3). CFUG 3 * future consciousness of the ith household of CFUG 3.
CFUG 4 FUT	Slope dummy or dummy for the future consciousness of the ith household of sallenibaguwa, (CFUG 4). CFUG 4 * future consciousness of the ith household of CFUG 4.
CFUG 5 FUT	Slope dummy or dummy for the future consciousness of the ith household of khawakoratmate , (CFUG 5). CFUG 5 * future consciousness of the ith household of CFUG 5.
CFUG 10 FUT	Slope dummy or dummy for the future consciousness of the ith household of belakholapakha, (CFUG 10). CFUG 10 * future consciousness of the ith household of CFUG 10.
CFUG 18 FUT	Slope dummy or dummy for the future consciousness of the ith household of indresworthalpu ka, (CFUG 18). CFUG 18* future consciousness of the ith household of CFUG 18.

7.3 TESTING OF HYPOTHESES

The above-mentioned principal hypotheses are tested preliminarily using Karl Pearson's Correlation Coefficient Method. The Karl Pearson Correlation Coefficient between the three year's average quantity of fodder received by the ith household from CFUG and PROCESS (that is, -0.33), ENFORCEMENT (-0.54) and MONITORING (-0.35) and FUT CONSC (that is, -0.19) have negative signs. Each of these coefficients is significant at the 1% level. These coefficients empirically validate our hypotheses that a high index of PROCESS, ENFORCEMENT and MONITORING of the CFUG and its members' high future consciousness make a CFUG perform better in terms of the distribution of a smaller amount of fodder among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future. Table 7.2 presents the Karl Pearson's Correlation Coefficients of the dependent and independent variables.

Table 7.2
Karl Pearson's Correlation Coefficients between Dependent (CFUG Fodder) and Independent Variables of Fodder Model

	Cfug fodder	Pro-cess	Enfor-cement	Moni-toring	Lead p edu	Forest	Planta-tion+	Natu ral	Fut Consc	Castebr ah-min	Fam size	Lu	Crop	Farm	Govt
Cfug Fodder	1.0	-0.33**	-0.54**	-0.35**	0.01	0.22**	0.24**	-0.07	-0.19**	-0.04	0.01	0.06	-0.09	-0.07	-0.29**
Process	-0.33**	1.00	0.53**	0.78**	0.42**	-0.01	0.14**	-0.11*	0.27**	0.26**	0.05	0.09	-0.03	-0.01	-0.13*
Enforcement	-0.54**	0.53**	1.00	0.34**	-0.05	-0.04	0.44**	-0.22**	0.19**	0.13**	0.07	0.18**	0.00	0.05	-0.08
Monitoring	-0.35**	0.78**	0.34**	1.00	0.30**	0.001	0.12*	-0.18**	0.28**	0.09	0.04	0.09	0.11*	0.03	-0.19**
Lead p edu	0.01	0.42**	0.05	0.30**	1.00	-0.05	0.04	0.22**	0.13*	0.40**	0.01	-0.02	0.08	0.04	-0.03
Forest	0.22**	-0.01	-0.04	0.001	-0.05	1.00	0.17**	-0.36**	-0.08	0.11*	-0.23**	-0.01	0.30**	0.07	-0.19**
Plantation +	0.24**	0.14**	0.44**	0.12**	0.04	0.17**	1.00	-0.55**	-0.26**	-0.02	0.16**	0.35**	0.08	-0.08	-0.30**
Natural	-0.07	-0.11*	-0.22**	-0.18**	0.22**	-0.36**	-0.55**	1.00	0.19**	0.34**	-0.02	-0.07	-0.12**	-0.02	0.54**
Fut Consc	-0.19**	0.27**	.19**	0.28**	0.13	-0.08	-0.26**	0.19**	1.00	0.19**	-0.09	-0.02	0.03	0.03	0.04
Brahmin	-0.04	0.26**	0.13*	0.09	0.40**	0.11*	-0.02	0.34	0.19**	1.00	-0.07	0.09	0.1	0.1	0.19**
Fam Size	0.011	0.05	0.07	0.04	0.01	-0.23 **	0.16**	-0.02	-0.09	-0.07	1.00	0.46 **	0.30**	0.03	0.11*
Lu	0.06	0.09	0.18**	0.1	-0.02	-0.01	0.35**	-0.07	-0.02	0.09	0.46 **	1.00	0.45**	0.07	0.18**
Crop	-0.09	-0.03	0.00	0.11*	0.08	0.30**	0.08**	-0.12**	0.03	0.1	0.30 **	0.45 **	1.00	0.10	0.16**
Farm Fodder	-0.07	-0.01	0.05	0.03	0.04	0.07	0.08	-0.02	0.03	0.1	0.03	0.07	.0.1	1.00	0.03
Govt Fodder	-0.3**	-0.13*	-0.08	-0.19**	-0.03**	-0.19**	-0.30**	0.54**	0.04	0.19**	0.11*	0.18**	0.16**	0.03	1.00

** Significant at the 1% level
* Significant at the 5% level.
N = 272
Source: table 7.3

7.4 AVERAGE STATISTICS OF THE DEPENDENT AND INDEPENDENT VARIABLES AND DATA SOURCES

Dependent Variable

The three years' average quantity of fodder (including grass and tree leaves) received (in thousand kgs) by the ith household from CFUGs is the dependent variable for the linear multiple regression fodder model. The information about the fodder supply (in back-loads) from CFUGs for the fiscal years of 1996/97, 1997/98 and 1998/99 was acquired through the discussions with the executive committee members of each of the 19 CFUGs. Appendix H presents the discussion guidelines used to collect information pertaining to fodder supply from CFUG. Likewise, the respondents were asked the questions as how many back-loads of fodder the household received per child and adult from the community forest during the seasons of the year. The fodder supply calendar is given in appendix table C3. Appendix G presents the household interview schedule used to collect information about the back- loads of fodder received by the households from CFUG. The approach followed to convert the back-loads of fodder into kilograms is given in chapter IV. Table 7.3 depicts that on average a household receives 6,080 kg of fodder per annum from CFUG.

Table 7.3

Average Statistics of the Dependent and Independent Variables of the Fodder Model

Variables	Unit	Average	Std. Deviation
Dependent variable			
CFUG FODDER	000 kgs	6.08	3.57
Independent variable			
PROCESS	Index	0.46	0.24
ENFORCEMENT	Index	0.33	0.19
MONITORING	Index	0.45	0.16
LEAD P EDU	%	55.59	20.57
FOREST	hectare	48.15	50.69
PLANTATION PLUS	1 or 0	0.59	0.49
NATURAL	1 or 0	0.18	0.38
Future consciousness	1 or 0	0.61	0.49
CAST BRAHMIN	1 or 0	0.63	0.49
FAM SIZE	average	6.68	2.93
L U*	standard unit	3.50	2.10
CROP	NRs. 000	37.63	30.59
FARM FODDER	000 kgs	0.99	0.12
GOVERNMENT FODDER	000 Kgs	0.059	0.24
CFUG 4		0.059	0.24
CFUG 9		0.059	0.24
CFUG 11		0.059	0.24
CFUG 16		0.059	0.24
CFUG 17		0.059	0.24
CFUG 1 FUT		0.044	0.21
CFUG 3 FUT		0.022	0.15
CFUG 4 FUT		0.037	0.19
CFUG 5 FUT		0.026	0.16
CFUG 10 FUT		0.011	0.10
CFUG 18 FUT		0.0074	0.086

Note: N = 272. *LSU = Livestock in standard unit (including average of cattle, buffalo and goat in standard unit).
LSU = 0.8 buffalo = 1.0 cattle = 5.0 goat (The University of Reading, 2001).
Source: the information about household related variable was collected during 1999-2000. The information about CFUG related information was collected during 2001.

Explanatory Variables

Management Activism

The above table 7.3 depicts that the average index of the PROCESS, ENFORCEMENT, and MONITORING are respectively 0.46, 0.33 and 0.45. The methodology of data collection of each of these aspects is given in chapter IV. Table 7.1 shows the methods adopted to develop each of the indices of PROCESS, ENFORCEMENT, and MONITORING.

Approximately 56% of the executive committee members are educated at least with some primary education (any grade from the 1st to the 5th grade).

Forest Related Attributes

CFUG owns 48.15 hectares of forest on average. The average statistics of the plantation plus natural forest is 0.59 and natural forest is 0.18. In the spreadsheet, CFUG was given 1 mark if it owns plantation plus natural forest, otherwise 0. The same methodology followed to deriving codes for the natural forest. The information about each of the aspects of management activism, forest and leaders' education was collected using discussion guidelines given in appendix H.

Household Related Attributes

In response to the question: "Do you agree that the community forest should be protected for the future?" approximately 61% of the 272 household (or average, 0.61) heads agreed that community forest be protected for future. Approximately, 63% of 272 households belong to CAST BRAHMIN/CHHETRI. Table 8.3 depicts that households in kabhre have 6.68 numbers of family members, on an average. The average statistics reveals that a household owns 3.5 units of livestock. Furthermore, a household obtains net income of NRs. 37,630 per annum from crops. A household gathers 990 kgs of fodder from farmlands and 59 kgs of fodder from the government forest per annum. The methodology adopted to convert the back-loads of fodder (that is, grass and tree fodder) is given in chapter IV. Chapter IV presents the methodology of data collection of each of these household related variables. The interview schedule used to collect household related information is given in appendix G.

Table 7.3 depicts that the statistics of standard deviations of all the variables except forest area is smaller than their corresponding averages. This means there is not much variability in these data. However, the standard deviation of the forest area in hectare demonstrates that there is somewhat greater variation in the area of community forest owned by CFUG. The following section 7.5 presents the estimable equation for the fodder model. The present chapter adopts the same methodology for the selection of fodder model as mentioned in the fuel wood model (section 6.4 of chapter VI).

7.5 FODDER MODEL [2]

$P_{ik} = ß_0 + ß_1$ (PROCESS)$_k$ + $ß_2$ (ENFORCEMENT)$_k$ + $ß_3$ (MONITORING)$_k$ + $ß_4$ (LEAD P EDU)$_k$ + $ß_5$ (FOREST)$_k$ + $ß_6$ (PLANTATION PLUS)$_k$ + $ß_7$ (NATURAL)$_k$ + $ß_8$ (FUT CONSC)$_i$ + $ß_9$ (CASTBRAHMIN)$_i$ + $ß_{10}$ (FAM SIZE)$_i$ + $ß_{11}$ (LU)$_i$ + $ß_{12}$ (CROP)$_i$ + $ß_{13}$ (FARM FODDER)$_i$ + $ß_{14}$ (GOVERNMENT FODDER)$_i$ + $ß_{15}$ (CFUG 4) + $ß_{16}$ (CFUG 9) + $ß_{17}$ (CFUG 11) + $ß_{18}$ (CFUG 16) + $ß_{19}$ (CFUG 17) + $ß_{20}$ (CFUG 1 FUT)$_i$ + $ß_{21}$ (CFUG 3 FUT)$_i$ + $ß_{22}$ (CFUG 4 FUT)$_i$ + $ß_{23}$ (CFUG 5 FUT)$_i$ + $ß_{24}$ (CFUG 10 FUT)$_i$ + $ß_{25}$ (CFUG 18 FUT)$_i$ (2)

where, subscript i refers to the ith household and k to the kth CFUG. $ß_0$ refers to the intercept. $ß_1$- $ß_{25}$ are the slope coefficients. These slope coefficients refer to the predicted change in the left-hand side variable (or the dependent variable) which can be attributed to the corresponding right hand side variables (or independent variables), with the rest of the independent variables remaining constant.

7.6 INTERPRETATION OF THE LINEAR REGRESSION RESULTS OF FODDER MODEL

Overall Fit of the Model

The coefficient of the linear multiple regression is positive (0.968). It indicates that the dependent variable (or the three years' average quantity of fodder in thousand kgs) is highly positively associated with the regressors keeping other variables constant. The coefficient of multiple determination or R^2 is 0.937. It indicates that the 25 regressors, keeping the other factors constant, explain about 94% of the variation in the dependent variable. As R^2 is near to unity, it suggests that the sample regression line explains the data fairly well. The multiple correlation coefficient and the goodness of fit obtained by using the 25 explanatory variables, taken together, was tested using F statistics. The F statistics (that is, F = 146.205 at df 1= 25 and df2 = 246) is significant at the 1% level (p = 0.000).

This study uses Durbin-Watson statistic to detect the serial or autocorrelation of the residuals in the model. The significance level of this statistic is assessed using the standard decision rule (Gujarati, 2003). This rules says, for no positive or no negative autocorrelation, du (or 1.991) < d (or 1.933) < 4 – du (or 2.007) at the 5% level of significance (when number of observations (n) is 200 and number of explanatory variables or k is 20). If dl ≤ d ≤ du, (or 1.551≤ 1.993 ≤ 1.991) there is no positive auto correlation. If 4 – dl (or 4-1.551) < d < 4, there is no negative correlation. However, in this study, n = 272 and k = 25. Thus, Durbin-Watson statistic (1.933) should be significant at the 5% level of significance. Therefore, this model does not suffer from positive or negative autocorrelation.

Significance of the Coefficients of Explanatory Variables

The Fisher's t- test[3] is applied to determine the significance of the individual coefficients of explanatory variables (or the ßs that contributed to the performance of CFUG in terms of the average quantity of fodder distributed during the past three years among the user members). If each coefficient is significant then it contributes to the prediction of performance of CFUG distinctly from chance variation.

Table 7. 3 depicts that the t-statistics of the coefficients of PROCESS (p = 0.000), and ENFORCEMENT (p = 0.000) are significant at the 1% level. The t-statistics of the coefficient of FUT CONSC (p = 0.036) is significant at the 5% level. Therefore, we accept the hypotheses that high actual figures of PROCESS, ENFORCEMENT, and FUT CONSC make a CFUG perform better in terms of the distribution of a smaller amount of fodder among the user members in the current

period so as to preserve more foliage for a better regeneration of the forest in the future. Similarly, the t-statistics of the coefficient of MONITORING ($p = 0.030$) and LEAD P EDU ($p = 0.000$) are significant respectively at the 5% and 1% level. Therefore, we reject the null hypotheses that MONITORING and LEAD P EDU are not significantly associated with the average quantity of fodder from CFUG. We accept the alternative hypotheses that a unit increase in the index of monitoring and primary education of the leaders increases fodder from CFUG. The t- statistics of the coefficients of the PLANTATION PLUS and NATURAL forests are significant at the 1% level. Similarly, the t-statistics of the coefficient of FOREST area in hectares ($p = 0.088$) is significant at the 10% level. The t-statistics of the coefficient of the caste BRAHMIN/CHHETRI ($p = 0.026$) is significant at the 5% level. Therefore, we accept the hypothesis that the household head belonging to caste Brahmin/Chhteri wishes to receive a smaller amount of fodder from the CFUG. The t-statistics of the coefficients of LU ($p = 0.005$) is significant at the 1% level. Since the t-statistics of the coefficient of CROP ($p = 0.001$) is significant at the 1% level, we accept the hypothesis that a high net crop income reduces fodder from CFUG. The t-statistic of the coefficient of FAM SIZE ($p = 0.329$) is not significant. Therefore, we cannot derive a definite conclusion of the influence of family size on the quantity of fodder received by the ith household from CFUG.

Similarly, the t-statistics of the coefficient of the average quantity of GOVERNMENT FODDER ($p = 0.000$) is significant at the 1% level. We expected a positive coefficient of government fodder. Therefore, we accept the hypothesis that the ith household receiving a larger quantity of fodder from the government forest intends to receive a smaller amount of fodder from the community forest. The t-statistics of the coefficient of FARM FODDER ($p = 0.676$) is not significant. The number of farm fodder tress and land owned by the household may explain the average quantity of fodder from CFUG.

Similarly, the t-statistics of the shift coefficients for the dummies of CFUG 4 (p = 0.002), 9 (p = 0.000), 11 (p = 0.000), 16 (p = 0.000) and 17 (p = 0.000) are significant at the 1% level. Similarly, the t-statistics of the coefficients for the dummies of future consciousness of the households of CFUG 1 (p = 0.000), 10 (p = 0.000) and 18 (p = 0.003) are significant at the 1% level. The t-statistics of the coefficients for the dummies of the responses to future consciousness of the households of the CFUG 3 (p = 0.034) and 5 (p = 0.027) are significant at the 5% level. Therefore, these dummies capture the variation in responses to the future consciousness among the 272 households. The t-statistics of the coefficient of the dummy for the future consciousness of the households of CFUG 4 (coefficient of CFUG 4 * FUTCONSC) (p = 0.139) is not significant. This variable is adopted to obtain a significant Durbin-Watson statistic. Table 7. 4 shows the estimated coefficients, standard errors and t-statistics and their significance levels for the fodder model.

Table 7.4

Estimated Coefficients, Standard Errors, and t Statistics and Their Significance Levels for the Fodder Model.

Regressors	Coefficients	Standard errors	T-statistic
CONSTANT	1.907	0.663	2.878 *
PROCESS	-7.078	0.843	-8.400 *
ENFORCEMENT	-10.589	0.736	-14.378 *
MONITORING	1.739	0.795	2.188 * *
LEAD P EDU	0.100	0.009	10.734 *
FOREST	0.0041	0.002	1.711 * * *
PLANTATION PLUS	6.170	0.279	22.149 *
NATURAL	4.444	0.404	11.009 *
FUT CONSC	-0.367	0.174	-2.114 * *
CAST BRAHMIN	-0.390	0.174	-2.234* *
FAM SIZE	0.024	0.024	0.978
LU	0.109	0.039	2.811*
CROP	-0.0084	0.003	-3.222*
FARM FODDER	0.209	0.499	0.418
GOVERNMENT FODDER	-5.035	0.367	-13.715*
CFUG 4	1.508	0.473	3.187*
CFUG 9	-4.472	0.607	-7.366*
CFUG 11	-2.924	0.598	-4.894*
CFUG 16	-2.049	0.356	-5.760*
CFUG 17	8.683	0.355	24.428*
CFUG 1 FUT	1.694	0.369	4.595*
CFUG 3 FUT	1.097	0.515	2.132* *
CFUG 4 FUT	0.780	0.525	1.485
CFUG 5 FUT	0. 913	0.410	2.226* *
CFUG 10 FUT	3.666	0.622	5.897*
CFUG 18 FUT	2.179	0.714	3.053*
R = 0.968 R^2 = 0.937	$\bar{R}^2$ = 0.931 Standardised error = 0.9409		
F statistics = 146.205*	Durbin-Watson = 1.933 (significant at the 5% level)		

Note: *t-statistic significant at 1% level. ** t-statistic significant at the 5% level. *** t-statistic significant at the 10% level.
* F statistics significant at the 1% level (p = 0.000).
Source: table 7.3.

Interpretations of the Coefficients of the Explanatory Variables

Management Activism

The implication of the equation (5) of chapter V is that if households use part of their leisure time in group activity, the group improves the index of its management activism (that is, PROCESS, ENFORCEMENT and MONITORING). At a high index of PROCESS, CFUG supplies a smaller amount of fodder among the user members. Consequently, CFUG preserves more fodder in the current period for a better regeneration of the forest so that more fodder can be supplied in the future. For example, the coefficient of the PROCESS is negative (-7.078). It indicates that a unit increase in the average index of PROCESS reduces fodder from CFUG by 7,078 kg per annum per household. The possible reasons are as follows. If CFUG represents at least one household from each of the castes of the general members and at least one woman in the executive committee, CFUGC improves the index of PROCESS. The index of PROCESS improves if CFUG conducts meetings (once in a month for some and once in two months for others and once in a year for all). Furthermore, an index of PROCESS improves if attendance of executive committee members (that is, at least 50% of the total executive committee members) enables CFUG to hold its committee meetings. Similarly, if CFUG decides for the harvest and distribution of fodder in its meetings, then the PROCESS improves. An improvement in the index of the PROCESS can instil a feeling of common understanding among the user members, including an awareness of the need to protect the forest for the future. Therefore, CFUG supplies a smaller amount of fodder among its members in the current period so as to preserve more foliage for a better regeneration of the forest in the future.

Following equation (6) of chapter V we concluded that if households pay membership fee for the group activity, the group improves the index of the ENFORCEMENT. Empirically, the coefficient of the ENFORCEMENT of property rights is negative (that is, -10.589). It indicates that an increase in the index of enforcement of property rights reduces fodder from CFUG by 10,589 kg per annum per household. The possible reasons are as follows. If households pay membership fee, the CFUG spends this contribution so collected on the monitoring of implementation of the decisions (that is, to hire forest guard and spend in village development) and thus improves the index of ENFORCEMENT. Furthermore, if users receive fodder on the specified day/date and at specified time of entry into and exit from forest, and as per the predetermined amount, CFUG improves the index of ENFORCEMENT. Similarly, if

CFUG supplies weighed fodder among the user members, it improves the index of ENFORCEMENT. In sum, if CFUG improves its enforcement of property rights, it can ensure users' stake in community forestry. Consequently, CFUG preserves more fodder in the current period so as to supply more fodder in the future.

However, the coefficient of MONITORING of implementation is positive (that is, 1.739). It indicates that an increase in the average index of monitoring of implementation increases fodder from CFUG by 1,739 kgs per annum per household. The possible reasons are as follows. If hired forest guard or group patrol monitors forest use effectively, then CFUG improves the index of MONITORING. The index of monitoring improves, if CFUG fines rule breakers. Furthermore, if user members harvest fodder in group, the index of monitoring improves. The index of MONITORING improves, if CFUG deploys its funds in the village development activities. Thus, an improvement in the index of MONITORING enables CFUG to supply more fodder in the current period.

Nevertheless, the aggregates of the coefficients of PROCESS and ENFORCEMENT (that is, - 17.667) is greater than the coefficient of MONITORING (that is, 1.739) by -15.928. Thus, this study concludes that CFUG's high index of the management activism makes it perform better in terms of the distribution of a smaller amount of fodder among the user members in the current period so as to preserve more fodder for a better regeneration of the forest in the future. In chapter III, we discussed that it is easier to enforce harvest rules and monitor forest use effectively in a small group. It is easier to monitor the forest use in a small group. However, if the group size is large but users reside in proximity to each other and forest resource is not far away from the village, rule violation can be easily detected. Thus, CFUG can improve its index of management activism.

Leader's Primary Education

The coefficient of LEAD P EDU is positive (0.100). It indicates that a percentage point increase in the leaders with primary education increases fodder from CFUG by 100 kgs per annum per household. It is possible that leaders are more worried about the improved livelihood of the members. However, it may not imply that leaders are not future conscious. Note that leader's education is a form of social asset. Educated leaders can promote users' knowledge and skills so that they use forest in a judicious way, that is, without spoiling regenerating plants. Educated leaders can convince members to lop off fodder branches without effecting the growth of plants.

Forest Related Attributes

The coefficient of FOREST area is positive (that is, 0.041). This positive coefficient of forest area implies that an increase in a hectare of forest area increases fodder from CFUG by 41 kgs per annum per household. It is possible that the forest contains space (either because of low density of trees or grown up trees) that is more open. Consequently, a larger amount of grass is available from the open space. Furthermore, if CFUG owns natural forests and natural plus plantation forest with mixed tree species, households can receive a larger amount of tree leaves with an increase in the area of the forest.

The coefficient of PLANTATION PLUS is positive (that is, 6.170). It indicates that a typical household receives a larger quantity of fodder from CFUG by 6,170 kgs per annum, if CFUG owns plantation plus natural forest of mixed tree species. Similarly, the coefficient of NATURAL forest is positive (that is, 4.444). It indicates that a typical household intends to receive a larger quantity of fodder by 4,444 kgs per annum, if the CFUGs own natural forest. The plantation plus natural forest, and natural forests contain fodder trees. Tree fodder is one of the major forms of livestock feed in the hills. Therefore, households intend to receive a larger quantity of fodder from the CFUG's plantation plus natural forest and natural forest.

Household Related Attributes

Future Consciousness

Equation (4) chapter V shows the marginal rate of time preference between the current consumption and future consumption of forest produce. Intuitively, if a typical household thinks that hill forests are for use over time, then it should have low time preference for current consumption of forest produce so that forest produce for future consumption are safeguarded. The implication is that households need to be future conscious about the protection of the forest for the future. Next, equation (5) of chapter V indicates that if a typical household expends its current leisure time in group activities, the forest can be protected for the future. The implication is that a typical future conscious household spends his/her time in protecting the forest for future. If households are future conscious, they intend to reduce the current withdrawal of fodder from the community forest with a hope of getting more fodder in future. For example, the coefficient of FUT CONSC is negative (that is,-0.367). It implies that a future conscious household would want to receive a smaller amount of fodder by 367 kgs per annum. Cutting of grass and lopping off fodder leaves hampers regeneration of plants. Excess harvest of grass exposes forest floor to sun and wind, causing it to dry up. It possibly, hampers further regeneration and growth of trees. Drying up of forest floor and lack of regenerating plants causes water sources to dry up. Degradation of upstream forest increases risks of floods for downstream agricultural lands. Therefore, households intend to be future conscious for the protection of the forest so as to safeguard the future of the hill economy. Consequently, hill households intend to receive a smaller amount of fodder in the current period to preserve more foliage for a better regeneration of the forest in the future.

Caste Brahmin/Chhetri

The coefficient of CASTBRAHMIN/CHHETRI is negative (that is, - 0.390). This coefficient indicates that if a member household head belongs to CASTBRAHMIN/CHHETRI background he/she intends to receive a smaller quantity of fodder from CFUG by 390 kgs per annum. It is possible that Brahmin/Chhetri households are more aware on the benefits of the protected community forest. Consequently, they plan to receive a smaller quantity of fodder from the community forest.

Family Size

In principle, increase in population causes pressure on natural resources including forest. Alternatively, the demand of forest products heightens as population increases. For example, the coefficient of FAM SIZE is positive (0.024). It indicates that a unit increase in the FAM SIZE of the household increases the demand for fodder from CFUG by 24 kgs per annum per household. Household with a larger family size may have a larger number of members in the labor force. Thus, the households may use the labor force for the collection of fodder. However, the t-statistic of the coefficient of family size ($p = 0.329$) is not significant. Thus, the coefficient is inclusive. Perhaps, the economically active labor force in the family and land owned may explain average quantity of fodder from CFUG. However, we have not formally examined this.

Livestock in Standard Unit

In chapter II, we concluded that an increase in the population of livestock increases the demand for fodder. For example, the coefficient of LU is positive (that is, 0.109). It indicates that an increase in the size of livestock owned by the household by a unit increases fodder from CFUG by 109 kgs per annum per household. A discussion with the executive committee members and corner meetings revealed that forest grass and tree fodder are more nutritious and the hill households prefer these products to feed their livestock. Therefore, it can be concluded that pressure on forest fodder increases, as household owns a larger number of livestock.

CROP

The coefficient of CROP or net crop income is negative (that is, -0.0084). It indicates that a NRS. 1000 increase in the ith household's net income from crops reduces fodder from CFUG by 8.4 kg per annum per household. It is possible that households, with more income from crops, purchase manufactured feed as substitutes of fodder. Second, such households may have more land and fodder trees. Thus, they may obtain more fodder from their own farmlands. Lastly, households with more net crop income, may adopt improved living styles: they may keep few livestock requiring a smaller amount of fodder from the CFUG and send children to schools so that labour force for the acquisition of fodder is reduced.

Farm Fodder

The coefficient of FARM FODDER is positive (that is, 0.209). This positive coefficient implies that the household collecting average quantity (in thousand kgs) of fodder from own farmlands intends to obtain a larger quantity of fodder from the community forest by 209 kgs per annum. We expected positive sign of the average quantities of fodder from own farmlands. However, the t-statistic of the coefficient of the FARM FODDER is not significant ($p = 0.676$).

Government Fodder

The coefficient of GOVERNMENT FODDER is negative (-5.035). It indicates that the household obtaining larger average quantity of fodder (in thousand kgs) from government forest is willing to obtain a smaller amount of fodder from the community forest by 5,035 kgs per annum. The community forest is the group's property. Households require decision of the group to receive fodder from the community forest. Otherwise, households collecting fodder have to face sanctions for not following the rules. However, the supervision of government forest by staff is a rare phenomenon in hills. Consequently, government forest is used as an open access resource in the hills. Therefore, households intend to obtain a larger quantity of fodder from the government forest. Households may not be mindful of protecting government forests for future but they may be keen about protecting the community forest because they are provided with the property rights to the use of community forest.

CFUG Dummies

If the coefficient of dummy for the CFUG is positive, the fodder regression function shifts upward. Further, the coefficient of the dummy for the CFUG is negative, if the fodder regression function shifts downward. The coefficients of the dummies for CFUG 4 or sallernibaguwa (1.508) and 17 or thulopakha (8.683) are positive. These coefficients indicate that the households of CFUG 4 and 17 intend to receive a larger quantity of fodder by 1,508 and 8, 683 kgs per annum, respectively (that is, larger quantities of 3,415 kgs and 10, 590 kgs per annum, respectively), compared with similarly placed households in other similar CFUGs, given that the values of the other variables are the same as for the other CFUGs. If households own less land, they get little quantity of fodder from their lands. Consequently, they intend to receive more from the community forest. For example, in thulopakha CFUG the average land holding is just 0.38 hectares per household.

The coefficients for the dummies of the CFUG 9 (-4.472), 11 (-2.924) and 16 (-2.049) are negative. The coefficients indicate households are willing to receive a smaller amount of fodder by 4, 472 kgs, 2,924 kgs and 2,049 kgs respectively (that is, smaller by 2,565 kgs, 1,017 kgs and 142 kgs per annum per household, respectively), as compared with the similarly placed households in other similar CFUGs. In chapter III, we argued that proximity of the household to the resource influences the performance of the CFUGs. In this perspective, the households of the CFUG 9 and 11 told the research team that their community forest is relatively farther for fodder. Because of this reason, they may receive a smaller amount of fodder from the community forest. Further, fodder consists of grass and tree fodder. The average quantity of fodder received by households may be smaller if they receive only tree fodder. For example, households do not receive grass from banskhark kha (CFUG 9) and sanobanmaldol (or CFUG 16) community forests. Users receive tree fodder from these community forests.

Future Consciousness Dummies

The coefficient of the dummies for the responses to the future consciousness for the households in CFUG 1 or vakundebesi (1.694), 3 or ratmatejhagarpur (1.097), 4 or sallenibaguwa (0.780), 5 or khawakoratmate (0.913), 10 or belakholapakha (3.666) and 18 or indresworthalpu ka (2.179) are positive. These coefficients indicate that future conscious households of these CFUG wish to receive larger quantities of fodder by 1,327 kgs (1,694 kgs –367 kgs), 730 kgs, 413 kgs, 546 kgs, 3, 299 kgs and 1,812 kgs per annum, respectively, as compared with the average response for all the households (that is, -0.367) of the future conscious households on the average.

The possible reasons are as follows. First, future conscious households may intend to receive a larger quantity of fodder from the CFUGs if they are not satisfied with the current distribution of fodder. For example, some user members of vakundebesi, khawakoratmate, sallenibaguwa and belakholapakha CFUG told us that the households residing near forest harvest more backloads of grass than they are allowed. By rule, a household of vakundebesi CFUG can harvest a back-load of grass in a day during the grass-harvesting season (of 15 days). However, the CFUG management is not able to control the over harvesting of grass by some households residing near the community forest. Furthermore, in CFUG 5, the management opens forest for grass for four months but the households residing near the forest receive more back-loads of grass. Households residing farther away from the forest get fewer back-loads of grass. In belakhola CFUG, the management does not make any rule for the harvest of fodder. The user members told us that households residing near the forest harvest more fodder and those residing farther away from the forest obtain fewer back-loads. In indresworthalpu ka CFUG, households located near the community forest harvest tree fodder on individual basis. However, households residing far away from the forest can- not harvest because they harvest grass in group. Monitors effectively keep vigil during group harvest. Thus, because of the location differences households those not satisfied with the current distribution of fodder may intend to receive a larger quantity of fodder with a unit increase in their future consciousness.

7. 7. CONCLUSION

The coefficients of the management and future consciousness are negative and statistically significant. Thus, this study finds that a high index of management activism of the CFUG and its user members' high future consciousness make it perform better in terms of the distribution of a smaller amount of fodder among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future. The coefficient of leaders' primary education is positive. It indicates that a percentage point increase in the leaders with primary education increases fodder from CFUG. The coefficient of the forest area indicates that fodder supply from the community forest increases with an increase in forest area by a hectare. Similarly, if the group owns plantation plus natural forest fodder supplies from the community forest increases. The household head of Brahmin/Chhetri caste intends to receive a smaller amount of fodder from the community forest. However, a typical household intends to receive a large amount of fodder from the community forest if it owns a larger size of livestock in standard units. The negative coefficient of net crop income indicates a typical household intends to receive a smaller amount of fodder from the community forest with an increase in net crop income by NRs. 1000. Similarly, the negative coefficient of the average quantities of fodder from the government forest indicates a typical household obtaining a larger quantity of fodder from the government forest intends to receive a smaller amount of fodder from the community forest.

The negative coefficients for the shift dummies of the CFUG 9 (or banskhark kha), 11 (or dharapanikhareti) and 16 (or sanobanamaldol) indicate households intend to receive a smaller amount of fodder from these CFUGs respectively. The positive coefficients for the dummies of the thulopakha (or 17) and sallenibaguwa (or 4) CFUGs indicate households intend to receive a larger quantity of fodder from these CFUGs respectively.

The positive coefficients for the slope dummies of the responses to the future consciousness of the households of vakundebesi (or CFUG 1), ratmatejhagarpur (or 3), sallenibaguwa (or 4), khawakoratmate (or 5), belakholapakha (or 10) and indresworthalpu ka (or CFUG 18) indicate that future conscious households intend to receive larger quantities of fodder from these CFUGs, as their respective positive coefficients outweigh the negative coefficient for the future conscious households in general.

The next chapter (chapter VIII) deals with the interpretations of leaf litter model.

[1] Note that the operational plan or rules of the CFUG prohibit user members to obtain tree leaves from community forest. However, we were reported by the executive committee as well as general members that they gather fodder from their community forest (of particularly plantation plus natural forest and natural or mixed species of broad leaves). In addition, the responses were verified with the corner meetings in the village and self-observation by the field research team concerning the use of community forest. We noticed lopped branches of fodder trees. It can be argued that tree leaves obtained by user member is illegal and thus the amount of tree leaves acquired in this way can not be taken as the indicator of performance of CFUG. However, livestock keeping is critical to the sustenance of hill economy. Therefore, tree fodder is basic to household economy: livestock keeping. Moreover, normative requirement is that household be allowed to obtain tree fodder from their community forest given that growth of trees is not hampered. Therefore, tree fodder (or leaves) is one of the components of fodder (grass plus tree leaves) for this model.

[2] The fodder model with satisfaction variable included 27 variables. The coefficients and t-statistics of the variables are as follows. PROCESS = -5.896 (-5.795*), ENFORCEMENT = -4.896 (-9.246*), MONITORING = 4.894 (4.336*), LEADERS' SECONDARY EDUCATION = -0.02 (-2.476*), FOREST = 0.041 (9.689*), FOREST TYPE = 1.335 (6.511*), FUT CONSC = -0.444 (-1.818* * *), SATISFACTION = -0.693 (-3.02*), CASTE = 1.174 (8.421*), FAM SIZE = 0.054 (1.479), LU = 0.130 (2.206* *), CROP = -0.016 (-3.970*), FARM FODDER = -1.038 (-1.364), GOVERNMENT FODDER = -4.552 (- 9.118*), CFUG 4 = 5.691 (11.352*), CFUG 9 = 1.906 (4.233*), CFUG 17 = 5.192 (10.937*), CFUG 10 FUT = 3.156 (3.421*), CFUG 11 FUT = 1.892 (2.678*), CFUG 15 FUT = 1.064 (2.019), CFUG 18 FUT = 3.567 (3.353*), CFUG 19 FUT = 1.968 (3.145*), CFUG 2 SAT = 1.618 (2.475*), CFUG 10 SAT = -3.027 (-2.060* *), CFUG 11 SAT = 2.934 (4.357*), CFUG 18 SAT = 2.602 (4.294*), CFUG 19 SAT = 2.455 (3.310*).

$R = 0.927$ $R^2 = 0.859$ ADJUSTED $R^2 = 0.843$. DURBIN- WATSON = 1.867 REGRESSION F = 54.984 (Significant at the 0% level).

*t-statistics significant at the 1% level. * * t-statistics significant at the 5% level. * * * t-statistics significant at the 10% level.

CFUG = Community Forest User Group dummy. CFUG FUT = Dummy for the future consciousness of the ith household about the protection of forest for future. CFUG SAT = Dummy for the satisfaction with the current produce received.

In this model, satisfaction with the current produce received from the CFUG is considered as independent variable. However, the extent of satisfaction from the produce received from the CFUGs in fact a performance variable. Thus, this variable is dropped from the regression model.

[3] One tailed t-test is used if the effect of independent variable on the dependent variable is expected for one direction. H_0 or null hypothesis is rejected, if the value of the test is greater than + 1.645 at the 5% level of significance.

Two tailed test is used if no directional effect of independent variable on the dependent variable is suggested. H_0 will be rejected if the value of the statistics is equal or less than –2.58 and greater than or equal to + 2.58 at 1% level of significance. Similarly, if the value of test statistic is equal or less than –1.96 and greater than or equal to + 1.96, the null hypothesis is rejected. The degree of freedom = n- 2.

CHAPTER VIII

EMPIRICAL FINDINGS FROM THE LEAF LITTER MODEL

8.1 INTRODUCTION

In chapters VI and VII, we analysed and interpreted the empirical results of the linear multiple regression models of fuel wood and fodder. The conclusions derived from these two chapters are as follows. A typical household intends to receive a smaller amount of fuel wood and fodder from the community forest given a high index of management activism of the group and its members' high future consciousness for the protection of the forest for the future. Thus, the choice problem is verified by the empirical results of the fuel wood and fodder models. The present chapter adopts the same choice-theoretic framework and intends to see whether the empirical results of the linear multiple regression of the leaf litter model corroborates the implication of the choice-theoretic problem.

In this chapter, we intend to understand why a Community Forest User Group's (CFUG) high management activism and its user members' high future consciousness make it perform better, which is reflected in the distribution of a smaller amount of leaf litter among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future. This chapter is organised as follows. Section 8.2 deals with the definitions of the dependent and independent variables followed by the testing of the hypotheses in section 8.3. In section 8.4, we present the average statistics of the dependent and the independent variables. Sections 8.5 and 8.6 present the estimable equation of the leaf litter model and interpretations of the regression results of this model respectively. The chapter concludes with section 8.7.

8.2 DEFINITIONS OF THE DEPENDENT AND INDEPENDENT VARIABLES OF THE MODEL

The definitions of the dependent and the independent variables used in the leaf litter model are given in table 8.1 below.

Table 8.1
Dependent and Independent Variables of the Leaf litter Model and their Definitions.

Variables	Description
Dependent variable	
Leaf litter (P_{ik})	Average quantity of leaf litter (in thousand kgs) received by the ith household from the kth CFUG, during the past three years.
Independent variables	
PROCESS	Average index of the process of decision-making. It is the aggregate of the index of a) representation of caste (1 for representation of at least one household of each of the castes of general members, otherwise 0), and b) woman (1 for representation of at least one woman, otherwise 0) in the executive committee, c) decision-making for the harvest and distribution of leaf litter (1 for decision making by the committee/assembly or both, otherwise 0), d) number of meeting (1 for four years' average of the total of the monthly executive committee and annual general assembly meetings of 6 and above, otherwise 0), and e) attendance of the executive committee members in the meetings (1 for four years' average attendance of 50% and above numbers of members of the total executive committee members in the executive meetings, otherwise 0) divided by the total number of items (or 6).
ENFORCEMENT	Average index of the enforcement of property rights. It includes aggregate index of a) membership fee (1 if membership fee is specified, otherwise 0), b) harvest rules (1 if each i) produce, ii) day/date, iii) time and iv) quantity is specified, otherwise 0), and c) distribution rules of leaf litter (1 for weighing of leaf litter, otherwise 0) divided by the total number of items (or 6).
MONITORING	Average index of the monitoring of the implementation of the decisions. It consists of the aggregate index of a) hired forest guard/group patrol (1 if hired forest guard/group patrol, otherwise 0), b) harvest of leaf litter in group (1 for group harvest, otherwise 0), c) fines (1 for fines from rule breakers in rupees, otherwise 0), d) mobilisation of group fund (1 for fund mobilised in rupees, otherwise 0) divided by the total number of items (4).
FOREST	Forest area in hectares
PLANTATION+	Natural forest (of mixed species of trees) with plantation of seedlings of pines (1 for plantation plus, otherwise 0).
NATURAL	Natural forest of mixed species of trees without plantation of pines (1 for natural forest, otherwise 0)
FUT CONSC	Dummy variable taking the value of 1 if the household head claims to be future conscious about the protection of the community forest, zero otherwise.
CASTBRAHMIN	Dummy variable taking 1 if the household head belongs to Brahmin/Chhetri caste, zero otherwise.
LITERACY	Literacy status of the ith household head (1 if household head is literate or possesses the skills of reading or writing, otherwise 0).
FAM SIZE	Number of members in the family of the ith household
LU	Livestock including cattle, buffalo and goat in standard units.
CROP	Ith household's annual net income from crops in NRs 1000.
FARM LEAF LITTER	Quantity of leaf litter (in thousand kgs) gathered by the ith household from its own farmlands.
GOVERNMENT LEAF LITTER	Quantity of leaf litter (in thousand kgs) obtained by the ith household from the government forest.
CFUG 1	Shift dummy or dummy for vakundebesi CFUG, (CFUG 1). 1 for CFUG 1, otherwise 0.
CFUG 3	Shift dummy or dummy for ratmatejhagarpur CFUG, (CFUG 3). 1 for CFUG 3, otherwise 0.
CFUG 9	Shift dummy or dummy for banskhark kha CFUG, (CFUG 9). 1 for CFUG 9, otherwise 0.
CFUG 10	Shift dummy or dummy for belakholapakha CFUG, (CFUG 10). 1 for CFUG 10, otherwise 0.
CFUG 17	Shift dummy or dummy for thulopakha CFUG, (CFUG 17). 1 for CFUG 17, otherwise 0.
CFUG 18	Shift dummy or dummy for indresworthalpu ka CFUG, (CFUG 18). 1 for CFUG 18, otherwise 0.
CFUG 2 FUT	Slope dummy or dummy for the future consciousness of the ith household of naubisegeruwapakha CFUG, (CFUG 2). CFUG 2 * future consciousness of the ith household of CFUG 2.
CFUG 4 FUT	Slope dummy or dummy for the future consciousness of the ith household of sallenibaguwa CFUG, (CFUG 4). CFUG 4 * future consciousness of the ith household of CFUG 4.
CFUG 14 FUT	Slope dummy or dummy for the future consciousness of the ith household of byangdhungathulopakha CFUG, (CFUG 14). CFUG 14 * future consciousness of the ith household of CFUG 14.
CFUG 15 FUT	Slope dummy or dummy for the future consciousness of the ith household of sanobanamaldol CFUG, (CFUG 15). CFUG 15 * future consciousness of the ith household of CFUG 15.

8.3. TESTING OF HYPOTHESES

The above-mentioned principal hypotheses are tested preliminarily using Karl Pearson's Correlation Coefficient Method. The Karl Pearson's Correlation Coefficient between the three years' average quantity of leaf litter received by the typical household from CFUG and the PROCESS (-0.36), ENFORCEMENT (-0.43) and MONITORING (-0.64) and FUT CONSC (-0.29) are negative. Each of these coefficients is significant at the 1% level. These coefficients empirically support our hypotheses that a high index of PROCESS, ENFORCEMENT, MONITORING of the CFUG and its members' high future consciousness makes a CFUG perform better in terms of the distribution of a smaller amount of leaf litter among its members so as to preserve more foliage in the current period for a better regeneration of the forest in the future. Table 8.2 shows the Karl Pearson's Correlation Coefficients of the dependent and the independent variables in the leaf litter model.

Table 8.2
Karl Pearson's Correlation Coefficients between Dependent (CFUG Leaf Litter) and Independent Variables for the Leaf Litter Model

	Cfug litter	Pro-cess	Enforce ment	Moni-toring	Forest	Planta tion+	Natural	Fut consc	Caste brah min	Lite racy	Fam size	Lu	Crop	Farm f litter	Govt litter
Cfug Litter	1.00	-0.36**	-0.43**	-0.64**	0.37**	0.12*	0.02	-0.29**	0.25**	0.14*	0.01	0.12*	0.07	0.26**	0.14*
Process	-0.36**	1.00	0.45**	0.79**	0.001	-0.01	0.06	0.33**	0.40**	0.13*	-0.03	-0.03	-0.05	0.01	-0.14*
Enforce ment	-0.43**	0.46**	1.00	0.45**	-0.05	0.25**	-0.35**	0.17**	0.04	0.02	0.02	0.04	0.02	-0.05	-0.11*
Moni-toring	-0.64**	0.79**	0.45**	1.00	-0.14*	0.04	0.07	0.31**	0.22**	0.05	0.00	0.02	-0.02	-0.09	-0.23**
Forest	0.37**	0.001	-0.05	-0.14*	1.00	0.48**	-0.36**	-0.24**	0.09	0.04	-0.04	0.22**	0.13*	-0.01	-0.18**
Planta tion+	0.12*	-0.01	0.25**	0.04	0.48**	1.00	-0.62**	-0.23**	-0.01	-0.01	0.06	0.29**	0.02**	0.39**	-0.31**
Na tural	0.024	0.06	-0.35**	0.07	-0.36**	-0.62**	1.00	0.21**	0.36**	0.04	-0.07	-0.11*	-0.09	-0.22**	0.51**
Fut Consc	-0.29**	0.33**	0.17**	0.31**	-0.24**	-0.23**	0.21**	1.00	0.19**	-0.03	-0.05	0.01	0.01	-0.22**	0.04
Cast Bra	0.25**	0.40**	0.04	0.22**	0.09	-0.01	0.36**	0.19**	1.00	0.30**	-0.07	0.11*	0.12*	0.17**	0.19**
Literacy	0.14*	0.13*	0.02	0.05	0.04	-0.01	0.04	-0.03	0.30**	1.00	-0.05	-0.04	0.04	0.09	-0.07
Fam Size	0.01	-0.03	0.02	0.00	-0.04	0.06	-0.07	-0.05	-0.07	-0.05	1.00	0.40**	0.49**	0.13*	0.03
Lu	0.12*	-0.03	0.04	0.02	0.22**	0.29**	-0.11*	0.01	0.11*	-0.04	0.40**	1.00	0.61**	0.15**	0.14*
Crop	0.07	-0.05	0.02	-0.02	0.13	0.21**	-0.09	0.01	0.12*	0.04	0.49**	0.61**	1.00	0.23**	0.17**
Farm	0.26**	0.01	-0.05	-0.09	-0.01	0.39**	-0.22**	-0.22**	0.17**	0.09	0.13*	0.15**	0.23**	1.00	-0.14*
Govt	0.14*	-0.14*	-0.11*	-0.23**	-0.18**	-0.31**	0.51**	0.04	0.19**	-0.07	0.03	0.14*	0.17**	-0.14*	1.00

Note: ** Significant at the 1% level. * Significant at the 5% level. N = 256
Source: table 8.3.

8.4 AVERAGE STATISTICS OF THE DEPENDENT AND INDEPENDENT VARIABLES

Dependent Variable

The three years' average quantity of leaf litter (in thousand kgs) received by the typical household from a CFUG is the dependent variable for the leaf litter model. The information about the supply of leaf litter from CFUG in back-loads among the user members for the fiscal years of 1996/97, 1997/98 and 1998/99 was obtained through discussions with the executive committee members of each of the 19 CFUGs. Appendix H presents the discussion guidelines or checklists used to acquire information regarding supply of leaf litter from each of the 19 CFUGs. Likewise, randomly selected member households of each of the 19 CFUGs were asked as how many back loads of leaf litter the household received per child and adult from the community forests during the leaf litter harvesting seasons. Thus, the information about the back-loads of leaf litter received by the households from the CFUG was verified in this way. The household interview schedule used to collect leaf litter related information is given in appendix G. The methodology of data collection of leaf litter related information and approach followed to convert back-loads of leaf litter into kilogram are discussed in chapter IV. Table 8.3 below depicts that a household receives 4,039.2 kgs of leaf litter per annum on average.

Table 8.3
Average statistics of the Dependent and Independent Variables of the Leaf Litter Model

Variables	Unit	Average	Std. Deviation
Dependent variable			
CFUG leaf litter (3 year's average)	1000 Kgs	4.0392	2.7717
Independent variables			
PROCESS	Index	0.5625	0.2853
ENFORCEMENT	Index	0.4271	0.2043
MONITORING	Index	0.5750	0.1858
FOREST	Hectare	40.296	40.6467
PLANTATION +	1 or 0	0.6250	0.4850
NATURAL	1 or 0	0.1875	0.3911
FUT CONSC	1 or 0	0.5938	0.4921
CASTBRAHMIN	1 or 0	0.6211	0.4861
LITERACY	1 or 0	0.6289	0.484
FAM SIZE	Number	6.9297	2.8428
LU*	Standard unit	3.6576	2.0637
CROP	NRs. 000	35.15	28.507
FARM LEAF LITTER	000 Kgs	0.6637	1.1081
GOVERNMENT LEAF LITTER	000 Kgs	0.3897	1.6049
CFUG 1		0.0625	0.2425
CFUG 3		0.0625	0.2425
CFUG 9		0.0625	0.2425
CFUG 10		0.0625	0.2425
CFUG 17		0.0625	0.2425
CFUG 18		0.0625	0.2425
CFUG 2 FUT		0.0625	0.2425
CFUG 4 FUT		0.03906	0.1941
CFUG 14 FUT		0.01953	0.1387
CFUG 15 FUT		0.05859	0.2353

Note: LU = average livestock including cattle, buffalo and goat in standard units.
1 LSU = 0.8 buffalo = 1.0 cattle = 5.0 goats (The University of Reading, 2001).
N = 256.
Source: Field Survey, the information about household related variable were collected during 1999-2000. The information about CFUG related variable was collected during 2001.

Explanatory or Independent Variables

Management activism

The above table 8.3 depicts that the average index of PROCESS, ENFORCEMENT, and MONITORING are respectively 0.56, 0.43 and 0.58. The methodology of data collection of each of the aspects of the management activism is given in chapter IV. Table 8.1 above shows the approach followed to derive the index of each of the aspects of the management activism.

Forest related attributes

Households own 40.3 hectares of community forest, on an average. The average statistics of the plantation plus natural forest is 0.63 and natural forest is 0.19. In the data set, plantation plus natural and natural forest was coded as 1, otherwise 0. The same procedure was adopted to get a dummy variable for natural forest. The check list or discussion guidelines used to collect each of the aspects of the management activism and forest related characteristics is given in appendix H.

User member related attributes

As regards future consciousness, approximately 59% of the 256 household (or average 0.59) heads agree that the community forest should be protected for the future. The average statistic of caste Brahmin/Chhetri is 0.62. Table 8.3 above shows that out of 256 respondents, 63 per cent of them are literate. A household in the survey village has 6.9 family members, on an average. Furthermore, a household owns 3.65 livestock in standard units. Similarly, a household obtains net income of NRs. 35,150 per annum from crops, on an average. A household gathers 663.7 kgs of leaf litter from its farmlands per annum, on an average. Similarly, households obtain 389.7 kgs of leaf litter from the government forest per annum, on an average. The methodology of data collection of each of these household related variables is discussed in chapter IV. The information about each of these household related attributes was collected using the household interview schedule in appendix G.

The statistics of standard deviation of the dependent and independent variables (except forest area) are smaller than their corresponding average. This means there is not much variability in these data. However, the statistic of standard deviation of forest area in hectares is slightly greater than its average (that is, by 0.3). This, in fact, indicates the slight variation in the community forest area across the 16 CFUGs. In section 8.5 given below, we present the estimable equation for the leaf litter model. The leaf litter model is selected following the same approach used for the selection of fuel wood model (as described in section 6.4 of chapter VI).

8.5 THE LEAF LITTER MODEL[i]

$P_{i\,k} = \beta_0 + \beta_1$ (PROCESS)$_k$ + β_2 (QUALITY)$_k$ + β_3 (MONITORING)$_k$ + β_4 (FOREST)$_k$ + β_5 (PLANTATION +)$_k$ + β_6 (NATURAL)$_k$ + β_7 (FUT CONSC)$_i$ + β_8 (CAST BRAHMIN)$_i$ + β_9 (LITERACY)$_i$ + β_{10} (FAM SIZE)$_i$ + β_{11} (LU)$_i$ + β_{12} (CROP)$_i$ + β_{13} (FARM LEAF LITTER)$_i$ + β_{14} (GOVERNMENT LEAF LITTER)$_i$ + β_{15} (CFUG 1) + β_{16} (CFUG 3) + β_{17} (CFUG 9) + β_{18} (CFUG 10) + β_{19} (CFUG 17) + β_{20} (CFUG 18) + β_{21} (CFUG 5 FUT)$_i$ + β_{22} (CFUG 4 FUT)$_i$ + β_{23} (CFUG 14 FUT)$_i$ + β_{24} (CFUG 15 FUT)$_i$ (3)

where, subscript i refer to the ith household and k to the kth CFUG. β_0 refers to the intercept. β_1 - β_{24} are the slope coefficients. These slope coefficients refer to the predicted change in the right-hand side variable or (or the dependent variable) which can be attributed to the corresponding left-hand side variables (or independent variables) with the rest of the independent variables remaining constant.

8.6 INTERPRETATIONS

Overall Fit of the Model

The coefficient of the linear multiple regression is 0.969. It indicates that the three years' average quantity of leaf litter received by the ith household from CFUG is highly correlated with the regressors keeping the other variables constant. The coefficient of the multiple determination (or R^2) is 0.938. It indicates that the 24 regressors, keeping the other factors constant, explain about 94% of the variation in the dependent variable. As R^2 is near to unity, it suggests that the sample regression line explains the data fairly well. The multiple correlation coefficient obtained by the prediction by the 24 independent variables taken together was tested using F statistics. The F statistics (that is, F = 146.3 at df 1 = 24 and df2 = 231) is significant at the 1% level (p = 0.000).

The Durbin-Watson statistic is used to detect the autocorrelation of the residuals in the model. The significant level of Durbin-Watson is assessed following the standard decision rule (Gujarati, 2003). The estimated Durbin-Watson statistics (that is, 1.720) do not suffer either from negative autocorrelation (that is, 4- du or 1.896 ≤ d or 1.720 ≤ 4- 1.462) or positive autocorrelation (that is, dl or 1.462 ≤ d or 1.720 ≤ du or 1.896) at the 1% level of significance, when number of observation equals 200 and explanatory variables 20. Hence, the decision-rule states that the Durbin-Watson statistic is inconclusive.

Significance of the Coefficients of the Explanatory Variables

The significance of the coefficients of the explanatory variables (or ß that contributed to the performance of CFUG in terms of the average quantity of leaf litter distributed during the past three years among the user members) is assessed using Fisher's t-test. If the estimated coefficient is significant, then it contributes to the prediction of the performance of CFUG, distant from chance variation.

The table 8.4 below depicts that the t-statistics of the coefficient of PROCESS (that is, $p = 0.000$) and MONITORING (that is, $p = 0.000$) are significant at the 1% level. Therefore, we accept the hypotheses that a high index of the PROCESS and MONITORING makes a CFUG perform better in terms of the distribution of a smaller amount of leaf litter among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future. The coefficient of ENFORCEMENT ($p = 0.023$) is significant at the 5% level. It indicates that an increase in the index of ENFORCEMENT positively influences the distribution of leaf litter from CFUG. The coefficient of FUT CONSC ($p = 0.034$) is significant at the 5% level. Therefore, we accept the hypothesis that user members' high future consciousness makes a CFUG perform better in terms of the distribution of a smaller amount of leaf litter among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future.

The t-statistic of the coefficient of the FOREST area ($p = 0.019$) in hectares is significant at the 5% level. The t-statistics of the coefficients of the PLANTATION PLUS natural forest ($p = 0.000$) and NATURAL forest ($p = 0.000$) are significant at the 1% level. We expected a negative sign of the coefficient of CAST BRAHMIN/CHHETRI. However, the coefficient of this caste is positive and our hypothesis is not borne out. The t-statistic of the coefficient of LU or size of livestock in standard unit ($p = 0.000$) is significant at the 1% level. Therefore, we accept the alternative hypotheses that the size of livestock in standard units positively influences the distribution of leaf litter from CFUG. The coefficient of literacy ($p = 0.058$) is significant at the 10% level. The coefficients of FAM SIZE ($p = 0.267$) and CROP ($p = 0.183$) are not significant. Hence, crop income and family size are not the predictors of the three years' average quantity of leaf litter received by the ith household from CFUG. The number of working members in the family may reflect a statistically significant effect on the average quantity of leaf litter from the community forest. Similarly, the size of land owned by the ith household might depict a statistically significant effect on the average quantity of leaf litter from CFUG. The coefficient of the quantity of leaf litter from GOVERNMENT forest ($p = 0.000$) is significant at the 1% level. Thus, we accept the hypothesis that households obtaining a larger quantity of leaf litter from the government forest receive a smaller quantity of leaf litter from CFUG. The coefficient of the average quantity of leaf litter from own farmlands or FARM LEAF LITTER ($p = 0.152$) is not significant.

The coefficients of dummies for CFUG 1 ($p = 0.000$), 3 ($p = 0.000$), 9 ($p = 0.000$), 10 ($p = 0.000$), 17 ($p = 0.000$) and 18 ($p = 0.000$) are significant at the 1% level.

Therefore, these coefficients capture the variation from the common intercept term for the 16 CFUGs. The coefficients of dummies for future consciousness of CFUG 2 (p = 0.000) and 15 (p = 0.000) are significant at the 1% level. The coefficient of dummy for future consciousness of CFUG 15 (0.056) is significant at the 10% level. These dummies capture the variation in response to the future consciousness among the 256 households. However, the dummy for future consciousness of CFUG 14 (p = 0.276) is not significant and we used this dummy to obtain inclusive Durbin-Watson statistic. Table 8.4 shows the estimated coefficients, standard errors and t-statistics and their significance levels for the leaf litter model.

Table 8.4
Estimated Coefficients, Standard Errors, and t-Statistic and their Significance Levels for the Leaf Litter Model

Regressors	Coefficient	Standard Errors	t-statistic
Constant	9.793	0.557	17.57*
PROCESS	-16.084	1.709	-9.411*
ENFORCEMENT	3.010	1.318	2.284**
MONITORING	-5.481	1.881	-2.914*
FOREST	-0.006	0.003	-2.366**
PLANTATION+	9.228	0.659	14.00*
NATURAL	5.173	0.622	8.319*
FUT CONSC	-0.264	0.124	-2.128**
CASTBRAHMIN	0.517	0.146	3.536*
LITERACY	0.199	0.105	1.903***
FAM SIZE	0.022	0.020	1.112
LU	0.150	0.030	4.926*
CROP	-0.0031	0.002	-1.335
FARM LEAF LITTER	-0.085	0.059	-1.439
GOVERNMENT LEAF LITTER	-0.397	0.085	-4.681*
CFUG 1	6.243	0.571	10.93*
CFUG 3	-15.896	1.233	-12.9*
CFUG 9	-11.638	0.886	-13.1*
CFUG 10	-5.912	0.874	-6.761*
CFUG 17	2.639	0.310	8.519*
CFUG 18	-4.109	1.012	-4.061*
CFUG 2 FUT	-7.783	0.872	-8.922*
CFUG 4 FUT	0.710	0.369	1.922***
CFUG 14 FUT	0.448	0.410	1.091
CFUG 15 FUT	4.015	0.373	10.77**
R = 0.969		R^2 = 0.938	

Adj. R^2 = 0.932 Standard Error = 0.7234
Regression F = 146.347#
Durbin-Watson Statistic = 1.72

Note: * t-statistic significant at the 1% level. ** t-statistic significant at the 5% level. *** t-statistic significant at the 10% level. # Regression F-statistic significant at the 1% level (p = 0.000).
Source: table 8.3

Interpretations of the Coefficients of Explanatory Variables

Management Activism

The implication of equation (5) of the chapter V is that if households use part of their leisure time in the group activity, the group improves the index of its management activism (that is, PROCESS, ENFORCEMENT and MONITORING). Consequently, the group may be able to preserve more leaf litter in the forest in the current period so as to supply more leaf litter some time in future. For example, the coefficient of PROCESS is negative (that is, -16.084). It indicates that a unit increase in the average index of the PROCESS of decision-making reduces the supply of leaf litter from community forest by 16,084 kgs per annum per household. The process of decision-making improves if at least one household from each of the castes of general members, and at least one woman are represented in the executive committee. Similarly, the attendance of committee members as per the quorum rules (at least 50% of the total executive members) improves the index of PROCESS. Furthermore, if members decide for the harvest and distribution of leaf litter in the meetings, the index of PROCESS improves. Similarly, PROCESS improves if members hold meetings as per the mandates (that is, once/month for some and once/2 months for the others and once in a year for the 19 CFUGs). Thus, PROCESS can facilitate sharing of ideas about the rules of harvest and distribution of leaf litter, and the importance of protected community forest for hill economy with the members. Consequently, user members develop common understanding among themselves. Hence, CFUG supplies a smaller amount of leaf litter among its members in the current period so as to preserve more foliage for a better regeneration of forest in future.

Following equation (6 of chapter V), we concluded that if households pay membership fee for the group activity, the group improves the index of

ENFORCEMENT. The coefficient of average index of ENFORCEMENT of property rights is positive (that is, 3.010). It indicates that an increase in the index of ENFORCEMENT increases leaf litter from CFUG by 3,010 kg per annum per household. If users receive leaf litter during specified date, time, and a fixed quantity, then CFUG improves its enforcement of property rights. One can argue that leaf litter cannot be stored from one season to another because it decays after some time. Nevertheless, storage of leaf litter can improve regeneration of natural plants and thus improve leaf litter supply from the community forest. However, the positive coefficient of ENFORCEMENT imposes constraints over the household's goal of future consciousness.

Nevertheless, the coefficient of MONITORING of implementation is negative (that is, -5.481). It implies that a unit increase in the index of the monitoring of the implementation reduces leaf litter from CFUG by 5,481 kgs per annum per household. CFUG can monitor its implementation through forest guard or group patrol, and imposition of fines on the rule breakers. Intuitively, equation (7) of section 5.2 of chapter V implies that if households use their leisure time in alternative activities, they can increase the produce from alternative activities. Thus, households pay membership fee for the group out of the produce from alternative activities. CFUG can establish fund and hire forest guard from this fund to monitor forest use effectively. It can organise group harvest of the produce, thus strictly restricting the individual harvesting of the same. In addition, it can also build its image of monitoring of implementation by mobilising group fund in the village development activities. Thus, at a high index of MONITORING, CFUG performs better in terms of the distribution of a smaller amount of leaf litter among the user members.

In sum, the aggregate of the negative coefficients of the PROCESS (that is, -16.084) and MONITORING (that is, -5.481), which equals -21.565 is greater than the positive coefficient of ENFORCEMENT (that is, 3.010) by -18.555. Thus, the thesis is that a CFUG performs better in terms of the distribution of a smaller amount of leaf litter among its members in the current period so as to preserve more foliage for a better regeneration of the forest in the future. The implication is that forest has maximum biological yield capacity. The use of a forest beyond its capacity may cause its extinction after some time. Therefore, the CFUG should function in such a way that the regeneration capacity of the forest is well-maintained. Further, the user group has clear cut boundaries of its users and community forest. The users reside in proximity of the forest. In this sense, users can monitor the forest use behaviour of each other. Consequently, the effectiveness of the CFUG improves so that more leaf litter is preserved in the current period.

Forest Related Attributes

The coefficient of forest area (in hectare) is negative (that is, -0.006). It indicates that an increase in a hectare of forest reduces leaf litter from CFUG by 6 kgs per annum per household. A large forest may supply a smaller quantity of leaf litter if the density of tree is poor. Further, the number of members is proportionately larger for a larger forest, so that the quantity distributed per household is smaller for a large forest.

The coefficients of plantation plus natural forest (that is, 9.228) and natural forest (that is, 5.173) are positive. If CFUG owns plantation plus natural forest, it supplies a larger quantity of leaf litter by 9,228 kgs per annum per household. Similarly, the supply of leaf litter increases by 5,173 kgs per annum per household if CFUG owns natural forest. Plantation plus natural forest and natural forest contain mixed species of trees. Leaf litter is available from such forests throughout the year. Thus, plantation plus natural forest and natural forest supply larger quantities of leaf litter because of these reasons.

Household Related Attributes

Future Consciousness

Equation (4) of chapter V shows the marginal rate of time preference between the current consumption and future consumption of forest produce. Intuitively, if households have high time preference for the current consumption, then more of the produce for future consumption is consumed at present. Alternatively, a high consumption of current forest produce is possible only if produce for future is sacrificed today. Consequently, forest produce may not be available in future. Thus, the thesis of this study is that households are conscious about the protection of the forest for the future so that the forest produce is available in future. Therefore, households desire to receive a smaller amount of leaf litter from CFUG in the current period so as to preserve more foliage for a better regeneration of the forest in the future. For example, the coefficient of the future consciousness is negative (that is, -0.264). It implies that a future conscious household would want to receive a smaller quantity of leaf litter from the community forest by 264 kgs per annum. The possible reasons are as follows. First, user members participate in meetings and develop the common understanding about the importance of protected community forest for the hill economy. If households develop an understanding of the intimate relationship between forest and livelihood and hill natural system, they can be future conscious. Consequently, they intend to receive a smaller amount of leaf litter in the current period. Second, forest should be protected for leaf litter for tomorrow so that forest floor gets adequate protection for regenerating plants thus providing adequate support for the growth of the forest biomass.

Caste Brahmin/Chhetri

The coefficient of CAST BRAHMIN/CHHETRI is positive (that is, 0.517). It indicates that a typical household belonging to Brahmin/Chhetri caste intends to receive a larger quantity of leaf litter from the community forest by 517 kgs per annum. We expected a negative sign of the coefficient of the caste Brahmin/Chhetri. However, the coefficient is positive. Thus, the hypothesis is not borne out.

Literacy

The coefficient of the literacy of the ith household head is positive (that is, 0.199). It implies that a typical household head belonging to the literate category intends to receive a larger amount of leaf litter from CFUG by 199 kg/annum. The possible reason is that the literate members are more worried about the livelihood of their family members. However, it does not mean that they do not show their interest about the protection of community forest for the future. A literate household can educate his/her family members to use the community forest in such a way that the regenerating plants are not jeopardised.

Family Size

Rural population increase may have a direct impact on the demand for natural resources. For example, the coefficient of the FAM SIZE is positive (0.022). It indicates that an increase in the number of family member of the household increases leaf litter from CFUG by 22 kg per annum per household. One of the possible reasons is that the households having a larger number of family members may engage their family members to obtain larger quantity of leaf litter from the community forest. However, the t-statistic of the coefficient of FAM SIZE is not significant. Some other variables, like economically active labour force in the family and size of cultivable land owned by the households, may explain the average quantity of leaf litter from CFUG. However, we have not formally examined this.

Livestock in Standard Unit

In chapter II, we discussed that an increase in the number of livestock population increases demand for leaf litter. For example, the coefficient of the size of livestock (in standard unit) is positive (that is, 0.150). This positive sign of the coefficient indicates that a unit increase in the livestock (in standard unit) increases leaf litter obtained from CFUG by 150 kgs per annum per household. Leaf litter is used as bedding for livestock. Thus, households with a larger number of livestock may require a larger quantity of leaf litter. Similarly, the households use a larger quantity of leaf litter during rains to keep livestock bed free from dampness. Livestock also requires more leaf litter to keep their beds warm during winter.

CROP

The wealth position of the user members may determine the extent of leaf litter obtained from CFUG. Alternatively, at a high-income, forest user may receive a smaller quantity of leaf litter from the community forest. For example, the coefficient of the net crop income is negative (that is, -0.0031). It implies that an increase in net crop income by NRs. 1000 reduces leaf litter from CFUG by 3.1 kgs per annum per household. Households with high net income from crops can substitute manure (or leaf litter) by chemical fertiliser. Similarly, as households' income from crop increases, their life styles may improve: better living conditions, good food habits, and good education for the children and so on. Consequently, households may use less family labour for the acquisition of leaf litter from community forest. However, the t-statistic of the coefficient of the net crop income is not significant. Some other variables like size of land and its types (or khet/low rice land and bari/upland) and number of farm trees may explain the three years' average quantity of leaf litter from CFUG.

Farm Leaf Litter

The coefficient of FARM LEAF LITTER is negative (or -0.085). This coefficient indicates that a typical household obtaining average quantity of leaf litter (in thousand kgs) from own farmlands intends to receive a smaller amount of leaf litter from the community forest by 8.5 kgs per annum. The possible reasons are as follows. FARM LEAF LITTER is the household's own property. He/ She can obtain leaf litter from own farmlands whenever possible. In contrary, leaf litter of common lands (or Community Forest) is community property. CFUG members require decisions from the group to receive leaf litter from the community forest. However, the t-statistics of the coefficient of the average quantity of farm leaf litter is not significant. It can be argued that the number and types of trees and use practice of leaf litter may explain the three years' average quantity of leaf litter received by the household from the community forest.

Government Leaf Litter

The coefficient of the average quantity of GOVERNMENT LEAF LITTER is negative (that is, - 0.397). This coefficient indicates that a typical household collecting average quantity of leaf litter (in thousand kgs) from the government forest intends to receive a smaller amount of leaf litter from the community forest by 397 kgs per annum. The government forests are used as open access resources in the hills. There is no effective monitoring of the government forest use. Therefore, households can obtain a larger quantity of leaf litter from the government forest. However, user members cannot receive leaf litter from the community forest unless permitted by the group.

Therefore, a typical household may intend to obtain more leaf litter from the government forest.

CFUG Dummies

If the coefficient of the dummy under reference is positive, the leaf litter regression function shifts upward. Further, if the coefficient of dummy is negative, the leaf litter regression function shifts downward. The coefficient for the dummies of ratmatejhagarpur or CFUG 3 (that is, -15.896) and banskhark kha or CFUG 9 (that is, -11.638) are negative. The coefficients for the dummies of ratmatejhagarpur and banskhark kha CFUG indicate that households of these CFUGs intend to receive smaller quantities of leaf litter respectively by 15,896 kgs and 11,638 kgs per annum per household, respectively (that is, smaller by 6,103 and 1,845 kgs per annum per household, respectively), as compared with the similarly placed households in other similar CFUGs. Location of the forest from the village of the user members may reduce the current withdrawal of leaf litter from the community forest. For example, the user members of the banskhark kha told us that the community forest is located at a distance. The user members of the banskhark kha obtain litter from public lands near their village. Thus, households intend to receive a smaller amount of leaf litter from the community forest. Ratmatejhagarpur CFUG has two types of forest: one plantation and another, natural forest. Households are settled in two villages (that is, mahadevsthan and jhagarpur). The households of jhagarpur use plantation forest. The households of jhagarpur told us that they receive leaf litter just 2-3 days per annum. The households of mahadevsthan use natural forest. They can receive leaf litter throughout the year from this forest. However, households told us that they use very less leaf litter. Thus, it is because of this reason that the coefficient may have negative sign.

The coefficients of belakholapakha or CFUG 10 and indresworthalpu ka or CFUG 18 indicate households intend to receive a smaller amount of leaf litter, that is, smaller by 3,881 kgs and 5,684 kgs per annum respectively, as compared with their counterparts from other similar CFUGs. The user members intend to receive a smaller quantity of leaf litter, if their requirement for the current consumption is less.

The coefficients for the CFUG dummies for vakundebesi or CFUG 1 (6.243) and thulopakha or CFUG 17 (2.639) are positive. These coefficients indicate that households of vakundebesi and thulopakha intend to receive larger quantities of leaf litter by 6,243 kgs and 2,639 kgs per annum per household, respectively (that is, larger by 16.036 and 12,432 kgs per annum per household, respectively), as compared with similarly placed households in other similar CFUGs. The possible reasons are as follows. Households intend to receive a larger quantity of leaf litter from the community forest, if they are not satisfied with the current distribution system. For example, the members of the vakundebesi CFUG told us that households settled near the forest reach forest early and harvest leaf litter from the best site and receive a larger quantity of the same. The implication is that CFUG should adopt group harvest of leaf litter to supply an adequate quantity of leaf litter among the households. Similarly, the thulopakha CFUG does not adopt distribution system for leaf litter. Households independently harvest leaf litter from thulopakha community forest. The user members reaching early in the forest harvest more leaf litter. Thus, household may be getting inadequate leaf litter because of this and in consequence, they may intend to receive more leaf litter from these CFUGs.

Future Consciousness Dummy

The coefficient of the dummies for the responses to future consciousness for the households of naubisegeruwapakha (-7, 783) is negative. This coefficient indicates that future conscious households of this CFUG intend to receive a smaller amount of leaf litter by 7,519 kgs (7,783-264 kgs) per annum per household) as compared with the average response of future conscious household in general. One of the possible reasons is that if regeneration of new plants is poor, households may be interested to harvest less leaf litter. Because, excess harvest of leaf litter makes forest floor dry and consequently, plants cannot grow. The coefficients of the dummies for the responses to future consciousness are positive for CFUG 4 or sallenibaguwa (that is, 0. 710), 14 or byangdhungathulopakha (that is, 0. 448) and 15 or sanobandandal (that is, 4.015). These coefficients indicate that the future conscious households from these CFUGs intend to receive larger quantities of leaf litter from the CFUGs in contrast with the negative average response (that is, -0.264), of the future conscious households in general who would like to receive smaller quantities of it.

8.7 CONCLUSION

The coefficients of the management activism and future consciousness are negative. Thus, these findings empirically support the choice problem of chapter V that if CFUG members invest their current leisure time in matters concerning management activism of the group and real produce through the payment of membership fee for the monitoring of forest use, CFUG improves its index of management activism. The implication is that a high index of management activism of the CFUG and its user members' high future consciousness make it perform better in terms of the distribution of a smaller amount of leaf litter among the user members in the current period so as to preserve more foliage for a better regeneration of the forest in the future.

The negative coefficient of the forest area in hectares indicates that the quantity of leaf litter supply from CFUG reduces with an increase in forest area by a hectare.

However, the positive coefficients of plantation plus, and natural forest imply that supply of leaf litter from the community forest increases when CFUG owns each of these types of forest. A typical household of each caste Brahmin/Chhetri, and literate status intends to receive a larger quantity of leaf litter from the community forest. The positive coefficient of the size of livestock in standard units denotes an increase in the size of livestock by a unit increases leaf litter from the community forest. The negative coefficients of the average quantity of leaf litter from the government forest indicate that an increase in leaf litter from each of these sources reduces leaf litter from the community forest.

The negative coefficients of the shift dummies for ratmatejhagarpur and banskhark kha indicate that households intend to receive smaller quantities of leaf litter from these CFUGs. The positive coefficients of the dummies for vakundebesi and thulopkha indicate that households intend to receive larger quantities of leaf litter from these respective CFUGs.

The negative coefficient of the slope dummy for the responses to the future consciousness of the households of naubisegeruwapakha indicates that the future conscious households of this CFUG would want to receive a much smaller quantity of leaf litter from the community forest, as compared with the future conscious households in general. However, the positive coefficients of the responses to the future consciousness of the households of sallenibaguwa, byangdhungathulopakha and sanobanamaldol imply that the future conscious households of these CFUGs intend to receive larger quantities of leaf litter from these CFUGs, respectively, in contrast with the future conscious households in general, who would like to receive a smaller quantity of leaf litter from the CFUG.

The next chapter (IX) deals with the conclusion and policy implications.

[1] The leaf litter model with satisfaction variable included 24 variables. The coefficients and t-statistics of the variables are as follows. PROCESS = 3.48 (7.283*), ENFORCEMENT = - 4.420 (-7.378*), MONITORING = -14.199 (-15.449*), FOREST = 0.001 (0.393), FOREST TYPE = -0.535 (-3.645*), FUT CONSC = -0.326 (-2.105**), SATISFACTION = -0.535 (- 3.436*), CASTE = 0.525 (3.976*), FAM SIZE = 0.035 (1.335), CROP = -0.004 (-1.267), LU = 0.139 (3.423*), FARM LEAF LITTER = 0.013 (0.084), GOVERNMENT LEAF LITTER = -0.880 (-1.496), CFUG 9 = -2.481 (-7.023*), CFUG 14 = -3.559 (-9.038*), CFUG 15 = 1.715 (3.596*), CFUG 16 = -1.537 (-3.127*), CFUG 17 = -1.623 (-4.662*), CFUG 18 FUT = 2.815 (3.906*), CFUG 5 SAT = 2.124 (5.107*), CFUG 10 SAT = -2.221 (-2.187**), CFUG 11 SAT = 1.1270 (2.881*), CFUG 13 SAT = 0.966 (1.755***), CFUG 18 SAT = 3.506 (8.961*)

$R = 0.943$. $R^2 = 0.890$. Adjusted $R^2 = 0.878$. Regression $F = 74.378$ (significant at the 0% level).

Durbin - Watson statistic = 1.610.

* t – statistics significant at the 1% level. * * t- statistics significant at the 5% level. * * * t- statistics significant at the 10% level.

CFUG = dummy for the Community Forest User Group. CFUG FUT = dummy for future consciousness.

CFUG SAT = dummy for satisfaction with the current produce received from CFUG.

In this model, the satisfaction with the current produce received from the CFUG is the explanatory variable. Satisfaction with the current produce received from the CFUG is in fact the performance variable. And this variable was dropped from the leaf litter model because of this reason.

CHAPTER IX

CONCLUSION AND POLICY IMPLICATIONS

Stability of a Community Forestry User Group is a necessary pre-requisite to establish it as a long enduring organisation at the local level. CFUG may be expected to be stable if it performs better. CFUG performs better if it distributes a smaller amount of fuel wood, litter, and fodder among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future. In this perspective, a better understanding of the performance of CFUG and of the policy choices to improve its performance is an area of great policy relevance.

As stated in chapter I, hill households in Nepal exclusively depend on the forest for their livelihood. Therefore, it is essential that the hill people should be provided with an access to forest products. In addition, the protection of the forest for the future is necessary. One of the institutional mechanisms to supply the products among the hill people and protect forest effectively is the government's forest agency. However, the government agency was not able to supply the forest products among hill people and protect the forest effectively because of the inadequate staff and insufficient budget. Forests are scattered in a number of small forest patches in the hills. Lack of access roads to hill forest complicated the monitoring of forest use effectively. Consequently, forest management was decentralised in 1977, thus entrusting the tasks of the protection of forest and distribution of forest products with the village panchayats or local elected bodies. However, panchayat officials were not able to effectively monitor the forest use and distribute forest products among the villagers and instil a feeling of co-operation among themselves. Therefore, the government introduced devolution in forest management in 1987, thereby instituting the concept of User Group in

Community Forestry. His Majesty's Government's new forest policy empowered Community Forest User Group to use and protect the forest for the future through its own institutional mechanism under this system. This policy entrusts CFUG to determine the withdrawal of the forest products for the current needs of its members.

The point of departure of this thesis is that the Community Forest User Groups (CFUGs) rely on their political decisions to determine the appropriation of the forest products for the current needs because there is no market for forest products in the hills. Household preferences for the withdrawal of the forest products for the current needs, in this context, are reflected in the social choice/actions or political decisions by the CFUGs. The political decision-making of the CFUG has to settle for the withdrawal of a smaller amount of fuel wood, fodder and litter among the user members in the current period if it has to reflect the concern of the user member households to take care of the regeneration of the forest for the future.

In order to evaluate this proposition empirically, we sought to examine the influence of three principal issues, namely, the impact of CFUG's management activism and its user members' future consciousness on the performance of CFUG in terms of the distribution of fuel wood, fodder and litter among the user members. The three principal issues, which have a significant bearing on the performance of CFUG, are as follows.

a) Whether and why a high management activism of the CFUG makes it perform better in terms of the distribution of a smaller amount of fuel wood, fodder and litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

b) Whether and why a high future consciousness of the user members makes a CFUG perform better in terms of the distribution of a smaller amount of fuel wood, fodder and litter among the user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

c) How far do the other relevant factors, namely, leaders' primary education, forest area and its types, caste and the literacy of the household head, number of members in the family of the respondents, livestock size, net crop income, average quantities of the fuel wood, fodder and litter collected from own farmlands and the government forest, influence the distribution of fuel wood, fodder and leaf litter.

The present community forest policy entrusts forest users to establish the institutions of their own, select representatives for the executive committee, participate in the meetings and make political decisions concerning the formulation and enforcement of harvest and distribution rules for forest products, distribute products among members and invest labour input and membership fee for the protection of the forest for the future (chapter two). However, rules on paper have no meaning unless they are effectively enforced. A CFUG improves its effectiveness or management activism if its rules-in-use are effective. In this study, the effectiveness/management activism of the CFUG is characterised to include the following three aspects: the process of decision-making, enforcement of property rights and the monitoring of implementation of decisions.

In this study, we define a CFUG to improve the process of decision-making, based on the following criteria. A CFUG improves the process of decision-making if a) it represents at least i) one household from each of the castes of the general members and one woman in the executive committee, b) user assembly and executive committee organise meetings as per the mandates, c) executive committee members attend the executive committee meetings as per the quorum rules so that meetings are conducted, and d) CFUG CFUG decides upon the harvest and distribution of fuel wood, fodder, and litter in the meetings.

CFUG improves the enforcement of property rights if it a) effectively specifies and collects the membership fee, and specifies b) the rules of i) harvest and ii) distribution of fuel wood, fodder, and leaf litter. Thus, the enforcement of property rights ensures the users' stake in community forestry.

CFUG strengthens its credibility among the user members if it a) monitors the forest use through hired forest guard/group patrol, b) applies punitive measures on the rule breakers and c) adopts group harvest, and d) mobilises its fund in village development activities.

In chapter III, we described that forest has a regeneration rate. Harvest of forest products beyond its regeneration rate jeopardises the forest resource system. Therefore, forest management should be effective in regulating the appropriation of the forest products for the current needs and protection of the forest resource system for future. For this, a CFUG should be careful while making decisions about the withdrawal of forest products for the current needs.

The fundamental principle behind group or team production is that the group or team consists of user members with similar interests. If CFUG effectively functions as per its tasks, co-ordination is feasible and ultimately it leads towards a better performance. CFUG is advantaged in many respects. Interdependent households in terms of the dependence on forest resource, social and cultural ties and market imperfection makes CFUG a success. Nepal is characterised by labour; credit and insurance market imperfections alike other developing countries. Agriculture is one of the major sources of employment, which provides seasonal employment (or during crop growing and harvest seasons). The hill people spend their leisure time in group activity. Furthermore, the community forests guarantee people's livelihood by supplying the basic forest products thus insuring against the shortages of forest products. Further, there is absence of credit market in hills. Villagers can not obtain loan for tree farming in private lands. Therefore, involvement in group is a necessity for hill households.

Next, common understanding about the critical role of forest resource system for the current needs as well as for the future binds user members together and leads towards success. Similarly, CFUG members live in proximity to each other. Proximity to each other enables the user members to observe the forest use behaviour of the user members and monitor the forest use effectively.

A general trend of research in community forestry in Nepal (as well as in other countries, to our knowledge) is that it focuses on the forest product use patterns, institutional characteristics of the user groups and the influence of the institutional rules on the condition of community forest. However, there is a lack of studies showing the influence of the effectiveness of the CFUG and user members' future consciousness on the current distribution of fuel wood, fodder, and litter among user members. Therefore, this study contributes towards this end.

This thesis takes the following choice-theoretic problem of a typical hill household as its foundation. A typical household is in equilibrium when the current and the future consumption of forest products from the group, labour input in group and alternative activities and expenditure on monitoring of the forest are optimally chosen simultaneously.
A typical household is in equilibrium if the following three conditions hold good.

$$\text{MRS } C_t\, C_{t+1} = \text{MRT } P_{Gt}\, P_{Gt+1}, \quad (1)$$

where, MRS C_t C_{t+1} refers to the marginal rate of substitution between the current (C_t) and future consumption (C_{t+1}) of forest produce. Alternatively, it gives the household's preference for the current consumption of forest products in relation to future consumption of forest produce. MRT P_{Gt} P_{Gt+1} refers to the marginal rate of transformation between the current and future forest produce from group activities.

$$\text{MRS } C_{t+1}\, L_t = \text{MRT } P_{Gt+1}\, L_t, \quad (2)$$

where, MRS C_{t+1} L_t refers to the marginal rate of substitution between current leisure and future consumption of forest produce. MRT P_{Gt+1} L_t refers to the marginal productivity of the current expenditure/application of labour for the monitoring of forest use in protecting the forest for the future.

$$\text{MRS } M_{Gt}\, P_{Gt+1} = \text{MRT } M_{Gt}\, P_{Gt+1} \quad (3)$$

where, MRS M_{Gt} P_{Gt+1} refers to the marginal rate of substitution between the current produce from alternative activities (that is, M_{Gt} or membership fee) devoted to the monitoring of forest use the future forest (P_{Gt+1}). MRT M_{Gt} P_{Gt+1} refers to the marginal productivity of expenditure on monitoring of the forest use in protecting the forest for the future.

To get necessary information for this study, we chose kabhrepalanchowk, middle hill district, which have witnessed substantial efforts by the government and Development Assistance from the Australian Government to foster Community Forestry, beginning with 1978. Further, forests handed over to the groups in this district are in production stage. The district has sufficient data base in terms of the number of groups formed and the forest handed over to the groups.

The sampling units of this study consisted of the functioning CFUGs and their member households. A CFUG distributing fuel wood among its members for consecutive three fiscal years including the survey year (that is, 1996/97, 1997/98 and 1998/99) is defined as a functioning one. The executive committee members were requested to provide information on the annual quantity of fresh fuel wood distributed among the user members. And in this way, the functioning CFUGs were identified. Nineteen Community Forest User Groups were having data on the quantity of fuel wood (for the consecutive fiscal years of 1999/1998, 1998/1997 and 1997/1996) distributed among the user members. The 19 CFUGs, including seventeen located in six Village Development Committees (VDCs) (a village development committee is similar to panchayat and it has nine wards) and two in one municipality, are the sample for this study.

The second unit of sample/population is the member households of CFUG. We collected the lists of households whose name entered in the records/register of the CFUG. This latter type of households is known as the member of CFUG in this study. From the collected lists, 306 households (that is, 16 households from each 17 of the CFUGs in the VDC, and 17 households from the rest 2 CFUGs) were selected following the procedure of systematic sampling. We selected two additional households one each from banskhark ka and vasmepakha because of the reasons to be explained presently. Each of the selected households' names was marked following the systematic random sampling methodology. However, two household heads were not available at that time. Therefore, we selected the households next to the marked households. After a week, the two selected households in the first stage approached us along with an executive committee member and made a request that they wanted to provide information. Therefore, we interviewed these two households also.

The households were categorised into two family size classes (households with less than 6 and those with 6 and more family members) from the collected lists. The total number of households with the family size with less than 6 members is divided by 8 and household falling under this number is marked. Then, the locations of the households are identified with the help of local field assistants and other local villagers if required. Similar procedure is followed in selecting households from the family size class of six and more members. The head of the selected household was approached and interviewed.

This thesis develops linear multiple regression models for fuel wood, fodder and litter to see whether the empirical results of these models validate the implications of the above-mentioned choice theoretic problem. Karl Pearson' s Coefficient of Correlation Method was applied as groundwork for finalising these models. Three years' average quantities of fuel wood, litter and fodder received by the household were regressed respectively on 21, 24 and 25 independent variables using cross sectional data. The overall fitness of the linear multiple regression models is assessed using the coefficient of determination and F test. Decision rule of the Durbin Watson statistics is applied to detect the serial or auto correlation problem of the residuals in the model. The significance of the individual independent variables is assessed using Fisher's t-test and thus conclusions towards the effects of the individual independent variables on dependent variables were derived.

EMPIRICAL FINDINGS

The major findings of each of the models are as follows.

The negative coefficients of the management activism and the future consciousness, which we describe below, validate our hypotheses that a high index of these variables make a CFUG perform better in terms of the distribution of a smaller amount of fuel wood, litter and fodder among user members in the current period so as to preserve more fresh fuel wood and foliage for a better regeneration of the forest in the future.

Fuel Wood Model

The coefficient of the process of decision-making (that is, -8.790) and the enforcement of property rights (that is, -5.627) are negative. These coefficients indicate that an increase in the average index of these variables reduces fuel wood from CFUG by 8,790 and 5, 627 kgs per annum per household respectively. The coefficient of the monitoring of the implementation of the decisions is positive (that is, 4.966), which implies an increase in the average index of the monitoring of implementation increases the current distribution of the fuel wood from community forest by 4, 966 kgs per annum per household. The overall coefficient of the management activism (that is, taking together the impact of the process of decision-making, the enforcement of property rights and the monitoring of implementation) is negative (that is, -9.451). It indicates that an increase in the average index of the management activism of the CFUG reduces the current distribution of fuel wood from the community forest by 9,451 kgs per annum per household. The coefficient of the leaders' educated at least with some primary education (any grade from the 1st to 5th grade) is positive (that is, 0.036). It indicates that a percentage point increase in the primary education of the leaders increases fuel wood from community forest by 36 kgs per annum per household. The coefficient of the forest area (that is, -0.0048) in hectares is negative. This coefficient indicates that an increase in the forest area by a hectare reduces fuel wood from the community forest by 4.8 kgs per annum per household. Similarly, the negative coefficient of the natural forest (that is, -2.328) indicates that fuel wood supply from the community forest reduces by 2, 328 kgs per annum per household, if CFUG owns natural forest of mixed tree species. The possible reasons are as follows. Tree fodder and protected water are available from the natural forest. Therefore, households are interested to protect the natural forest for the future. The coefficient of the future consciousness of the user member showing the impact of the user member's concern about the protection of forest for future is negative (-0.061). It indicates that an increase in the future consciousness of a typical household reduces fuel wood from the community forest by 61 kgs per annum. Similarly, the coefficients of the family size (that is, 0.012) and livestock in standard units (that is, 0.032) are positive. These coefficients indicate that an increase in the number of family members by one increases fuel wood from community forest by 12 kgs and a unit increase in the size of livestock in standard units increases fuel wood by 32 kgs per annum per household. The coefficient of the net crop income is negative (that is, -0.0015), which implies an increase in the household's net income from crop by NRrs. 1000 reduces fuel wood from the community forest by 1.5 kgs per annum per household. The coefficient of the average quantity of fuel wood from own farmlands is negative (-0.066). It indicates that a 1000-kg increase in the average quantity of fuel wood from own farmlands reduces fuel wood from the community forest by 66 kgs per annum per household. The coefficient of the government fuel wood is positive (that is, 1.010). It indicates that a 1000-kg increase in the quantity of fuel wood from government forest increases fuel wood from community forest by 10 kgs per annum per household. However, we expected negative coefficient of government forest. Therefore, our hypothesis does not born out from this coefficient.

The coefficients of the CFUG dummies for ratmatejhargarpur (that is, -4.981), banskhark kha (-6.629) and byangdhungathulopakha (- 0.989) are negative. The coefficients of ratmatejhagarpur and banskhark kha indicate that the households intend to receive a smaller amount of fuel wood by 4, 981 kgs and 6, 629 kgs per annum per household the values of the other explanatory variables remaining the same, that is, as compared with similarly placed households in other CFUGs with similar attributes of management effectiveness, etc. The coefficient for the dummy of byandhungathulopakha (-0.989) indicates that the households of this CFUG intend to receive a smaller average quantity of fuel wood by 989 kgs per annum.

The coefficients of the dummies for the responses to future consciousness of the households of vakundebesi (0.256), naubisegeruwapakha (0.231), thuliban (3.502), belakholapakha (0.199), dharapanikhareti (0.136) and sanobanamaldol (0.188) are positive. These coefficients indicate that a unit increase in the future consciousness of the typical household increases the fuel wood from CFUG by 195 kgs, 170 kgs, 3,441 kgs, 138 kgs, 75 kgs and 127 kgs respectively in contrast with the negative (-0.061) of a similar increase in the future consciousness on the average quantities of 256 kgs, 231 kgs, 3,502 kgs, 199 kgs, 136 kgs and 188 kgs per annum per household respectively, in comparison with other similarly placed households in other CFUGs with similar attributes of management activism, etc.

Fodder Model

The coefficient of the process of decision making (-7.078) and the enforcement of property rights (-10.589) are negative, implying that a unit increase in the average index of the process of decision-making and the enforcement of the property rights reduces fodder from community forest by 7,078 kgs and 10, 589 kgs per annum per household respectively. The positive coefficient of the monitoring of the implementation of the decision (1.739) denotes that a unit increase in the average index of the monitoring of implementation increases the current distribution of fodder from community forest by 1,739 kgs per annum per household. The aggregate of the negative coefficients of the process of decision-making and the monitoring of implementation of the decisions is greater in absolute value than the positive coefficient of the enforcement of property rights by 15. 928. It indicates fodder from community forest reduces by 15,928 kgs per annum per household with a unit increase in the average index of the management activism.

The positive coefficient of the leaders educated up to primary level (0.100) implies that a percentage point increase in the same increases fodder from community forest by 100 kgs per annum per household. The coefficient of the forest area (0.0041) implies that an increase in the forest area by a hectare increases fodder from community forest by 4.1 kgs per annum per household. Furthermore, if CFUG owns plantation plus natural forest (6.170) and natural forest (4.444), these positive coefficients shows, fodder supply increases by 6,170 kgs and 4, 444 kgs per annum per household respectively.

The negative coefficient of the future consciousness of the typical hill household (-0.367) implies that an increase in the future consciousness by one unit reduces fodder from community forest by 367 kgs per annum per household. Similarly, if the household head belongs to caste Brahmin/Chhetri, as the negative coefficient shows (-0.390), he/she intends to reduce fodder from community forest by 390 kgs per annum. The coefficient of the size of the livestock in standard units is positive (0.109), which indicates that an increase in the number of livestock by a standard unit increases fodder from community forest by 109 Kgs per annum per household. The negative coefficient of the net crop income (-0.0084) shows that an increase in the net crop income of the household by NRs. 1000 reduces fodder from community forest by 8.4 kgs per annum. Similarly, the negative coefficient of the government fodder (-5.035) indicates that an increase in the fodder from the government forest by 1000 kgs reduces fodder from community forest by 35 kgs per annum per household. The coefficient of the average quantity of fodder from own farmlands is positive (that is, 0.209), indicating a 1000-kg increase in the fodder from own farmlands increases fodder from community forest by 209 kgs per annum per household. However, this coefficient is not significant.

The coefficients for the dummies of banskhark kha (-4.472), dharapanikhareti (-2.924) and sanobandandal CFUGs (-2.049) are negative. These coefficient indicate that households of these CFUGs intend to receive (and accordingly receive) a smaller amount of fodder by 4,472 kgs, 2,924 kgs and 2, 049 kgs respectively as compared with similarly placed households in other similar CFUGs. Similarly, the positive coefficients for the dummies of sallenibaguwa (1.508) and thulopakha CFUGs (8.683) indicate that the household of these CFUGs intend to receive a larger amount of fodder, that is, larger by 1508 kgs and 8683 kgs per annum per household, respectively, as compared with similarly placed households in other CFUGs with similar characteristics.

The coefficients of the dummies for the responses to the future consciousness are positive for the households in vakundebesi (1.694), ratmatejhargarpur (1.097), sallenibaguwa (0.780), khawakoratmate (0.913), belakholapakha (3.666) and indresworthalpu ka CFUGs (2.179). These coefficients indicate that a unit increase in the future consciousness of the households increases fodder from these respective CFUGs by 1,694 kgs, 1,097 kgs, 780 kgs, 913 kgs, 3, 666 kgs and 2179 kgs per annum as compared with the average response for all households (that is, -0.367), that is, by 1,327 kgs, 730 kgs, 413 kgs, 546 kgs, 3,299 kgs and 1,812 kgs per annum per household, respectively.

Litter Model

The coefficients of the process of decision-making (that is, -16.084) and the monitoring of implementation of the decisions (that is, -5.481) are negative, which indicate a unit increase in the average index of each of these aspects reduces litter from community forest by 16, 084 kgs and 5,481 kgs per annum per household, respectively. The coefficient of the enforcement of property rights (that is, 3.010) is positive. It indicates that a unit increase in the average index of the enforcement of property rights increases litter from the community forest by 3,010 kgs per annum per household. The aggregates of the negative coefficients of the process of decision-making and the monitoring of implementation of the decisions are greater in absolute value than the positive coefficient of the enforcement of the property rights by 18.555, which indicates an increase in the average index of the management activism reduces litter from the community forest by 18, 555 kgs per annum per household.

The coefficient of the forest area is negative (-0.006), which indicates an increase in the community forest area by a hectare reduces litter from community forest by 6 kgs per annum per household. The coefficient of the plantation plus natural forest (that is, 9.228) and natural forest (5.173) are positive. These coefficients indicate that if the group owns plantation plus natural forest and natural forest litter from the community forest increases by 9, 228 kgs and 5,173 kgs per annum per household, respectively.

The coefficient of the future consciousness of a typical household is negative (-0.264). It indicates that a unit increase in the future consciousness of the household reduces litter from the community forest by 264 kgs per annum per household. The coefficient of the caste Brahmin/Chhetri is positive (that is, 0.517). It indicates that a typical household head belonging to the caste Brahmin/Chhetri intends to receive a larger quantity of litter from the community forest by 517 kgs per annum. We expected a negative coefficient for the caste Brahmin/Chhetri. Therefore, this hypothesis does not born out. The coefficient of the literacy is positive (that is, 0.199), which indicates that a typical household head belonging to the literate category intends to receive a larger amount of litter from the community forest by 199 kgs per annum. The possible reason is that literate household heads are more concerned for the improved livelihood of the family members. However, they may educate their family members to harvest litter without spoiling regenerating plants. The coefficient of the livestock size in standard unit is positive (0.150). It indicates that a unit increase livestock (in standard units) increases litter from the community forest by 150 kgs per annum per household. The coefficient of the net crop income is negative (that is, -0.003), which indicates an increase in the net crop income of a typical household by a NRs. 1000 reduces litter from the community forest by 3 gs per annum. The coefficients of the average quantity of litter from own farmlands (that is, -0.085) and government forest (-0.397) are negative. These coefficients indicate that the households obtaining average quantities of litter (in thousand kgs) from own farmlands and government forest intend to receive a smaller amount of litter from the community forest by 85 kgs and 397 kgs per annum per household, respectively.

The coefficients for the CFUG dummies are negative for ratmatejhagarpur (that is, -15.896), banskhark kha (-11.638), belakholapakha (-5.912) and indresworthalpu ka CFUG (-4.109). The coefficients for the dummies of ratmatejhagarpur and banskhark kha CFUG indicate that households of these CFUGs intend to receive a smaller amount of litter by 15, 896 kgs and 11, 638 kgs per annum, respectively, as compared with similarly placed households in other similar CFUGs. Similarly, the coefficients for the CFUG dummies for vakundebesi (6.243) and thulopakha (2.639) are positive. Thus, the coefficient for the dummies of vakundebesi and thulopakha indicate that the households of these CFUGs intend to receive a larger amount of litter from community forest by 6,243 kgs and 2,639 kgs per annum per household, respectively in comparison with similarly placed households in other similar CFUGs.

The coefficients of the dummies for the responses to future consciousness are positive for sallenibaguwa (0.710), byangdhungathulopakha (0.448) and sanobanamaldol (4.015) indicating that a unit increase in future consciousness of the households in those CFUGs leads to an increase in litter supply from these CFUGs as compared to the average response to a unit increase in average future consciousness of households (that is, -0.264), that is, an increase by 446 kgs, 184 kgs, and 3,751 kgs per annum per household, respectively. However, the coefficient of the dummy for the response to future consciousness for the households of naubisegeruwapakha CFUG is negative (that is, -7.783), which indicates that a typical household of this CFUG would intend to receive a smaller amount of litter in comparison with an average household from all the CFUGs taken together, in response to a unit increase in their respective future consciousness.

POLICY IMPLICATIONS

The policy implications of the findings are as follows.

This thesis provides empirical evidence about participatory decision-making by the group leading to social action/choice, which reflects the preferences of the household members in the absence of markets. Households are future conscious, if they realise that they will be able to reap the long-term benefits of the protected community forest and are interdependent in terms of the dependence on forest products and natural system. Consequently, common understanding develops among the user members, which makes group activity a feasible option. The empirical results of the management activism and households' future consciousness imply that the groups are effective managers for the protection of the forest for the future and households have long time horizon. The major policy implications for the government and the CFUG are given below under the respective subheads.

Policy implications for the government

First, households continue to be effective managers of the community forest given that the current provision of usufruct right of forest is continued. It means the groups should be provided legal rights over the forest for a longer duration. Under the current policy, a CFUG is registered for 5 years only. Therefore, this current provision should be lifted and there should be no tenure limitation for the community forest governance and management by the user members.

Second, one of the implications of the high management activism is that an appropriate constitution of an institution (like CFUG) can be an effective mechanism for the forest governance and management. The local communities, who have more knowledge about the forest and forest use behaviour of the people, can generate realistic ideas and vision that can facilitate the smooth development of organisation and lead it towards success. The implication is that the general assembly should be designed in such a way that it represents and articulates the interests of all the traditional forest dependants of a forest area thus safeguarding their legitimate respective interests. Thus, villagers should be independently given responsibility to select general members for the group. Under the current system, the DFO creates CFUG.

Policy implications for the CFUG

One of the implications of the negative coefficient of households' future consciousness is that the political decisions/social actions of the CFUG assembly and executive committee should reflect their members' low time preference for the withdrawal of forest product for the current needs. If households withdraw smaller quantities of forest products in the current period, this can transform into a well-maintained forest in the future. The policy implication is that there should be adequate room for discussions, bargaining, negotiation and compromise in the meetings of the CFUG assembly and executive committee. The discussions should be instructive or educative. Specifically, the members should be made aware that the forest has a certain level of carrying capacity and withdrawal of forest products beyond this capacity would adversely affect the regeneration condition of the forest thereby hill natural system. Next, the decisions should be backed by the approximate assessment of the regeneration condition of the forest. Forest products should be extracted in a way so that the regenerating plants and growth of trees are taken care of, well.

Next, the implication of the negative coefficient of the management activism is that CFUG can be an effective mechanism for the forest governance and management given that the household members apply their leisure time in group activities. The management activism of CFUG may include the following aspects as i) process of decision-making, ii) enforcement of property rights and iii) monitoring of the implementation of the decisions.

The process of decision-making can be effective if a CFUG represents at least one household from each of the castes of general members and one woman in its executive committee, conducts assembly and executive committee meetings regularly, the executive members attend in the committee meetings as per the quorum rules and operates harvest and distribution of fuel wood, fodder and leaf litter following the decisions of the assembly or executive committee or both.

A representative CFUG will articulate the interests of all the castes and women and thus facilitate sharing of information with all the castes and women. Such representation can generate realistic ideas and vision, which facilitate the development of stable organisation at the local level. The policy implication is that future conscious executive committee members or leaders that can establish effective mechanism for dialogue, debate and consensus among the members should be selected. Similarly, leaders should be selected from among those who perceive that forest is essential for future and trusted by all the members of the group and those who are sincere to accomplish the assigned tasks and committed to the common benefit.

Next, regular meetings can make CFUG a lively platform for sharing information and thereby articulating the interests of each of the members concerned. Specifically, CFUG can be accountable and stable if it organises its assembly and executive committee meetings as per the mandate of the constitution.

Next, stewardship by user members in Community Forestry implies that they are the producers and managers of the forest. Thus, it is essential that the CFUG makes its decisions in its assembly or executive committee meeting about what, how, why, to whom and how much about the withdrawal and distribution of a produce while keeping the forest stock intact. The policy implication is that the CFUG should have its production plan, which should provide guidelines on these issues. Therefore, training on the preparation of technical plan to the CFUG members seems most essential.

An effective functioning of a CFUG requires that the property rights consisting of membership rules (i.e. rules of membership fee) and rules of harvest (that is, specification and implementation of rules relating to produce, day/date, time and quantity) and distribution (weighing of produce) be specified and enforced. Property rights are enforced if CFUG effectively follows its production plan.

Further, effectiveness of a CFUG requires that it collect membership fee from its members. Membership fee defines the size of the members for a community forest area. Membership fee is the input in forest management. CFUG can hire forest guard for the monitoring of the forest effectively. It increases the financial strength of the group. A CFUG can mobilise its fund in village development activities so that it can establish as a credible organisation at the local level.

Next, a CFUG improves its monitoring of the implementation of the decisions if it adopts guard/group patrol, applies punitive measures on the rule breakers, harvests produce in group and invests its fund in village development activities. Thus, CFUG can establish itself as a stable and enduring institution if it is characterised by a high index of monitoring of the implementation of the decisions. Effective monitoring of the implementation of the decisions is necessary to assure the users that the rules are obeyed. The implication is that if monitoring is effective, the CFUG can be a credible institution for providing forest products among the user members for the current needs while keeping the forest stock intact for the future.

Further, restraints on user behaviour and compliance of group rules are the most essential elements of monitoring mechanisms. Specifically, a CFUG can improve its status of monitoring of implementation of its decisions, if it effectively controls individual access to forest products. Forest guard may not be able to have close vigilance over forest product harvesting by each of the individual appropriator. Specifically, if group harvest of forest products is adopted, the appropriators cannot diverge from the rules. The rule of thumb is to follow accepted norms otherwise face insult and group norms or fines. Group harvest requires less time than individual harvesting and reduces monitoring costs. If user members harvest the products in group, CFUG can assure its members to supply adequate amount of forest products. If group harvesting of forest produce is strictly enforced, CFUG enhances its credibility.

LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH

Limitations of the study and some of the suggestions for future research are as follows.

One of the limitations of this thesis is that it does not take timber as the indicator of the performance of CFUG. The field survey revealed that 6 out of the 19 CFUGs appropriated timber sometimes in a year preceding the survey. Thus, the data on the amount of timber appropriated from all of these 19 CFUGs was not available. Next, the influence of long time horizon of the user members on the performance of CFUG could be assessed in terms of the volume of biomass of the standing trees. However, this was not possible because of time and financial constraint and lack of necessary information and skills required.

Another limitation of this study is that we could not develop an estimable equation for the households depending upon the two Community Forests for fuel wood, fodder and litter. Fifty of the 306 households received forest products from the two CFUGs. We developed a separate equation for 50 households. The quantities of fuel wood (as a dependent variable) received from the two CFUGs were added together and regressed on the independent variables. However, the coefficient of future consciousness was not significant. The model had auto correlation problem (with less than 0.75 Durbin-Watson statistic).

Since the government agency and international donors are involved to foster community forestry in Nepal for the last two and half decades, forest user members may have developed future consciousness over time. In this context, the evolution of future consciousness one the distribution of forest produce could be more relevant. However, this study takes the measurement of future consciousness for a particular point of time.

In this study, we have assessed the influence of the management activism of the CFUG and its user members' future consciousness on the distribution of fuel wood, fodder, and litter for a mid hill district (that is, kabhrepalanchowk). Viewed from geographical diversity of Nepal, this study has a narrow focus. A similar data set from each terai, hill and mountain ecological belts could provide a comparative analysis of the performance of the CFUGs.

An economic test of the evaluation of CFUG is the Pareto concept of social welfare. An economic welfare can be defined as the satisfaction derived from the use of exchangeable goods and services. In Paretian welfare sense, a change causes an improvement in social welfare if it makes at least one person better off without making any body else worse off. The welfare of the community depends upon the welfare of the individuals or an individual in the society. However, Paretian concept of social welfare has limited application in social forestry because it does not study the distribution of produce among the user members. Further, it does not embrace comparison of interpersonal utility. Since the objective of the Community Forestry is to make individual members self-sufficient in forest product, the yardsticks of the performance of the CFUGs could include measures of social welfare resulting in from the availability of a number of forest products. Next, the user members rely on a number of goods in Community Forestry. To assess whether particular product meets the requirement of the user members, one needs to determine the quantity of produce required for a day or so on and examine how much is supplemented from the community forest. Thus, based on this one could develop the index of performance of CFUG in terms of the distribution of particular product. Therefore, contribution of the Community Forestry on the social welfare of the individual members could be assess in terms of the aggregate index of the fulfilment of the needs on a number of products like fuel wood, fodder and leaf litter.

Further, this thesis finds that future conscious households wish to receive a smaller amount of fuel wood, fodder, and litter so as to preserve more fresh wood and foliage for a better regeneration of the forest in future. However, the present study does not capture the influence of pruning of branch wood or thinning/singling of trees, harvest of fodder and litter on the regeneration condition of the forest. Therefore, the limitation of this thesis is that it does not address the technical issue, that is the impact of harvesting of fuel wood, fodder and litter on the regeneration condition of the community forest.

SIGNIFICANCE OF THE STUDY

The major significance of this study is as follows.

The thesis attempted to provide empirical evidence about participatory decision making by the group leading to social action/choice, which reflects the preferences of the household members in the absence of markets.

This study has brought out the choice theoretic problem of a typical hill household. The major implication of the choice theoretic problem is that households possess low time preference and therefore are willing to accept less current produce from community forest with a hope of getting more of the forest produce in future. Given the level of time preference, households expend their current leisure time and real produce for the effective monitoring of forest for the future.

The major strength of this study is that it empirically provides empirical support for the idea that the CFUG is an effective institution to protect the community forest for future while providing adequate forest products for the current needs. We concluded that the CFUG performs better in terms of the distribution of a smaller amount of fuel wood, fodder, and litter for the current needs. Similarly, this thesis shows that the effectiveness of the rules-in-use establishes CFUG as a credible institution among its members.

Community forestry management is an on-going process. It implies that the CFUG should be able to formulate and enforce rules as per the changing situation. In other words, the rules in use should be flexible and responsive to cope with the changing requirement. Stability of a local institution is not a one shot process. Therefore, CFUG members should be able to come up with the trial and error process so that the rules are effectively formulated and enforced as per the situation. Therefore, the critical part of the rule making is that user members should be able to formulate and enforce the rules as per the changing requirement.

APPENDIX A

ATTRIBUTES ASSOCIATED WITH THE CFUG OR INSTITUTION

INTRODUCTION

The aim of this appendix is to present information about attributes associated with the institution or Community Forest User Groups. This section deals with the roles and responsibilities of the Community Forest User Group Assembly and Committee, official position of the executive committee member, index of the management activism of the group and the leaders' education.

ROLES AND RESPONSIBILITIES OF THE USER ASSEMBLY AND EXECUTIVE COMMITTEE

Table A1 shows the roles and responsibilities of the general assembly and executive committee.

Table A 1

Roles and Responsibilities of the User Assembly and the Executive Committee of the CFUGs of the Kabhrepalanchowk District.

	Roles and Responsibilities of the User Assembly and Committee
User Assembly	i) Formulate rules and regulations and implement the operational plan. ii) Select members for the executive committee and specify their functions, rights and duties. iii) Replace committee members and dismiss them iv) Select sub-committee and specify their functions, rights and duties v) Participate in general assembly meeting once in a year and suggest and give advice to the committee in matters pertaining to the protection and enhancement of forest, harvest and distribution of forest products. vi) Determine and pay membership fee.
Executive Committee	1. Assist DFO staff revise and change the rules of protection of forest, harvest and distribution of forest products, and fines. 2. Implement operational plans consisting of the following aspects i) Conduct monthly and annual meetings, inform users about the decisions of the general assembly and committee meetings, and submit the decisions of the meetings to the DFO. ii) Maintain minutes of the meetings, and statistics of the produce withdrawn from the forest, and sold, and income and expenditure of the group, iii) Prepare an audit report of the income and expenditure and submit it in the general assembly meeting for approval. iv) Operate CFUG account, with the joint signatures of the two executive members. v) Determine the date for the harvest and distribution of forest products, conduct harvesting and distribution of forest products following the operational plan. Conduct thinning/singling operations with the consent of the forest staff. Protect forest from illegal withdrawal of produces, fires, grazing, encroachment, destruction of plants. vi) Recruit forest guard, monitor forest use, and punish rule breakers. Approve the resignation of the executive members except the chief of the committee.

Source: CFUG Constitution and Operational Plan, 1999-2000.

OFFICIAL POSITIONS OF THE MEMBERS OF THE FOREST USER GROUP COMMITTEE (CFUGC)

A Community Forest User Group defines the official positions of the members of the executive committee in the constitution. The tenure of the executive committee is for two years. The continuity of an executive member of the committee depends upon his availability, skills and seriousness to accomplish the assigned task. The official position of the executive committee is given in table A2.

Table A2

Percentage of Official Positions Occupied by the Executives and Members of the Executive Committee, and Representation of Men and Women in the Community Forest User Group Committee

Vdc/municipality	CFUG	Positions		Total Members	Men	Women
		Executives	Members			
Khanalthok	Vakundebesi	36	64	11	82	18
Mahadevsthan	Naubisegeruwapakha	36	64	11	82	18
	Ratmatejhagarpur	36	64	11	100	00
	Sallenibaguawa	38	62	13	69	31
Panchkhal	Khawakoratmate	31	69	13	92	8
	Thuliban	27	73	15	87	13
	Vasmepakha	44	56	9	89	11
Phoolbari	Banskhark ka	36	64	11	56	44
	Banskhark kha	33	67	9	100	0
	Belakholapakha	45	55	11	100	0
	Dharapanikhareti	36	64	11	67	33
	Voltasethulipokhari	44	56	9	100	0
Puranogaun	Baserithuloban	38	62	13	85	15
Tukucha	Byangdhungathulopakha	44	56	9	56	44
	Sanobanamaldol	44	56	9	89	00
	Sanobandandal	57	43	7	91	9
	Thulopakha	30	70	10	80	20
Panauti Municipality	Indresworthalpu ka	36	64	11	82	18
	Jyalachiti	33	67	15	87	13

Source: Field Survey, 2001.

The above table A2 displays that about 57% of the members in sanobandandal Community Forest User Group Committee (CFUGC) hold executive positions. By executives, we mean chief, vice chief, secretary, joint secretary and treasurer other than the members of the executive committee. Similarly, approximately 44% of the members belong to the executive category in vasmepakha, byangdhungathulopakha, belakholapakha, voltasethulipokhari and sanobanamaldol.

MANAGEMENT ACTIVISM

As mentioned in chapter V, the management activism of the CFUG is characterised to include the following three aspects: process of decision-making, enforcement of property rights, and monitoring of the implementation of the decisions.

Average Index of the Process of Decision-Making

Average index of the process of decision-making = index of four years' average of the total of the monthly and annual meetings of 6 & above + four years' average attendance of the 50% and above of the total executive members in the executive committee meetings + representation of one household from each of the castes of general members in the executive committee + representation of one woman in the executive committee + decision making by executive committee or assembly or both for the harvest and distribution of fuel wood, fodder and leaf litter divided by the total number of items, namely, five. Table A3 shows the average index of the process of decision-making.

Table A 3:
Average Index of Process the of Decision-Making

Vdc/municipality	Cfug	Four years' average meeting (1)	Four years' Average attendance members (2)	Caste Repre sentati on (3)	Woman represe ntation (4)	Fuel wood			Litter		Fodder		
						Deci-sion Fuel (5)	Deci sion Sita (5)	Aver age (6)	Decisi on (5)	Avera ge (6)	Deci sion grass (5)	Decision Fodder (5)	Aver age (6)
k.thok	Vakunde	1	1	0	1	1	1	0.83	1	0.8	1	Na	0.80
Maha-dev-sthan	Naubise	0	0	1	1	1	1	0.67	1	0.6	1	1	0.67
	R.jgarpur	0	0	0	0	1	0	0.17	0	0	1	0	0.17
	S.baguwa	1	1	1	1	1	0	0.83	0	0.8	0	0	0.67
Panch-khal	Khawakoratmate	1	1	0	1	1	1	0.83	1	0.8	1	0	0.67
	Thuli	1	1	1	1	1	1	1	1	1	1	1	1
	Vasme	1	1	1	1	1	1	1	1	1	1	1	1
Phool bari	Banska	0	0	0	1	1	0	0.33	0	0.2	na	0	0.20
	Banskha	0	0	1	0	0	0	0.17	0	0.2	0	0	0.17
	Belakhola	1	0	0	0	1	0	0.33	0	0.2	0	0	0.17
	Dharapani	0	0	1	1	1	0	0.5	1	0.6	0	0	0.33
	Voltase	1	0	0	0	0	0	0.17	0	0.2	1	Na	0.40
Puranogaun	Baseri	0	0	1	1	0	0	0.33	0	0.4	na	0	0.40
Tukucha	B.dhunga	0	0	1	1	0	0	0.33	0	0.4	0	Na	0.40
	S.amaldol	1	1	1	0	0	1	0.67	1	0.8	na	0	0.60
	S.dandal	0	0	1	1	0	1	0.5	1	0.6	na	0	0.40
	T.pakha	1	0	0	1	0	0	0.33	0	0.4	0	Na	0.40
Panauti Municipality	I.thalpu ka	0	0	0	1	1	0	0.33	1	0.4	1	0	0.33
	Jyalachit	1	1	1	1	0	0	0.67	1	1	1	0	0.83

Source: Field survey, 2001.

Note: 1) 1 for four years' average of the total of the monthly and annual meetings of 6 and above, otherwise 0. 2) 1 for four years' average attendance of the 50% and above of the total number of executive members in the committee meeting, otherwise 0. 3) 1 if one household from each of the castes of general members represented in the executive committee, otherwise 0. 4) 1 if one woman represented in the executive committee, otherwise 0. 5) 1 if executive committee /assembly or both decide for the harvest and distribution of fuel wood, fodder and litter, otherwise 0. 6). 1+2+3+4+5/number of items.

'na' refers to not applicable. The vakundebesi, voltase, byangdhunga and thulopakha community forests are plantations of pines and tree fodder is not available from these forests. The banskharka ka, banskhark kha, baserithuloban, sanobanamaldol and sanobandandal are the natural forests and grass is not available from these forests.

- *Four Years' Average Numbers of Annual Executive Committee and General Assembly Meetings*

Banskhark ka executive committee organised only 1 meeting per annum, on an average, during the past four years.. The khawaokoratmate CFUG organised 14 executive committee meetings and but 15 general assembly meetings per annum, during the past four years. The vakundebesi executive committee held 13 executive committee meetings per annum. Further thuliban CFUG accounts for a largest number of assembly meetings, that is, 2.5 per annum. Table A4 shows the four years' average numbers of monthly and annual meetings of the CFUGs.

Table A 4

Four years' Average Number of Monthly and Annual Meetings of the CFUG and Attendance of Members in the Monthly and Annual Meetings During 1996/95-1999/98

Vdc/municipality	CFUG	Four years' average monthly meeting (1)	Four years' Average Attendance of members in the committee meetings (2)	Four years' average Annual Meeting (3)	Four years' average attendance of members in the assembly meetings (4)	Four years' Average total meeting (1+3) (5)
Khanalthok	Vakundebesi	13.0	8.6	1.0	76.8	14
Mahadevsthan	Naubisegeruwa	4.8	2.6	0.3	21.8	5.1
	Ratmatejhagarpur	4.8	3.3	0.5	48.5	5.3
	Sallenibaguwa	11.0	8.7	1.3	116.0	12.3
Panchkhal	Khawakoratmate	14.0	10.1	1.5	177.0	15.5
	Thuli	9.5	9.2	2.5	157.3	12.0
	Vasme	7.5	4.5	2.0	73.8	9.5
Phoolbari	Banskhark ka	3.8	1.4	1.3	42.0	5.1
	Banskhark kha	1.0	1.1	0.5	16.0	1.5
	Belakholapakha	5.8	3.4	1.0	113.8	6.8
	Dharapanikhareti	2.8	2.4	1.5	67.8	4.3
	Voltasethulipokhari	5.0	2.3	0.8	35.0	5.8
Puranogaun	Baseriban	1.5	1.0	0.8	27.8	2.3
Tukucha	Byangdhunga	4.5	2.9	0.5	24.0	5.0
	Sanobanamaldol	7.5	4.4	1.3	49.5	7.8
	Sanobandandal	1.5	0.7	1.3	29.0	2.8
	Thulopakha	4.3	2.4	2.3	99.0	6.6
Panauti	Indresworthalpu ka	2.0	7.9	0.3	48.3	2.3
Municipality	Jyalachiti	9.0	1.3	Na	Na	9.0

Source: Field survey, 2001.
Note: 1. The four years' average number of monthly meetings of the executive committee was obtained dividing the four years' aggregates of monthly meetings by total number of months. 3. The four years' average number of meetings was obtained by dividing the aggregates of the annual number of meetings of the assembly by four. 5. This is the aggregate of the four years' average numbers of the executive and general assembly meetings.
'na' refers to not applicable

- ***Attendance of the Executive Members in the Committee Meetings***

Four years' average of the members' attendance in the monthly meetings was obtained dividing aggregates of the number of members who attended the meetings by the total number of meetings. The table A4 displays the average attendance of the executive committee members in the meetings, during the past four years. In khawakoratmate, 10.1 executive committee members attended the meetings per annum, during the past four years. Approximately, 9.2 executive members attended the executive committee meetings in thuli CFUG, on an average. In sallenibaguwa and vakundebesi CFUGs, the average number of members, who attended executive committee meetings are 8.7 and 8.6, during the past four years. The index of the four years' average number of members' attendance in the executive meetings is derived following the two approaches as given below. First, four years' average attendance of members was converted into percentage, dividing this average figure by the total number of executive committee members of the corresponding CFUG, and multiplied by hundred. Second, CFUG with the four years' average number of members' attendance of 50% and above of the total number of executive members in the monthly meetings was given one mark; otherwise 0.

- *Representation of the Households from Caste of the General Members in the Executive Committee*

Table A.5 shows the caste representation in the CFUGC. Eight of the 19 CFUGC (that is, vakundebesi, ratmatejhagarpur, khawakoratmate, banskkark ka, belakholapakha, voltasethulipokhari, thulopakha and indresworthalpu ka) do not represent one household from each of the castes of the general members. Lower castes particularly, sarki, pariyar and kami are not represented in these CFUGCs. The upper castes (Brahmin and Chhetris) and newar and tamang/magar are represented in the executive committee. The Byangdhungathulopakha, Sanobanamaldol, vasmepakha and dharapanikhareti CFUG have mono caste settlements. Therefore, the executive committee members belong to a single caste. The rest 7 CFUGs represent at least one household from each of the castes of the general members in the executive committee (table A5).

Table A5

Caste Representation in the Community Forest User Group Committee (in percentage)

Vdc/municipality	CFUG		Castes					
		Total members	Brahmin	Chhetri	Newar	Tamang	K/P/S/D	Total
Khanalthok	Vakunde	11	64	0	9	27	0	100
Mahadevstahn	Naubise	11	82	0	18	0	0	100
	R.jhagarpur	11	0	0	9	0	91	100
	S.baguwa	13	77	0	0	8	15	100
Panchkhal	Khawakoratmate	13	77	7	8	8	0	100
	Thuliban	15	60	20	7	7	6	100
	Vasme	9	67	33	0	0	0	100
Phoolbari	Banska	9	78	0	0	22	0	100
	Banskha	11	0	0	73	27	0	100
	Belakhola	11	73	9	0	18	0	100
	Dharapani	9	100	0	0	0	0	100
	Voltase	11	73	0	0	27	0	100
Puranogaun	Baseri	13	92	0	0	8	0	100
Tukucha	B.dhunga	9	na	na	na	na	100	100
	S. amaldol	9	na	100	na	na	na	100
	S.dandal	7	0	86	0	0	14	100
	T.pakha	10	10	20	70	0	0	100
Panauti municipality	I.thalpuka	11	64	36	0	0	0	100
	Jyalachiti	15	13	73	7	0	7	100

Source: Field survey, 2001.

Note: k = kami (iron workmen), p = pariyar (tailor men), s = sark (leather works), d = danuwar.

"0" refers to no representation of the caste under reference. Na refers to not applicable that is, single caste

- *Representation of the Women in the Executive Committee*

Table A2 above displays that there is no representation of a woman member in the executive committees of ratmatejhagarpur, mahadevstahn, vdc, banskhark kha, voltase and belakholapakha, phoolbari, vdc, and sanobanamaldol, tukucha, VDC. Women occupy about 44% of the position each in byangdhunga and banskhark ka CFUGC. Slightly lower than one third of the total executive committee members in sallenibaguwa (31%), and almost one third of the members in dharapanikhareti (33%) are women. In thulopakha, approximately, one fifth of the executive committee members are women.

Average Index of the Enforcement of Property Rights

The aggregate index of the specification of membership fee, specification of rules of harvest (including index of produce, day/date, time of entry into and exit from the forest, and the quantity of produce) and distribution (weighing of bundles of fuel wood and back loads of sita, grass, tree fodder and leaf litter) divided by the total number of items (namely, six) equals the average index of the enforcement of property rights. The table A6 shows the index of the enforcement of property rights with reference to fuel wood (including sita), fodder (grass and tree fodder) and leaf litter.

Table A6

Index of the Enforcement of Property Rights

Vdc/municipality	CFUG		Fuel wood										Litter					Fodder								
			Fuel wood					Sita										Grass				Tree fodder				
		fee	p	D	t	q	w	p	d	t	q	Ave	p	d	t	q	ave	p	d	t	q	p	d	t	q	Ave
K.lthok	Vakunde	1	1	1	1	1	0	1	1	1	0	0.73	1	1	1	0	0.67	1	1	1	0	na	na	na	na	0.67
Maha-devsthan	Naubise	1	1	1	1	1	0	1	1	1	0	0.73	1	1	1	1	0.83	1	1	1	1	1	1	1	1	0.82
	R.jhagarpur	1	1	0	0	1	0	1	0	0	0	0.36	1	0	0	0	0.33	1	0	0	0	1	0	0	0	0.27
	S.baguwa	1	1	0	0	1	0	1	0	0	0	0.36	1	0	0	0	0.33	1	0	0	0	1	0	0	0	0.27
Panch-khal	K.ratmate	1	1	1	0	1	0	1	0	0	0	0.45	1	1	0	0	0.50	1	1	0	0	1	0	0	0	0.36
	Thuli	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0.67	1	1	1	0	1	1	1	1	0.73
	Vasme	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0.67	1	1	1	0	1	1	1	1	0.73
Phool-bari	Banska	1	1	1	1	1	0	1	0	0	0	0.55	1	0	0	0	0.33	na	Na	na	na	1	0	0	0	0.17
	Banskha	1	1	0	0	1	0	1	0	0	0	0.36	1	0	0	0	0.33	1	0	0	0	1	0	0	0	0.27
	Belakhola	1	0	0	0	1	0	0	0	0	0	0.18	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0.09
	Dharapani	0	1	0	0	1	0	1	0	0	0	0.27	1	0	0	0	0.17	1	0	0	0	1	0	0	0	0.18
	Voltase	1	1	1	1	1	0	0	0	0	0	0.45	1	0	0	0	0.33	1	0	0	0	na	na	na	na	0.33
Puranogaun	Baseri	1	1	1	1	1	0	1	0	0	0	0.55	1	0	0	0	0.33	na	Na	na	na	1	0	0	0	0.17
Tukucha	B.dhunga	1	1	0	0	1	0	1	0	0	0	0.36	1	0	0	0	0.33	1	0	0	0	na	na	na	na	0.33
	S.amaldol	1	1	0	0	1	0	1	0	0	0	0.36	1	0	0	0	0.33	1	0	0	0	1	0	0	0	0.27
	S.dandal	0	1	0	0	1	0	1	0	0	0	0.27	1	0	0	0	0.17	1	0	0	0	1	0	0	0	0.18
	T.pakha	1	1	1	1	1	0	1	0	0	0	0.55	1	0	0	0	0.33	1	0	0	0	na	na	na	na	0.33
Panauti Municipality	I.thalpuka	1	1	1	1	1	0	1	0	0	0	0.55	1	1	1	0	0.67	1	1	1	0	1	0	0	0	0.45
	Jyalachiti	1	1	1	1	1	0	1	0	0	0	0.55	1	1	1	0	0.67	1	1	1	0	1	0	0	0	0.45

Source: Operation plans and field survey, 2001.

Note: fee refers to the specification of membership fee in rupees (the information about the rates of membership fee is given in table A10). p = specification of produce, d = day/date, t = time of entry into and exit from the forest,

q = specification of quantity, w = weighing. 1 for specification of each of these items, otherwise 0.

Average = aggregate index of fee + p + d + t + q + w/total number of items.

'na' refers to not applicable as mentioned under the footnotes of table A3.

"Ave' refers to the average index.

Average Index of the Monitoring of the Implementation of the Decisions

The average index of the monitoring of implementation = index of forest guard/group patrol + fines collected from rule breakers + mobilisation of fund in village development activities + group harvest of produce divided by the total number of items, namely, four. Table A7 shows the average index of the monitoring of the implementation of the decisions, with reference to fuel wood, fodder and leaf litter.

Table A7

Average Index of the Monitoring of Implementation of the Decisions

Vdc/ Munici pality					Fuel wood			Litter		Fodder		
	Cfug	guard/ Patrol	fines	Fund	group fuel	Group Sita	Average	group	Average	Group grass	Group tree leaves	Aver age
Khanalthok	Khanalthok	1	1	1	1	1	1.00	1	1.00	1	Na	1
Mahadevsthan	Naubise	1	0	1	1	1	0.80	1	0.60	1	0	0.5
	Ratmatejhagarpur	1	1	1	1	0	0.80	0	0.60	0	0	0.5
	Sallenibaguwa	1	1	1	1	0	0.80	0	0.60	0	0	0.5
Panchkhal	Khwakoatmate	1	1	1	1	1	1.00	1	0.80	1	0	0.67
	Thuli	1	1	1	1	1	1.00	1	0.80	1	0	0.67
	Vasmepakha	1	1	1	1	1	1.00	1	0.80	1	0	0.67
Phoolbari	Banskhark ka	1	1	1	1	0	0.80	0	0.80	Na	0	0.75
	Banskhark kha	1	0	1	1	0	0.60	0	0.40	0	0	0.40
	Belakholapakha	1	0	0	0	0	0.20	0	0.20	0	0	0.17
	Dharapanikhareti	1	1	1	0	0	0.60	0	0.60	0	0	0.5
	Voltasethulipokhari	1	1	1	0	0	0.60	0	0.60	0	na	0.75
Puranogaun	Baseriban	1	0	0	0	0	0.20	0	0.25	na	0	0.20
Tukucha	Byangdhunga	1	0	0	0	0	0.20	0	0.40	0	na	0.25
	Sanobanamaldol	1	1	1	0	1	0.80	1	0.80	na	0	0.75
	Sanobandandal	1	0	1	0	1	0.60	1	0.80	na	0	0.5
	Thulopakha	1	0	1	0	0	0.40	0	0.60	0	na	0.5
Panauti	Indresworthalpu ka	1	0	0	0	0	0.20	1	0.40	0	0	0.17
municiaplity	Jyalachiti	1	1	1	0	0	0.60	1	0.80	1	0	0.67

Source: Field Survey, 2001.

Note: guard/patrol refers to the forest guard or voluntary group patrol (1 if forest guard or group patrol, otherwise 0). Fines refers to the amount of money collected from the rule breakers (1 if fines collected in rupees, otherwise 0). Fund refers to the mobilisation of group fund in village development activities (1 if fund mobilised in rupees in village development activities, otherwise 0). Group fuel, sita, litter, grass, and tree leaves refer to whether or not these products are harvested in group (1 if produce is harvested in group, otherwise 0).

'na' refers not applicable (refer to the footnotes of table A5).

- *Forest guard/patrol (or protection system)*

Table A8 given below shows that 14 of the 19 CFUG adopts hired forest guard and the rest 5 CFUGs have group patrol for the effective monitoring of the forest use.

- *Punitive measures*

The Community Forest User Group Committee of the kabhre district employs three kinds of punitive measures, that is, confiscation of tools, warnings (for encroachment of forestland and hunting) and fines (for stealing of forest produce and entering forest without identity card). Table A8 shows that 11 out of the 19 CFUG collected fines from rule breakers against stealing of forest products. In vakundebesi CFUG, the executive committee raises fines from the members who are absent for the monitoring of the forest use on the assigned day. The membership fee and rules of fines and punishments are given in table A11. Table A8 depicts the punitive measures adopted by the 19 CFUG of the kabhre district.

Table A8
Punitive Measures and Protection Rules of the CFUGs

VDC	CFUG	Punitive measures employed			Protection rules
		War Ning and confiscati on of tools	Fines (in NRs)	Remarks	
Khanalthok	Vakundebesi	Na	400	Absence in rotation and stealing of grass and leaf litter	Group
Mahadevsthan	Naubisegeruwa	1*	Na	na	Guard
	Ratmatejhagarpur	Na	565	Stealing of tree and delay in the payment of loan	Guard
	Sallenibaguwa	14c, 1*	420	Stealing of produce	Guard
Panchkhal	Khawakoratmate	Na	1,725	Stealing of produce (6) and entering forest without entry card (36)	Guard
	Thuli	Na	870	Stealing of produce	Guard
	Vasme	Na	1,350	Stealing of produce	Guard
Phoolbari	Banskhark ka	Na	150	Stealing of fodder	Group
	Banskhark kha	Na	Na	na	Guard
	Belakholapakha	Na	Na	na	Guard
	Dharapanikhareti	2c, 1*	250	Stealing of produce	Guard
	Voltasethulipokhari	1*	250	Stealing of produce	Guard
Puranogaun	Baseriban	Na	Na	na	Group
Tukucha	Byangdhunga	Na	Na	na	Guard
	Sanobanamaldol		1,470	Stealing of produce	Guard
	Sanobandandal	Na	Na	na	Group
	Thulopakha	Na	Na	na	Group
Panauti Municipality	Indresworthalpu ka	Na	Na	na	Guard
	Jyalachiti	4*, 2#	320	Stealing of produce (7) and hunting (1)	Guard

Source: Field Survey, 2001.
Note: 'c' refers to confiscation of tools. * refers to encroachment of forestland. # refers to hunting.
"na' refers to not available.

- *Mobilisation of Fund in Village Development Activities*

CFUG of kabhre district raises fund from the sale of forest produce (particularly, fuel wood) and fee from the members. The CFUG fund is used in a number of village development activities, like constriction of school and its maintenance, construction of drinking water projects, public building, and health centre. Table A9 shows the amounts of cash used in village level activities of the 19 CFUG of the kabhre district.

Table A9

Mobilisation of Cash in Village Development Activities by the CFUGs

Vdc/municipality	CFUG	Amount in NRs.	Activities
Khanalthok	Vakundebesi	570	Stipend to poor student and expense of adult literacy class
Mahadevsthan	Naubisegeruwa	2,805	Primary school and literacy class
	Ratmatejhagarpur	17,417	Construction of temples, schools, utensils for joint community use during feasts
	Sallenibaguwa	500	Women's training
Panchkhal	Khawakoratmate	93, 000	Assistance to schools, health centre, road construction and social organisation
	Vasmepakha	80	Assistance to poor for treatment
	Thuli	10, 000	Assistance to health centre
Phoolbari	Banskhark ka	4,500	Assistance to victims of floods and user member's toilet construction
	Banskhark kha	200	Assistance to participant of audit training
	Belakholapakha	Na	Na
	Dharapanikhareti	1,45000	Assistance to the construction of secondary school building and public house.
	Voltasethulipokhari	17,000	Assistance to the village drinking water project
Puranogaun	Baseriban	Na	Na
Tukucha	Byangdhunga	Na	Na
	Sanobanamaldol		Na
	Sanobandandal		Na
	Thulopakha	28,300	Public building at cremation spot, irrigation and drinking water projects.
Panauti Municipality	Indresworthalpu ka	Na	Na
	Jyalachiti	Na	Construction of public building

Source: Field Survey, 2001.
Note: na refers to not available.

LEADERS' EDUCATION

By leaders, we mean the members of the executive committee, including the chief of the CFUG. Table A11 given below demonstrates that one third of the members of the executive committee are educated with some secondary education (any grade from the 6th to the 10th grade). Approximately, 56% of the members have some primary education, that is, any grade from the 1st to the 5th grade. Only 12% of the members are not able to read and write (that is, illiterate).

Table A 10

Percentage of Executive Members Educated with some Primary Education (from grade the 1st to the 5th grade) and Secondary Education (from the 6th to the 10th grade) and Illiterate Stauts..

Vdc/municipality	CFUG	Total members	Primary	Secondary	Illiterate	Total
Khanalthok	Vakundebesi	11	63.6	36.4	0.0	100
Mahadevsthan	Naubisegeruwa	11	54.5	45.5	0.0	100
	Ratmatejhagarpur	11	9.1	9.1	81.8	100
	Sallenibaguwa	13	69.2	30.8	0.0	100
Panchkhal	Khawakoratmate	13	61.5	38.5	0.0	100
	Thuliban	15	60.0	40.0	0.0	100
	Vasmepakha	9	55.6	44.4	0.0	100
Phoolbari	Banskhark ka	9	66.7	33.3	0.0	100
	Banskhark kha	11	72.7	18.2	9.1	100
	Belakholapakha	11	36.4	63.6	0.0	100
	Dharapanikhareti	9	77.8	22.2	0.0	100
	Voltasethulipokhari	11	63.6	36.4	0.0	100
Puranogaun	Baseriban	13	53.8	30.8	15.4	100
Tukucha	Byangdhunga	9	33.3	11.1	55.6	100
	Sanobanamaldol	9	66.7	33.3	0.0	100
	Sanobandandal	7	71.4	28.6	0.0	100
	Thulopakha	10	30.0	30.0	40.0	100
Panauti Municipality	Indresworthalpu ka*	11	54.5	18.2	27.3	100
	Jyalachiti	15	66.7	33.3	0.0	100
	Total	208	56.3	32.2	11.5	100

Source: Field Survey: 2001

Table A 11

Rules of MembershipFee Fines and Punishments

VDC	CFUG	Fee	fuel wood	timber	sita	Grass	Litter	Fodder	agri-tools	Fire	grazing	Herbs	soil	encroach	hunting	destruction of plants	absence
Khanalthok	Vakunde	12	50-400	500-1000		50-200				Act	10-100	25-100	50-100		500-1000		suspend
Mahadevsthan	Naubise	100	50	200-1000		25	25		1000-3000	15-20			1000-3000	1000-3000	DFO	10-25	
	R.jhagarpur	60	50-500	100-1000	50	50	50	50			100			1000-3000	DFO		
	S.baguwa	30	100-500	500-1000	25-100	25-100			500-1000	500-1000	500-1000	25-100		DFO			
Panchkhal	K.ratmate	80	100-500	As per the case	10-30	10-30	10-30		As per the case	As per the case	5-15		As per the case	As per the case	As per the case		
	Thuli	60	2 times greater than the amount	As per the case	50-2000	25-100	25-100			DFO	Forest act						
	Vasme	60	200-1000	500-5000	25-100	25-100	25-100			200-1000	10-1000	100-1000	25-100	500	DFO		
Phoolbari	Banska	24	10-50	100				50		1000	10-15			1000	500	50-100	
	Banskha	42	50	200			25	25		500	5-10			2000	500-700	50-100	10-100
	Belakhola	120	200-1000	500-5000	25-100	25-100	25-100			200-1000	10-20	100-1000	25-100				
	Dharapani	0	cfugc	cfugc	50-100	50-100	50-100		CFUG	CFUG	5-10		CFUG				
	Voltase	25	100	500	50-100	50	50			1000	50			32000	500-1000	50	
Puranogaun	Baseri	50	cfugc	cfugc						CFUG	2-15			CFUG	CFUG		
Tukucha	B.dhunga	420	50	100-500						100-500	5-20			10000		20-1000	20-50
	S.amaldol	120	25-100	150	25-100		25-100	25-100			25-100		DFO			20-500	100
	S.dandal	0	50	150	50	50	50			500-1000					200-500	2-50	50
	Thulopakha	75	25-100	200*	25-100	20-100	20-100			As per the case	10-100			DFO	As per the case		
Panauti Municipality	Lthalpuka	120	100	cfugc	50-100	50-100	25-50				10-50						
	Jyalachiti	75	50-1000	500-5000		5-400	5-400	5-400		1000-10000	5-400		100-50000	500-15000	50-10000	100-1000	50

Source: Operation Plans, 1999-2000. Fields Survey, 2001.

Note: timber diameter up to 20" .If timber with the size of more than 20" diameter is stolen, then fine = NRs. 400.

APPENDIX B

BACKGROUND INFORMATION ABOUT FUEL WOOD MODEL

INTRODUCTION

The fuel wood model intends to provide the answers to the questions of why a high management activism of the Community Forest User Group and its user members' high future consciousness make it perform better, which is reflected in the distribution of a smaller amount of fuel wood in the current period, so as to preserve more fresh fuel wood for a better regeneration of the forest in the future. Three years' average quantity of fuel wood received by the ith household from the CFUG is the dependent variable in fuel wood model. Fuel wood consists of moisture content corrected fuel wood, plus sita or twigs. Twigs include the remains of fresh wood, dry branches, which is called sita pita or jhikra. The methodology adopted to collect information about fuel wood, and get the moisture content corrected fuel wood is discussed in chapter IV.

AVERAGE QUANTITY OF FUEL WOOD FROM THE PRIMARY COMMUNITY FOREST

Table B1 depicts the average quantity of fresh, and moisture content corrected fuel wood, and sita received by household (per adult and child) from each of the 19 CFUGs, during the past three years. A CFUG distributed 1,290 kgs of (moisture content corrected) fuel wood per annum, per household.

Thuliban CFUG distributed 470 kgs of (moisture content corrected) fuel wood per annum, per household. However, the dharapanikhareti CFUG distribtued 4,420 kgs of (moisture content corrected) fuel wood per annum per household, during the past three years.

Table B1

Average Quantities of Fresh and Moisture Content Corrected Fuel Wood and Sita Received (in 000 kgs) by the Member Household (per Child and Adult) from Community Forest User Group, During 1997/96-1999/1998.

Vdc/municipality	cfug	1997/1996							1998/1997							1999/1998							Three Years' average
		Fuel wood			sita			total	Fuel wood			sita			total	fuel wood			sita			total	
		Adult Fresh	Child Fresh	corre-cted	adult fresh	child fresh	corre-cted	corre-cted	Adult Fresh	Child Fresh	corre-cted	adult fresh	Child Fresh	corre-cted	corrected	adult fresh	child fresh	corrected	adult fresh	child fresh	corrected	corrected	
K.thok	vakunde	0.29	0.12	0.30	0.49		0.30	0.60	0.29	0.12	0.30	0.49		0.30	0.60	0.24	0.10	0.25	0.35		0.21	0.47	0.56
maha dev sthan	naubise				0.83	0.33	0.62	0.62	0.24	0.09	0.22	0.58	0.22	0.44	0.66	0.24	0.09	0.22	0.68	0.25	0.51	0.74	0.67
	R.jhagarpur	0.78	0.30	0.74	0.71	0.26	0.53	1.27	0.81	0.30	0.74	0.70	0.29	0.54	1.28	0.81	0.30	0.74	0.87	0.34	0.66	1.40	1.31
	S.baguwa	0.74	0.30	0.74	0.88	0.36	0.73	1.47	0.76	0.31	0.76	0.88	0.37	0.74	1.50	0.72	0.30	0.74	0.88	0.36	0.73	1.47	1.48
panch khal	K.ratmate	0.35	0.14	0.35	1.25	0.50	1.03	1.38	0.47	0.19	0.48	1.09	0.42	0.89	1.36	0.44	0.18	0.44	1.09	0.42	0.89	1.33	1.36
	thuli	0.30	0.12	0.30	0.27	na	0.16	0.47	0.37	0.15	0.38	0.27	na	0.16	0.54	0.22	0.09	0.22	0.27	na	0.16	0.39	0.47
	vasme	0.47	0.19	0.46	0.36	na	0.22	0.68	0.42	0.17	0.42	0.36	na	0.22	0.63	0.47	0.19	0.47	0.54	na	0.33	0.79	0.70
phool bari	banska	0.90	0.36	0.89	0.66	0.25	0.53	1.42	0.60	0.24	0.59	0.91	0.37	0.74	1.33	0.30	0.12	0.30	0.64	0.26	0.53	0.83	1.20
	banskha	0.26	0.10	0.24	0.71	0.26	0.53	0.77	0.65	0.24	0.59	0.90	0.29	0.66	1.25	0.65	0.24	0.59	0.71	0.26	0.53	1.13	1.05
	belakhola	0.57	0.23	0.56	2.49	0.99	2.0	2.56	0.34	0.14	0.33	2.46	0.96	2.01	2.35	0.17	0.07	0.17	2.49	0.99	2.01	2.17	2.36
	dharapani	0.64	0.23	0.56	3.12	1.10	2.24	2.80	5.98	2.11	5.20	1.10	0.39	0.79	5.99	nd	nd	nd	6.25	2.21	4.48	4.48	4.42
	voltase	0.44	0.18	0.44	0.52	0.21	0.43	0.87	0.24	0.10	0.24	0.60	0.23	0.49	0.73	0.28	0.11	0.28	0.39	0.16	0.32	0.60	0.73
P.gaun	baseri	1.51	0.63	1.55	0.70	0.29	0.60	2.15	0.22	0.09	0.23	0.23	0.1	0.20	0.43	0.34	0.14	0.35	0.70	0.29	0.60	0.95	1.18
tuku cha	B.dhunga	0.34	0.14	0.33	0.77	0.32	0.64	0.97	0.40	0.16	0.39	0.35	0.15	0.28	0.67	0.31	0.13	0.31	0.66	0.26	0.53	0.84	0.83
	S.amaldol	0.09	0.04	0.09	0.79	0.32	0.64	0.73	0.39	0.16	0.38	0.77	0.31	0.62	1.00	0.16	0.07	0.16	0.79	0.32	0.64	0.80	0.85
	S.dandal	0.97	0.37	0.92	1.52	0.59	1.20	2.12	0.25	0.11	0.25	1.14	0.46	0.90	1.16	0.97	0.37	0.92	1.52	0.59	1.20	2.12	1.80
	T.pakha	1.19	0.46	1.14	0.81	0.32	0.64	1.78	0.59	0.23	0.56	0.78	0.35	0.64	1.20	0.90	0.36	0.88	0.81	0.32	0.64	1.52	1.50
panauti	I.thalpuka	0.10	0.04	0.09	1.22	0.47	0.96	1.05	0.94	0.36	0.90	0.60	0.27	0.49	1.39	0.58	0.23	0.56	1.22	0.47	0.96	1.52	1.32
munici	jyalachiti	0.23	0.090	0.22	0.93	0.37	0.75	0.97	0.23	0.09	0.22	0.50	0.19	0.40	0.62	0.23	0.09	0.22	0.85	0.34	0.68	0.91	0.83
	Total	0.57	0.23	0.52	1.00	0.42	0.77	1.30	0.75	0.24	0.69	0.77	0.34	0.60	1.30	0.45	0.17	0.43	1.14	0.45	0.87	1.29	1.29
	N	290	232	306	306	198	306	306	306	242	306	306	198	306	306	290	235	290	306	198	306	306	306
	St.d. dev	0.39	0.16	0.39	0.74	0.24	0.54	0.68	1.30	0.36	1.1	0.64	0.28	0.52	1.25	0.27	0.10	0.24	1.33	0.41	0.95	0.88	0.88

Source: Field Survey: 1999-2000.

Note: "na" refers to children not allowed to collect sita. Nd refers to no distribution of fresh fuel wood. The moisture content of fresh fuel wood is corrected with a factor of 0.74 gram per kilogram. The moisture content of fresh sita is corrected with a factor of 0.61 gram per kilogram.

Adult = 40 kgs, Child 1 back-load = 20 kgs, N = number of households. Std.dev = standard deviation..

FUEL WOOD FROM ALTERNATE SOURCES

Slightly larger than two thirds (or 67% or 206) of the total households (that is, 306) obtained fuel wood from own-farmlands. A household obtains 450 kgs of moisture content corrected fuel wood from own farmlands per annum, on an average. Similarly, 48 (or 15.7 %) of the total households (306) gathered fuel wood from government forest. A household obtains 2,200 kgs of moisture content corrected fuel wood from the government forest, per annum. Fifty out of the 306 households also received fuel wood from secondary community forest. A household receives 550 kgs of moisture content corrected fuel wood from the secondary community forest per annum, on an average. Table B2 shows the average quantities of fuel wood obtained by households (per child and adult) from own farmlands, the government, and the secondary community forest. The fuel wood supply calendar for the community forest, own farmlands and government forest is given in table B3.

Table B2

Average Quantities of Fresh and Moisture Content Corrected Fuel Wood and Sita Obtained by the Household (Per Adult and Child) from the Government Forest, Own Farmlands and the Secondary Community Forests

VDC/municipality	CFUG	Government forest							Own farmlands							Secondary Community Forest						
		Fuel wood			Sita			Grand Total	Fuel wood			Sita			Grand total	Fuel wood			Sita			Grand total
		adult fresh	child fresh	Corrected	adult fresh	child fresh	Corrected		Adult fresh	child fresh	Correc Ted	Adult fresh	child fresh	Corrected		adult fresh	child fresh	corrected	adult fresh	child fresh	corrected	
k.thok	vakunde								0.21	0.09	0.22	0.15	0.07	0.13	0.17							
Maha-dev-sthan	naubise											0.62	0.27	0.54	0.54							
	R.jhagarpur				0.46	0.20	0.40	0.40	0.36	0.15	0.38	0.35	0.15	0.31	0.42							
	S.baguwa								0.55	0.24	0.58	0.22	0.09 4	0.19	0.55							
Panch-khal	K.ratmate								0.87	0.37	0.92	0.30	0.13	0.26	0.66							
	thuli								0.80	0.34	0.85	0.12	0.05	0.10	0.85							
	vasme											0.09	0.04	0.08	0.08	0.35	0.15	0.37	0.24		0.15	0.52
phool-bari	banska											0.73	0.31	0.63	0.63	2.14	0.92	2.26	0.22	0.10	0.20	2.46
	banskha				0.51	0.22	0.44	0.44				0.81	0.35	0.71	0.71							
	belakhola								0.79	0.34	0.83	0.26	0.11	0.23	0.38							
	dharapani								0.81	0.35	0.85	0.22	0.09	0.19	0.63							
	voltase											0.15	0.07	0.13	0.13	0.23	0.1	0.24	1.57	0.67	1.37	1.61
p.gaun	baseri	2.42	1.04	2.56	3.64	1.56	3.18	5.74				0.20	0.09	0.17	0.17							
Tuku-cha	B.dhunga											0.04	0.02	0.04	0.04							
	S.amaldol											0.35	0.15	0.31	0.31							
	S.dandal											0.37	0.16	0.32	0.32							
	T.pakha											0.64	0.27	0.56	0.56							
Panauti Munici-pality	I.thalpuka											0.65	0.28	0.56	0.56							
	yalachiti											0.29	0.12	0.25	0.25							
	Total average	2.43	1.04	2.56 (16)	1.54 (48)	0.66 (48)	1.34 (48)	2.20 (48)	0.68	0.29	0.72 (46)	0.35	0.15	0.31 (193)	0.45 (206)	0.92	0.39	0.97	0.66	0.38	0.55	1.53
	Std. dev.	1.09	0.47	1.15	1.90	0.82	1.66	2.85	0.46	0.20	0.49	0.43	0.18	0.37	0.48	1.33	0.57	1.41	0.74	0.36	0.66	1.37

Source: Field Survey, 1999-2000

Note: adult = 1 backload = 40 kgs, child = 1 back- load = 20 kgs. Std. dev. = standard deviation.
The moisture content of the fresh fuel wood is corrected using a factor of 0.74 gm/kg.
The moisture content of fresh sita is corrected using a factor 0.61 gm/ kg.
Figures in parentheses are the number of households.

Table B3

Fuel Wood Supply Calendar for Community Forest, Own Farmland and Government Forest

	CommunityFforest		Own Farmlands		Government Forests	
CFUG	Fresh fuel wood	Sita	Fresh fuel wood	Sita or Tree fodder residues	Fresh fuel wood	Sita
Vakundebesi	Dec-Jan/Push-Magh	Jan/Push-Magh	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Naubisegeruwa	Jan-Feb/Push-Fagun	Feb/Fagun/Mar-April/Fagun-Baisakh	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Ratmatejhagarpur	Jan-Feb/Push-Fagun	Aug-Oct/Bhadau-Kartik, Jan-jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh	Aug-Oct/Saun-Assuaj, Feb-May/Fagun-Baisakh	Dec-April/Push-Baisakh
Sallenibaguwa	Jan-Feb/Push-Fagun	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Khawakoratmate	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Thuli	Feb-Mar/Fagun-Chait	Mar/Fagun-Chait	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Vasme	Feb-Mar/Fagun-Chait	Mar/Fagun-Chait	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Banskhark ka	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Banskhark kha	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh	Sept-Oct/Bhadau/Assuaj,	Feb-April /Fagun-Baisakh
Belakholapakha	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Dharapanikhareti	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Voltasethulipokhari	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Baserithuloban	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh	Sept-Oct/Bbhadau/ Assuaj, Feb-May/Fagun-Baisakh	Nov-Jun/Kartik-Asadh
Byangdhunga	Feb-Mar/Fagun-Chait	Mar-April/Fagun-Baisakha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Sanobanamaldol	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Sanobandandal	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Thulopakha	Feb-Mar/Fagun-Chait	Mar-April/ Ffagun-Baisakha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Indresworthalpu ka	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		
Jyalachiti	Feb-Mar/Fagun-Chait	Aug-Oct/Bhadau-Kartik, Jan-Jun/Push-Jestha	Aug-Oct/ Bhadau-Kartik	Dec-April/Push-Baisakh		

Source: Field Survey, 1999-2000

Table B4

Record of Average Weight Per Bundle/dori of Fresh Fuel Wood for Some Household of Vakundebesi, Banskhark ka, Voltase and Sallenibaguwa CFUGs.

Name (vakundebesi)	Bundles	Kilograms	Name (voltase)	Bundles	Kilograms
Bimal khanal	**2.5**	375	Hari Pd. Adhikari	2.5	400
Ram prasad khanal	7.5	400	Janardan Adhikari	5.5	350
		320	Ramesh kunikel	2.5	377
		300	Average		376
		305	Krishna pd Nepal		
Badri bahadur khanl	2.5	400	(sallenibaguwa)	1	40
Average		340		2	70
Banskhark ka (forest)	1	350		3	50
	2	377		4	30
	3	375		5	50
	4	180	Average		60
	5	190			
	6	220			
Average		282			

Source: Field Survey, 1999-2000.

· APPENDIX C

BACK GROUND INFORMATION ABOUT FODDER MODEL

INTRODUCTION

Three years' average quantity of the fodder received by the user members from the CFUG is the dependent variable in the fodder model. The methodology adopted to gather fodder-related information is discussed in chapter IV. The check list used to collect fodder-related information from the CFUG is given in appendix H. The household questionnaire used to collect fodder related information is given in appendix G.

AVERAGE QUANTITY OF FODDER FROM COMMUNITY FOREST USER GROUPS

Fodder includes grass and tree fodder (or leaves) in this study. The three years' average quantity of fodder supply from CFUG is 5,600 kgs per annum per household. Table C1 demonstrates that a household receives 3,900 kgs of grass and 4,100 kgs of fodder per annum from CFUG.

FODDER FROM ALTERNATE SOURCES

The respondents were asked how many back loads of grass and tree leaves did the child and adult member of their family obtain during the seasons from own farmlands, government and secondary community forest. Table C2 shows that approximately 99% of the total household (that is, 306 households) obtain fodder from own farmlands. A household obtains 1,210 kgs of fodder consisting of 1,170 kgs of grass and 640 kgs of tree leaves from own farmlands per annum, on an average.

Similarly, only 5% (or 16) of the 306 households obtain fodder from the government forest. A household obtains approximately 5,860 kgs of fodder from the government forest per annum. Furthermore, 11% of the total households (or 34 of 306 households) receive grass from the secondary community forest. A household receives approximately 5,000 kgs of grass per annum from the secondary community forest. Households are not allowed to harvest tree leaves from vasmepakha secondary community forest. Similarly, tree fodder is not available from the secondary community forest (that is, panchakanya) of banskhark ka CFUG because it is a plantation forest of mono species of pines.

Table C1

Average Quantities of Fodder (including grass and tree leaves) Received by Household (Per Child and Adult) from the Community Forest (in '000' kgs) During 1997/96-1999/98

Vdc/municipality	CFUG	1997/98							1998/1999							1999/2000							Three years' grass average	Three years' fodder average	Three years' average of fodder
		grass			Fodder			grand	Grass			fodder			Grand	Grass			fodder			grand			
		child	adult	total	child	adult	Total	total	child	Adult	Total	child	adult	total	Total	child	adult	Total	child	adult	total	total			
k.thok	Vakunde	0.2	2.6	2.8	na	na	Na	2.8	0.4	2.0	2.6	na	na	na	2.3	0.2	1.9	2.1	na	na	na	2.1	2.4	na	2.4
Maha Dev Sthan	Naubise	0.1	1.3	1.3	na	na	Na	1.3	0.1	0.6	0.7	na	na	na	0.7	0.1	0.6	0.7	na	na	na	0.7	0.9	na	0.9
	R.jhagarpur	0.2	2.9	3.1	1.1	3.2	3.9	6.7	0.5	2.7	3.2	1.1	3.2	3.9	6.6	0.3	2.9	3.1	1.1	3.2	3.9	6.7	3.0	3.9	6.7
	S.baguwa	0.6	7.1	7.7	0.8	2.5	3.2	10.9	1.2	6.3	8.1	0.8	2.5	3.2	11	0.7	7.1	7.8	0.8	2.5	3.2	11.0	7.6	3.2	10.8
Panch Khal	K.ratmate	0.3	3.9	4.2	0.9	2.9	3.7	7.9	0.8	4.0	5.1	0.9	2.9	3.7	8.3	0.4	3.9	4.3	0.9	2.9	3.7	7.9	4.4	3.7	8.1
	Thuli	0.0	0.6	0.6	na	na	Na	0.6	na	0.5	0.5	na	na	na	0.5	na	0.6	0.6	na	na	na	0.6	0.5	na	0.5
	Vasme	0.0	0.4	0.4	na	na	Na	0.4	na	0.4	0.4	na	na	na	0.4	na	0.4	0.4	na	na	na	0.4	0.4	na	0.4
Phool Bari	Banska	0.0	na	na	1.0	3.1	3.9	3.9	na	Na	Na	1	3.1	3.9	3.9	na	na	na	1	3.1	3.9	3.9	na	3.9	3.9
	Banskha	0.3	4.1	4.3	1.2	3.8	4.5	8.8	0.6	2.9	3.5	1.2	3.8	4.5	7.8	0.2	2	2.2	1.2	3.8	4.5	6.7	3.2	4.5	7.8
	Belakhola	0.6	7.1	7.6	0.9	3.2	3.9	11.5	1.1	6.2	7.8	0.9	3.2	3.9	11	0.7	7.1	7.7	0.9	3.2	3.9	11.6	7.5	3.9	11.4
	Dharapani	0.5	5.6	5.8	0.8	3.1	3.5	9.3	1.0	5.9	6.8	0.8	3.1	3.5	9.9	0.5	5.6	5.8	0.8	3.1	3.5	9.3	6.0	3.5	9.5
	Voltase	0.3	3.9	4.2	na	na	Na	na	0.9	4.3	5.6	na	na	na	Na	0.4	3.9	4.3	na	na	na	na	4.5	na	4.5
P.gaun	Baseri	0.0	na	na	0.4	1.1	1.4	1.4	na	Na	Na	0.6	2.3	2.8	2.8	na	na	na	0.4	1.1	1.4	1.4	Na	na	1.9
Tuku Cha	B.dhunga	0.1	1.1	1.2	na	na	Na	1.2	0.6	3.0	3.8	na	na	na	3.4	0.1	1.1	1.2	na	na	na	1.2	1.9	na	1.9
	S.amaldol	0.0	na	na	1.8	5.8	7.3	7.3	na	Na	Na	1.8	5.8	7.3	7.3	na	na	na	1.8	5.8	7.3	7.3	na	7.3	7.3
	S.dandal	0.0	na	na	1.9	6.1	7.6	7.6	na	Na	Na	1.9	6.1	7.6	7.6	na	na	na	1.9	6.1	7.6	7.6	na	0	7.6
	T.pakha	1.0	12.0	12.7	na	na	Na	12.7	0.7	3.7	4.5	na	na	na	4.2	1.2	12	13	na	na	na	12.9	9.9	na	9.9
Panauti Municipality	I.thalpuka	0.5	5.8	6.1	0.5	1.3	1.7	7.8	0.8	4.0	5.1	0.5	1.3	1.7	6.3	0.6	5.8	6.2	0.5	1.3	1.7	7.9	5.7	1.7	7.3
	Jyalachiti	0.1	0.7	0.7	1.1	3.4	4.3	5.0	0.1	0.7	0.8	1.1	3.4	4.3	5	0.1	0.7	0.7	1.1	3.4	4.3	5.0	0.7	4.3	5.0
	Total	0.4	3.9	4.2	1.0	3.30	4.1	5.9	0.7	3.1	3.9	1.0	3.4	4.2	5.5	0.4	3.7	4.0	1.0	3.3	4.1	5.8	3.9	4.1	5.6
	N	158	241	241	147	192	192	290	158	241	241	147	192	192	292	158	241	241	147	192	192	290	241	191	306
	Std.dev.	0.3	3.1	3.3	0.5	1.7	2.0	3.9	0.5	2.7	3.3	0.5	1.6	1.9	3.9	0.3	3.2	3.5	0.5	1.7	2.0	4.0	2.9	2.0	3.7

Source: Field Survey, 1999-2000.

Note: N refers to the number of respondents. Std.dev = standard deviation.
Fodder consists of grass and tree fodder.
grass 1 back-load child = 20 kgs
Grass 1 back-loadadult = 50 kgs.
Fodder or tree leaves 1 back-load adult 1 = 30 kgs.
Fodder 1 back-load child = 20 kgs

Table C2

Average Quantities of Fodder (including grass and tree leaves) Received by Household Per Child and Adult from Own Farmlands, Government and Forest Secondary Community Forest (in 000 kgs)

Vdc/municipality	CFUG	Own farm							Government forest							Secondary community forest		
		Grass			Fodder			Grand	Grass			fodder			grand	grass		
		child	adult	total	child	adult	Total	Total	child	Adult	total	child	adult	total	total	child	adult	total
k.thok	Vakunde	3.66	9.05	12.5	0.28	0.43	0.71	13										
mahadev sthan	Naubise	3.33	10.8	12.9	0.13	0.2	0.34	13.3										
	R.jhagarpur	3.33	8.95	11	0.19	0.28	0.47	11.3										
	K.ratmate	4.24	11.6	15.3	0.46	0.69	1.15	16.4										
panchkhal	Thuli	3.09	9.14	12.2	0.2	0.3	0.5	12.7										
	Vasme	3.12	8.65	11.4	0.16	0.25	0.41	11.8										
phool bari	Banska	3.6	9.75	12.9	0.45	0.68	1.13	13.6									0.55	0.6
	Banskha	3.42	9.56	11.7	0.19	0.28	0.46	12								1.33	8.41	9.5
	Belakhola	3.32	8.39	11.1	0.24	0.36	0.61	11.6										
	Dharapani	3.83	11.8	13.7	0.35	0.53	0.88	14.5										
	Voltase	3.66	9.89	13.1	0.21	0.31	0.52	13.6										
P.gaun	Baseri	4.56	11.6	15.9	0.26	0.37	0.61	16.3	0.92	4.8	5.6	1.29	5.6	7.4	5.86			
tukucha	B.dhunga	2.28	6.05	7.9	0.08	0.12	0.2	7.92										
	S.amaldol	2.36	5.95	7.87	0.3	0.45	0.76	8.1										
	S.dandal	2.4	6.05	7.97				7.47										
	T.pakha	2.33	6.59	8.58	0.09	0.15	0.25	8.67										
panauti	I.thalpuka	2.93	8.29	10.5	0.29	0.43	0.72	11.1										
municipality	Jyalachiti	3.05	8.6	11.2	0.12	0.18	0.29	11.4										
	Total	3.29	9.06	11.7	0.26	0.39	0.64	12.1	0.92	4.8	5.6	1.29	5.6	7.4	5.86	1.33	4.48	5
	N	243	301	301	201	202	202	302	15	16	16	15	16	16	16	14	34	34
	Std. Dev	1.64	4.59	5.6	0.29	0.44	0.74	5.85	0.55	3.2	3.2	0.89	3.9	5.3	3.23	0.59	4.74	5.4

Source: Field Survey, 1999-2000.

Note: "N" refers to the number of household. Std. dev = standard deviation.
Child 1 back-load = 20 kgs.
Adult 1 back-load = 40 kgs.
Fodder or tree leaves 1 back load adult 1 = 30 kgs.
Fodder 1 back-load child = 20 kgs

Table C3

Fodder Supply Calendar For The Community Forest, Own Farmlands and Government Forest

Vdc/Municipality	CFUG	Community Forest		Own Farmlands		Government Forest	
		Grass	Tree Leaves	Grass	Tree Leaves	Grass	Tree Leaves
Khanalthok	Vakunde	Jul-Sept/Saun-Bhadau	Na	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
Mahadevsthan	Naubise	Jul-Sept/Saun-Bhadau		Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Rjhagarpur	Jul-Sept/Saun-Bhadau		Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Sbaguwa	Jul-Sept/Saun-Bhadau		Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
Panchkhal	Khawakoratmate	Jul-Oct/Saun-Kartik		Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Thuli	Aug-Oct/Bhadau-Kartik		Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Vasme	Aug-Oct/Bhadau-Kartik		Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
Phoolbari	Banska	Na	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Banskha	Na	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Belakhola	Jul-Dec/Saun-Push	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Dharapani	Jul-Oct/Saun-Kartik	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Voltase	Jul-Sept/Saun-Bhadau	Na	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
Puranogaun	Baseri	Na	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh	Jul-Nov/Saun-Kartik	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha
Tukucha	Bdhunga	Jul-Sept/Saun-Bhadau	Na	Jun-Ddec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Sanibanamaldol	Na	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Sanobandandal	Na	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Thulopakha	Jul-Sept/Saun-Bhadau	Na	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
Panauti Municipality	Indresworthalpu ka	Jul-Sept/Saun-Bhadau	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		
	Jyalachiti	Jul-Sept/Saun-Bhadau	Jun-Nov/Ashadh-Kartik/Feb-May/Magh-Jestha	Jun-Dec/Ashadh-Mangsir	Oct-April/Kartik-Baisakh		

Source: Field Survey, 1999-2000.

Note: 'na' refers to not applicable, that is, product not available from the fores under reference.

APPENDIX D

BACKGROUND INFORMATION ABOUT LEAF LITTER

INTRODUCTION

Leaf litter is used for livestock bedding. Then, it is used as fertiliser after it is decomposed. Community forest is one of the principal sources of dry leaf litter (patkar). Households in the hills also use green leaf litter. User members of the natural community forest also lop off green foliage and shrubs (sottar). However, this study could not collect the information about the quantity of green litter received from the community forest because of the time constraint. The three years' average quantity of litter received by the ith household from CFUG is the dependent variable for the leaf litter model The methodology used to collect litter related information is given in chapter IV. The household interview questionnaire and checklist for discussion with the executive committee members of the CFUG used to collect leaf litter related information are given in appendix G and H respectively.

AVERAGE QUANTITY OF LEAF LITTER FROM PRIMARY COMMUNITY FOREST OR CFUG

A household received 3,590 kgs of leaf litter from the community forest per annum, on an average. As shown in table D1, a child received 427 kgs (that is, 1,208 kgs/ 3) and adult 3,303 kgs (that is, 9,910 kgs/ 3) per annum, on an average, during the past three years. The vasmepakha CFUG distributed a smallest quantity of leaf litter, that is, 710 kgs per annum per household, on an average. However, household of belakholapakha CFUG received a largest quantity of leaf litter, that is, 8,540 kgs per annum per household, on an average. Table D1 depicts the average quantity of leaf litter received by the ith household (per child and adult) during the fiscal years of 1999/98, 1998/97 and 1997/96.

Table D1

Average Quantity of Leaf Litter Received (in 000 kgs) by the Household (per Child and Adult) from the Community Forest User Groups, During 1997/96-1999/98

vdc/municipality	CFUG	1997/96			1998/97			1999/98			Grand total		Three Years' Average
		child	Adult	Total	Child	Adult	Total	Child	Adult	Total	child	adult	
k.thok	Vakunde	0.23	2.04	2.25	0.11	0.71	0.74	0.12	1.05	1.16	0.38	3.80	1.39
Maha-Dev Sthan	Naubise	0.17	2.04	2.02	0.12	1.40	1.48	0.14	1.29	1.38	0.43	4.61	1.63
	R.jhagarpur	0.15	1.50	1.45	0.09	0.88	0.94	0.15	1.36	1.46	0.37	3.60	1.28
	S.baguwa	0.45	4.13	4.47	0.58	3.96	4.46	0.45	4.08	4.47	1.48	12.12	4.47
Panch-Khal	K.ratmate	0.35	3.13	3.43	0.39	3.46	3.80	0.35	3.13	3.43	1.08	9.72	3.55
	Thuli	na	1.00	1.00	na	0.85	0.85	na	1.00	1.00	na	2.85	0.95
	Vasme	na	0.75	0.75	na	0.64	0.64	na	0.75	0.75	na	2.14	0.71
Phool-Bari	Banska	0.69	6.36	6.93	0.78	5.22	5.86	0.69	6.29	6.86	2.17	17.86	6.55
	Banskha	0.30	2.72	2.91	0.38	2.54	2.87	0.32	2.89	3.09	0.82	8.15	2.96
	Belakhola	0.95	8.57	9.34	0.93	6.20	6.96	0.95	8.57	9.34	2.82	23.34	8.54
	Dharapani	0.82	7.45	7.86	0.50	3.29	3.54	0.82	7.45	7.86	2.15	18.18	6.42
	Voltase	na	1.80	1.80	na	1.53	1.53	na	1.80	1.80	na	5.13	1.71
P.gaun	Baseri	0.68	6.12	6.75	0.46	3.05	3.49	0.68	6.12	6.75	1.81	15.29	5.66
Tuku-Cha	B.dhunga	0.29	2.62	2.85	0.20	1.31	1.47	0.29	2.62	2.85	0.77	6.55	2.39
	S.amaldol	0.39	3.54	3.85	0.25	1.64	1.84	0.39	3.54	3.83	1.00	8.71	3.17
	S.dandal	0.34	3.06	3.31	0.17	1.41	1.54	0.34	3.06	3.31	0.84	7.53	2.72
	T.pakha	0.64	5.81	6.29	0.22	1.53	1.69	0.64	5.81	6.29	1.50	13.16	4.76
Panauti Munici Pality	I.thalpu ka	0.98	8.91	9.64	0.67	4.39	4.90	0.98	8.91	9.64	2.63	22.21	8.06
	Jyalachiti	0.11	1.02	1.11	0.09	1.11	1.18	0.11	1.28	1.37	0.31	3.40	1.22
	Total	0.47	3.82	4.10	0.39	2.38	2.62	0.46	3.73	4.03	1.28	9.91	3.59

Source: field survey, 1999-2000.
Number of sample households = 306.
Conversion of back- loads into kilogram
Child 1 back-load = 20 kgs
Adult panchkhal and naubise 1 back-load = 50 kgs.
Adult other 17 CFUG 1 back-load = 40 kgs.
Na refers to not applicable. It refers to children are not allowed to collect litter from forest.

LEAF LITTER FROM ALTERNATE SOURCES

The household interview schedule asks respondents how many back loads of leaf litter did your child and adult members of the family obtain from own farmlands, government forest and secondary community forest during the seasons. Table D2 depicts that approximately 45% (or 139 households) of the total households (that is, 306) obtain leaf litter from own farmlands. A household obtains 1,530 kgs of leaf litter from own farmlands (consisting of litter obtained by child; 130 kgs and adult; 1,410 kgs). Only 5% of the total households collect leaf litter from the government forest. A household obtains, on an average, 6,240 kgs of leaf litter from the government forest, per annum.

Furthermore, 16% of the total households (that is, 306) receive litter from the secondary community forest. A household receives 2,920 kgs of litter from the secondary community forest per annum, on average. Table D2 depicts the average quantity of litter obtained by household (per child and adult members of the family).

Table D2

Average Quantities of Leaf Litter obtained by the Households per Child and Adult from Own Farmlands, Government and Secondary Community Forest.

VDC/municipality	CFUG	Own farm			Government forest			Secondary Community Forest		
		Child	adult	Total	child	Adult	total	Child	adult	total
k.thok	Vakunde	0.06	0.66	0.71						
Mahadevsthan	Naubisegeruwa	0.05	0.58	0.63						
	Ratmatejhagarpur	0.09	1.05	1.14						
	Salllenibaguwa	0.18	2.07	2.25						
Panchkhal	Khawakoratmate									
	Thuli	0.11	1.20	1.30						
	Vasmepakha	0.04	0.41	0.44					1.06	1.06
Phoolbari	Banskhark ka	0.23	2.54	2.76				0.22	2.42	2.63
	Banskhark kha	0.14	1.60	1.74						
	Belakholapakha	0.10	1.18	1.28						
	Dharpanikhareti	0.21	2.32	2.53						
	Voltasethulipokhari	0.09	0.96	1.05				0.43	4.76	5.19
Puranogaun	Baseriban	0.03	0.35	0.38	0.51	5.72	6.24			
Tukucha	Byangdhunga	0.02	0.25	0.27						
	Sanobanamaldol	0.02	0.25	0.27						
	Sanobandandal	0.05	0.54	0.58						
	Thulopakha	0.01	0.11	0.11						
Panauti Municipality	Indresworthalpuka	0.19	2.15	2.34						
	Jyalachiti	0.09	0.98	1.07						
	Total	0.13	1.41	1.53	0.51	5.72	6.24	0.32	2.71	2.92
	N	139					16			50

Source: Field Survey, 1999-2000.
Note: Conversion factor of a back-load for a child 1 backload = 20 kgs and adult 1 back-load = 40 kgs.
"N" refers to the number of respondents.

Table D3

Leaf Litter Supply Calendar for the Community Forests, Own Farmlands and Government Forest

		Community Forest		Government Forest	On-farm
Vdc/municipality	CFUG	dry litter	Green litter		
Khanalthok	Vakundebesi	March-April/Chiat/Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
Mahadevstahn	Naubisegeruwa	Nov-Dec/Kartik/Mangsir,Feb-March/Fagun/Chait			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Ratmatejhagarpur	Nov-Dec/Kartik/Mangsir,Feb-March/Fagun/Chait	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Sallenibaguwa	Nov-Dec/Kartik/Mangsir,Feb-March/Fagun/Chait	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
Panchkhal	Khawakoratmate	Nov-Dec/Kartik/Mangsir,Feb-March/Fagun/Chait			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Thuli	Mar-April/Chiat/Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Vasmepakha	Mar-April/Chiat/Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
Phoolbari	Banskhark Ka	Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Banskhark Kha	Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Belakholapakha	Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Dharapanikhareti	Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Voltasethulipokhari	Mar-April/Chiat/Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
Puranogaun	Baseriban	Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha	Aug-Sept/Saun-Bhadau	Feb-April/Magh-Baisakh, Aug-Sept/Bhadau-Asauj	Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
Tukucha	Byangdhunga	Mar-April/Chiat/Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Sanobanamaldol	Aug-Oct/Bhadau-Kartik, Jan-June/Magh-Jestha			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Sanobandandal	Aug-Oct/Bhadau-Kartik, Jan-June/Magh-Jestha			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Thulopakha	Mar-April/Chiat/Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
Panauti Municipality	Indresworthalpuka	Aug-Oct/Bhadau-Kartik, Jan-June/Magh-Jestha	Aug-Sept/Saun-Bhadau		Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha
	Jyalachiti	Feb-May/Fagun-Baisakh			Aug-Oct/Bhadau-Kartik, Feb-June/Fagun-Jestha

Source: Field Survey, 1999-2000.

APPENDIX E

ATTRIBUTES ASSOCIATED WITH THE COMMUNITY FOREST

COMMUNITY FOREST AREA AND TYPES OF COMMUNITY FOREST

There is a large variation in the community forest area of the 19 CFUGs in kabhre district. For example, sanobanamaldol has 5.34 hectare while belakhola, 151.3 heactare of forest. Table E1 shows the community forest area and types of forests of the 19 CFUG of kabhre district.

Table E1
Forest Area (in hectare) and Types of Community Forest

Vdc/municipality	CFUG	Forest area in hectare	Forest types
Khanalthok	Vakunde	23.3	Plantation forest
Mahadevsthan	Naubisegeruwa	18.8	Plantation plus
	Ratmatejhagarpur	31	Plantation plus
	Sallenibaguwa	60	Plantation plus
Panchkhal	KhawakoRatmate	121. 8	Plantation plus
	Thuliban	63.21	Plantation plus
	Vasme	13.3	Plantation plus
Phool	Banskhark ka	23.8	Natural forest
bari	Banskhark kha	23.1	Plantation plus
	Belakholapakha	5.1	Plantation plus
	Dharapanikhareti	151.3	Plantation plus
	Voltase	24.1	Plantation forest
Puranogaun	Baseri	10.6	Natural forest
Tukucha	Byangdhunga	15.16	Plantation forest
	Sanobaamaldol	5.34	Natural forest
	Sanobandandal	12.24	Natural forest
	Thulopakha	23	Plantation forest
Panauti municipality	Indresworthlpuka	52.57	Plantation plus
	Jyalachiti	25.92	Plantation plus

Source: Operation plans and field survey, 1999-2000.
Note: plantation plus refers to the natural forest of mixed species of trees planted with seedlings of pines. Natural forest refers to the mixed forest without plantation. Plantation forest refers to the plantation of pines

APPENDIX F

ATTRIBUTES ASSOCIATED WITH THE USER MEMBERS

INTRODUCTION

The user member related attributes used in the linear multiple regression models are future consciousness, the caste and the literacy status of the household head, number of members in the family, size of the livestock in standard units and net income from crops.

FUTURE CONSCIOUSNESS

By future consciousness, we mean the alertness of the ith household about the protection of the forest for the future. About 62% of the total respondents or household heads agree that the forest should be protected for the future. Table F1 depicts the future consciousness of the respondents about the protection of the forest for the future.

Table F1

Future Consciousness of the Respondents About the Protection of the Forest for the Future(in percentage)

Vdc/municipality	CFUG	Total number of respondents	Future consciousness (%)	
			yes	No
Khanalthok	Vakundebesi	16	75	25
Mahadevsthan	Naubisegeruwa	16	100	0
	Ratmatejhagarpur	16	38	62
	Sallenibaguwa	16	62	38
Panchkhal	Khawakoratmate	16	44	56
	Thuli	16	100	0
	Vasmepakha	17	100	0
Phoolbari	Banskhark ka	17	76	24
	Banskhark kha	16	25	75
	Belakholapakha	16	19	81
	Dharapanikhareti	16	44	56
	Voltasethulipokhari	16	69	31
Puranogaun	Baseriban	16	69	31
Tukucha	Byangdhunga	16	31	69
	Sanobanamaldol	16	94	6
	Sanobandandal	16	81	19
	Thulopakha	16	94	6
Panauti Municipality	Indresworthalpu ka	16	12	88
	Jyalachiti	16	62	38
	Total	306	62	38

Source: Field Survey, 1999-2000.

CASTE OF THE RESPONDENTS

The household heads are classified into three caste categories: Brahmin or Chhetri, Magar/Tamang/Newar (M/T/N) and Sarki (leather workmen)/Kami (ironwork men)/Pariyar (tailormen)/Danuwar (S/K/P/D). Table F2 shows that 66% of the total interview respondents (that is, 306) belong to the Brahmin or Chhetri castes. Another one fifth of them are from Magar or Tamang or Newar castes. The rest 15% of the total respondents are from Sarki, Kami, Pariyar and Danuwar (or lower castes). Table F2 depicts the caste composition of the respondents in percentage.

Table F2

Castes of the Respondents in Percentages

Vdc/municipality	CFUG	Number of respondents	Caste composition of the respondents (%)		
			Brahmin/chhetri	M/T/N	S/K/P/D
Khanalthok	Vakundebesi	16	50	44	6
Mahadevsthan	Naubisegeruwa	16	69	31	
	Ratmatejhagarpur	16		13	87
	Sallenibaguwa	16	63		37
Panchkhal	KhawakoRatmate	16	75	6	19
	Thuli	16	94	6	
	Vasmepakha	17	100		
Phoolbari	Banskhark ka	17	82	12	6
	Banskhark kha	16		25	75
	Belakholapakha	16	69	19	12
	Dharapanikharcti	16	100		
	Voltasethulipokhari	16	69	31	
Puranogaun	Baseriban	16	100		
Tukucha	Byangdhunga	16			100
	Sanobanamaldol	16	94	6	
	Sanobandandal	16	100		
	Thulopakha	16	31	69	
Panauti municipality	Indresworthalpu ka	16	81	19	
	Jyalachiti	16	69	19	12
	Total	306	66	19	15

Source: Field Survey, 1999-2000.

Note: M = magar, T= tamang, N = newar, S = Sarki, K = kami, P = pariyar, D = danuwar

Literacy Status of the household head

The table F3 depicts that 56% of the total respondents (that is, 306) are literate. Approximately, 38% of the male household head are literate and 24% are illiterate, on an average. However, only 2% of the women household head are literate.

Table F3

Literacy Status of the Men and Women Respondents (in Percentage)

Vdc/municipality	CFUG		Men		Women		total	
		No	Literat e	Illiterate	literate	Illiterate	literate	Illiterate
Khanalthok	Vakundebesi	16	37	38	6	6	56	44
Mahadevsthan	Naubisegeruwa	16	13	31		31	37	63
	Ratmatejhagarpur	16	25	44	6	6	50	50
	Sallenibaguwa	16	31	31	6	13	56	44
Panchkhal	Khawakoratmate	16	50	37		13	50	50
	Thuliban	16	25	13	6		87	13
	Vasmepakha	17	35	23		12	65	35
Phoolbari	Banskhark ka	17	53	12	6		82	18
	Banskhark kha	16	19	37		19	44	56
	Belakholapakha	16	44	37			62	38
	Dharapanikhareti	16	38			31	69	31
	Voltasethulipokhari	16	44	13		19	69	31
Purnogaun	Baserithuloban	16	50	31		13	56	44
Tukucha	Byangdhunga	16	31	37		13	50	50
	Sanobanamaldol	16	50	6	6	13	81	19
	Sanobandandal	16	19	12	6	25	62	38
	Thulopakhapakha	16	25	19		6	75	25
Panauti Municipality	Indresworthalpu ka	16	69	6		6	87	13
	Jyalachiti	16	56	19			81	19
	Total	306	38	24	2	12	56	44

Source: Field Survey: 1999-2000.

Average Family Size

Table F4 depicts that 6.9 family member dwell in a household of kabhre district, on an average. The households of voltasethulipokhari and sanobanamaldol have the lowest number of family members, on average (that is, 5.7). However, a household of banskhark kha has 8.6 members in the family. Table F4 displays the average number of members (including children, adults and olds) in the households of the 19 CFUGs of the kabhrepalanchowk district.

Table F4
Average Family Size including the Average Number of Children, Adults and Olds

VDC/municipality	CFUG	Number of respondents	Average number of child, adult and old family members of the respondents				Total Average
			Child		Adult	Old	
			Below 10	10-15	15-59	60 and above	
Khanalthok	Vakundebesi	16	2.1	3.0	3.4	1.3	7.8
Mahadevstahn	Naubisegerua	16	1.7	1.9	4.1	1.1	6.9
	Ratmatejhagarpur	16	2.2	2.4	3.8	1.0	7.1
	Sallenibaguwa	16	1.6	2.1	3.8	2.0	7.4
Panchkhal	Khawakoratmate	16	1.8	2.1	4.1	1.5	7.3
	Thuli	16	1.8	2.0	3.5	2.0	6.7
	Vasme	17	1.9	2.5	4.8	1.3	7.7
Phoolbari	Banskhark ka	17	1.6	2.2	3.8	1.7	6.9
	Banskhark kha	16	1.9	2.3	5.1	1.0	8.6
	Belakholapakha	16	1.6	2.4	3.6	1.5	6.6
	Dharapanikhareti	16	1.6	2.1	4.3	1.3	7.1
	Voltasethulipokhari	16	1.3	2.1	2.9	1.4	5.7
Puranogaun	Baserithuloban	16	1.6	2.7	3.5	1.4	8.0
Tukucha	Byangdhunga	16	1.8	2.4	2.8	1.3	6.3
	Sanobanamaldol	16	1.7	1.9	3.3	1.0	5.7
	Sanobandandal	16	1.5	1.7	3.4	1.3	5.9
	Thulopakha	16	1.5	2.3	3.4	1.0	6.5
Panauti Municipality	Indresworthalpu ka	16	1.2	2.2	3.1	1.9	5.9
	Jyalachiti	16	1.4	2.0	4.1	1.4	7.2
	Total average		1.7	2.2	3.7	1.4	6.9
	Total	306	179	240	303	108	306

Source: Field Survey, 1999-2000.

Table F 4 above shows that the total average number of adult (16-59) family member is 3.7 per household. The total average number of child (10 to 15 age groups) is 2.2 per household. Children of 10 to 15 age group and adults are the indicators of family labour force for the collection of fuel wood, fodder and leaf litter in this study.

Net Crop Income

In the following sections, we present average statistics of the low rice land (or khet) and upland land (or bari), total land, crop production, and yield of the major crop and net income from crops.

Land ownership by land types

The type of terrain determines the use of land in central hills. Mainly, there are two categories of land in the hills: low rice land and rain fed uplands. The low land foothill basins (or tar) possess the potential for irrigation through canals (usually small and called as 'kulo') from streams as well as from collected rainwater. Rice and wheat are the major crops grown in such low rice land. Farmers also grow potato and other vegetables in lowlands. The rain fed-upland with terrace of gentle slope is traditionally used for growing maize, wheat and millet. Currently, farmers also grow fruits (orange, apple and guava) and vegetables (like potato, tomato and spinach) in the uplands.

A household owns, on an average, 0.68 hectare of land, including the low rice land and rain fed upland. Table F5 depicts that a household owns, on an average, 0.45 hectare of rain fed upland and 0.27 hectare of low land.

Table F5
Average Land Holdings of Low Rice land and Rain- fed Upland per Household (in hectares)

Vdc/muni Cipality	CFUG	Low rice land		Rain fed upland		Total		
		Average	Std. Deviation	Average	Std. deviation	No. of respondents	Average	Std. Deviation
Khanalthok	Vakundebesi	0.37	0.41	0.5	0.6	16	0.84	0.98
Mahadevsthan	Naubisegeruwa	0.26	0.19	0.34	0.2	16	0.61	0.35
	Ratmatejhagarpur	0.19	0.18	0.24	0.2	16	0.74	0.6
	Sallenibaguwa	0.34	0.28	0.61	0.5	16	0.84	0.7
Panchkhal	Khawakoatmate	0.31	0.22	0.7	0.5	16	0.87	0.72
	Thuliban	0.47	0.21	0.38	0.2	16	0.85	0.37
	Vasmepakha	0.21	0.17	0.33	0.2	17	0.52	0.34
Phoolbari	Banskhark ka	0.29	0.05	0.64	0.4	17	0.91	0.57
	Banskhark kha	0.33	0.23	0.69	0.4	16	1	0.55
	Belkholapakha	0.36	0.21	0.52	0.5	16	0.8	0.58
	Dharapanikhareti	0.26	0.16	0.55	0.3	16	0.77	0.41
	Voltasethuli	0.27	0.19	0.48	0.3	16	0.71	0.4
Puranogaun	Baseriban	0.33	0.22	0.85	0.4	16	1.18	0.55
Tukucha	Byangdhunga	0.17	0.15	0.21	0.2	16	0.38	0.32
	Sanobanamaldol	0.17	0.12	0.22	0.2	16	0.37	0.22
	Sanobandandal	0.17	0.12	0.19	0.1	16	0.35	0.19
	Thulopakha	0.16	0.14	0.56		16	0.38	0.19
Panauti Municipality	Indresworthalpu ka	0.16	0.09	0.21	0.2	16	0.33	0.19
	Jyalachiti	0.23	0.14	0.27	0.2	16	0.5	0.23
	Total	0.27	0.21	0.45	0.4	306	0.68	0.54

Source: Field Survey, 1999-2000

Crop Production and Yield

The data on production of crops were collected using household interview schedule in muri. Then, this local unit of measurement was converted to kilogram using equivalent weight in kilogram (the kilogram equivalents of 1 muri of crop are given in annex table F10). In this study, both area and yield determine crop output. Crop output is in ton. Crop yield is in ton per hectare.

Table F5 shows the average production and yield of major crops by land types. Rice, maize and wheat are the major crop in the study areas. The average production of maize (2.3 tonnes) exceeds the average production of rice (1.5 tonnes). However the average production of wheat is low (that is, just 0.2 ton in low rice land and 0.7 ton in rain fed-upland). The table F6 depicts that the production of cash crops (like potato and tomato) exceeds the production of cereals (like rice, maize, and wheat).

Table F6
Average Production and Yield of Major Crops of Low Rice Land and Rain-fed Upland

Average Production and yields of major crops of low rice land and rain-fed upland																					
Low rice land											rain fed-upland										
Rice		Wheat		Winter potato		Summer potato		Tomato		Mustard	Maize		Wheat		winter potato		Summer potato		Tomato		Mustard
Pro	Yie	Pro	Yie	Pro	Yie	Pro	Yie	Pro	Yie	pro	pro	yie	pro	Yic	pro	Yie	Pro	Yie	Pro	yie	prod
1.5	5.8	0.2	1.3	4.9	23.7	1.4	14.4	1.6	16	0.04	2.3	5	0.7	2.6	3.1	22	1.3	14.1	2.23	16.6	0.05

Source: Field Survey, 1999-2000
Note: Pro = Average production in tonne. Yie = Average yield in tonne/ha. Rice = winter rice

Table F5 reveals that the yields of cash crops (that is tomato and potato) exceed that of the yields of cereals. The yield of winter potato is 23.7 tonnes per hectare but the yield of winter rice is just 5.8 tonnes per hectare. Similarly, the yield of tomato (that is 16 tonnes/hectare) exceeds the yield of rice and wheat (1.3 tonnes/hectare). Cash crops are grown for commercial purpose. Cereals are grown for domestic consumption needs.

Net Crop Income

Crop production involves fixed as well as variable costs. Fixed cost is the opportunity cost of the land from the alternate uses. Fixed costs also include the environmental degradation of cultivated land because of its intensive use and application of chemical fertilisers, pesticides/insecticides. In other words, the loss in the biodiversity of agricultural land is the fixed costs in addition to the opportunity cost of the land.

The variable costs of production of crops are considered in this study. The components of variable costs include person-days, seeds, fertiliser, compost manure, pesticides/insecticides, and irrigation (in person-days). The data on labour and other input use per ropani of land was collected checklist for CFUG of annex H. Then, labour and other input use per hectare were estimated (1 ropani = 0.05087 hectare). The labour activities include preparation of land, showing of seed, planting of seedling, weeding of plants, harvest and transportation of crops from farmland and cleansing of product. The data on labour use was collected in person-days of employment rather than the amount of labour intake in the production of particular crop. Labour is valued multiplying the quantity of labour person-days by the national wage rate (that is, NRs. 60/day) for agricultural labour. The values of other inputs are derived multiplying their quantities by the local market prices. The table F7 depicts the input use and input costs of the five main products (that is, rice, wheat, maize, potato, and tomato). At the outset, total cost for the production of particular crop is estimated (per hectare). Then, total farm expense for a crop production activity is derived multiplying the area covered by the crop by the total cost.

Table F7

Input use and Input Cost per hectare of crop production

	Area	Seed			Bullock		Labor (man days)				Manure			Fertiliser	irrigation		pesticide	total
Crops	hectare	Kg/ha	RS/kg	Rs/ha	Days/ha	Rs/days	Rs/ha	Days/ha	Rs/day	Rs/ha	Kg/ha	Rs/kg	Rs/ha	Rs/ha	Days/ha	Rs/ha	Rs/ha	Farm expense
Rice	0.27	44.23	15	663.5	29.5	250	7375	216.3	60	12978	9830	0.32	3145.6	3538.4	59	3540	491.5	31732
Wheat	0.36	98.3	50	4915	19.66	250	4915	68.81	60	4128.6				393.2				14351.8
Maize	0.45	19.66	130	2556				137.62	60	8257.2	17203	0.32	5504.8	1966			589.8	18873.8
Potato	0.2	1129	9.2	10382	39.32	250	9830	186.8	60	11206	14745	0.32	4718.4	11796	39.32	2359	5898	56189.9
Tomato	0.13																	60208.75
total		1291		18517	88.48	250	22120	609.53	60	36570	41778	0.32	13369	17694	98.32	5899	6979.3	181356.25

Source: Field Survey, 1999-2000.

Note: ‘ha’ refers to hectare.

Gross revenue from production of crop is estimated using the following technique. Aggregate crop output = production of crop + by-product. Net revenue from crops is derived after deducting variable costs from gross revenue

Gross revenue from crop (GR) = GRic1 * pic1 + GRic2 * pic2 ....+ GRicn *picn

where, Gric1 = gross revenue of the ith household from crop 1. pic1 = price of crop. Gric2 = gross revenue of the household head from crop 2. pic2 = price of crop 2. GRcn = gross revenue of ith household from n crops. picn = price of n crops.

Price refers to the prevailing price in the survey areas of this study.

Net income or revenue from crops (NR)

$$NR = GR\ ic1 - \Sigma VC\ ic1$$

where, Gric1 = Gross revenue for the ith household from crop 1.

Vcic1 = variable cost of production of a crop for the ith household from crop 1.

Aggregate net crop revenue for the ith household is the sum of the net revenue from n khet and n bari crops. In this study, khet crops include rice, wheat, potato, mustard, and tomato and bari crops include maize, wheat, potato, and mustard.

Table F8 depicts the average net income per household from khet or lowland and bari or upland crops. A household earns NRs. 5,664 of net income from crops per annum. A households gets NRs.26, 040 of net inceom from khet crops and NRs. 33480 bari crops per annum.

Table F8

Average Net Income from Low Rice Land (or khet) and Rain-fed Upland (or bari) Crops per household (in NRs. 000)

Vdc/muni Cipality	CFUG	Average net income from khet and bari crops			
		Low land crops	Upland crops	Total	Std. Deviation
Khanalthok	Vakundebesi	17.02	25.00	40.43	41.77
Mahadevsthan	Naubisegeruwa	32.77	34.24	67.02	34.01
	Ratmatejhagarpur	22.72	32.67	52.58	42.73
	Sallenibaguwa	39.02	54.14	80.97	54.45
Panchkhal	Khawakoatmate	33.03	78.30	98.95	55.68
	Thuli	84.81	46.45	131.27	40.31
	Vasme	31.64	38.46	67.83	41.57
Phoolbari	Banska	13.31	36.41	29.01	29.01
	Banskha	14.56	37.19	50.85	27.34
	Belakhola	16.38	38.27	50.56	39.21
	Dharapani	11.11	29.97	39.69	20.67
	Voltase	12.39	26.46	36.52	20.03
Puranogaun	Baseri	13.88	45.88	59.76	28.36
Tukucha	Byangdhunga	23.05	21.06	44.11	35.31
	Sanobanamaldol	25.20	20.63	42.68	19.51
	Sanibandandal	24.00	19.45	42.24	18.41
	Thulopakha	23.04	23.40	46.45	18.18
Panauti Municipality	Indresworthalpuka	32.08	11.57	35.63	28.98
	Jyalachit	24.41	14.98	39.39	18.02
	Total	26.04	33.48	56.64	40.87

Source: Field Survey, 1999-2000.

Average Size of Livestock in Standard Unit

A household keeps approximately 3.79 livestock in standard unit, on an average. Table F9 shows that the average statistics of the cattle (that is, 2.07, including cow plus oxen) is almost similar to that of the average statistics of the buffalo (that is, 1.95). However, a household keeps 3.64 goats in standard units. Table F9 shows the average number of cattle, buffalo and goats and their equivalents in standard units.

Table F9

Average Number of Cattle, Buffalo and Goat and Equivalents of the average Number of Cattle, Buffalo and Goat in Standard Units (LSU)

VDC/mun-icipality	CFUG	Cattle		Buffalo		Goats		Total	
		Number	LSU	Number	LSU	number	LSU	LSU	Std. deviation
Khnalthok	Vakunde	2.36	2.36	1.33	1.67	3.75	0.75	3.56	1.83
Mahadevsthan	Naubise	1.64	1.64	2.15	2.69	3.91	0.78	4.16	2.21
	R.jhagarpur	2.93	2.93	1.46	1.83	4.3	0.86	4.58	2.04
	S.baguwa	2.25	2.25	2.53	3.17	3.54	0.71	5.23	2.36
Panchkhal	Khawakoratmate	1.64	1.64	2.64	3.30	5.0	1.0	4.89	3.30
	Thuli	2.0	2.0	2.29	2.86	4.23	0.85	4.31	1.33
	Vasme	1.8	1.8	2.0	2.50	3.80	0.76	3.49	1.60
Phoolbari	Banska	2.77	2.77	2.0	2.50	3.71	0.74	5.09	2.94
	Banskha	2.36	2.36	1.85	2.31	3.43	0.69	4.10	1.46
	Belakhola	1.92	1.92	2.08	2.60	3.79	0.76	4.33	2.00
	Dharapani	2.08	2.08	2.0	2.50	2.56	0.51	3.69	1.74
	Voltase	2.55	2.55	2.00	2.50	4.0	0.80	4.89	2.41
Puranogaun	Baseri	1.80	1.80	2.27	2.83	4.0	0.80	4.99	2.19
Tukucha	B.dhunga	1.0	1.0	1.0	1.25	1.93	0.39	1.82	0.62
	S.amaldol	1.73	1.73			3.82	0.76	2.15	1.06
	S.dandal	1.64	1.64	1.0	1.25	3.92	0.78	2.23	0.99
	T.pakha	1.57	1.57	1.78	2.22	3.14	0.63	2.49	1.28
Panauti municipality	Ithalpuka	2.31	2.31	1.80	2.25	2.77	0.55	3.03	1.31
	Jyalachiti	2.14	2.14	1.20	1.50	3.30	0.66	2.94	1.47
	Total average	2.07	2.07	1.95	2.43	3.64	0.73	3.79	2.14

Source: Field Survey, 1999-2000. 306

Note: N = 306

LSU = livestock in standard unit

1 LSU = 0.8 buffalo = 1.0 cattle = 5.0 goats, (The University of Reading, 2001).

Respondents by sex

Household heads irrespective of sex obtained from randomly selected names are the interview respondents for this study. The table F10 presents the percentage distribution of male and female respondent across the 19 CFUG.

Table F10:
Percentages of the Respondents according to sex

VDC/municipality	CFUG	Respondents	Men	Women
Khanalthok	Vakundebesi	16	87.5	12.5
Mahadevstan	Naubisegeruwapakha	16	68.8	31.2
	Ratmatejhagarpur	16	87.5	12.5
	Sallenibaguwa	16	81.3	18.7
Panchkhal	Khawakoratmate	16	87.5	12.5
	Thuliban	16	93.8	6.2
	Vasmepakha	17	88.2	11.8
Phoolbari	Banskhark "ka"	17	94.1	5.9
	Banskhark "kha"	16	81.3	18.7
	Belkholapakha	16	100	0.0
	Dharapanikhareti	16	68.8	31.2
	Voltase	16	81.3	18.8
Puranogaun	Baserithuloban	16	87.5	12.5
Tukucha	Byangdhunga	16	87.5	12.5
	Sanobanamaldol	16	81.3	18.7
	Sanobandandal	16	68.8	31.2
	Thulopakha	16	87.5	12.5
Panauti	Indresworthalpu "ka"	16	93.8	6.2
Municipality	Jyalachiti	16	100	0.0
	All total	306	85.6	14.4

Source: Field Survey, 1999-2000

Table F10 demonstrates that the percentage of the male household heads exceeds that of the women. Of the total 306 respondents, approximately 86% of them is male.

Table F 11
Kilograms Equivalent of Muri

Crop Grain	Kilograms equivalent of 1 Muri
Rice (husked)	72
Rice (unhusked)	48
Maize	64
Wheat	64
Barley	37
Millet	72
Potato	62
Mustard	59

APPENDIX G
QUESTIONNAIRE FOR MEMBER HOUSEHOLD
ECONOMIC PERFORMANCE OF USER GROUP/COMMUNITY FORESTRY

PURPOSE OF THE SURVEY

The main aim of this survey is to understand the influence of the management activism of the Community Forest User Group Committee and user members' future consciousness on the distribution of fuel wood, fodder and litter among the user members. The information of the survey will be utilised in writing a thesis and can help the concerned agency in preparing plan of Community Forestry and evaluation of the outcome of similar project in future.

QUESTIONNAIRE

Date District Sample No Village

Development Committee

Forest User Group/Committee

Village Ward

1. How many back loads of fuel wood, sita, grass, tree fodder and litter did your child and adult family obtain from community, own farmlands and government forest during the forest produce harvest seasons of the last year?

Produce from which forest.	Adult		Child	
	Number	Number of Back loads	Number	Number of Back loads
Fuel wood Community forest Own farmlands Government forest Sita Community forest Own farmlands Government forest				
Litter Community Forest Own farmlands Government Forest				
Grass Community forest Own farmlands Government forest				
Tree fodder Community forest Own farmlands Government forest				

2. From which of the following forests do you and your family members collect fuel wood, sita, grass, tree fodder and litter?   :ention the months in which you fetch these products.

Products	Own farmlands	Community Forest	Government Forest
	Month	Month	Month
Fuel wood			
Litter			
Grass			
Tree fodder			

3. Personal Characteristics of the Respondents :

1. Name: 2. Age: 3. Sex:

4. Education: 4.1 Literate ( ) 4.2. Illiterate:

5. Age, sex and occupation of the family members

S.N.	Name	Sex	Age

6. Do you agree that the Community Forest should be protected for future?

Yes ( ) No ( ) (1 for yes, otherwise 0)

7. Total number of cow, oxen, buffalo and goat

Type	Nol
Cow	
Oxen	
Buffalo	
Goat	

8. Area of low rice land or khet and upland or bari

Type of land	Area in ropani
Low rice land or khet	
Upland or bari	

9. Production from cultivated low rice or khet and upland or bari land

	Khet or low rice land		Bari or uplands	
Crop	Production	Price/kg	Production	Price/ kg
Paddy				
Wheat				
Maize				
Millet				
Mustard				
Potato				
Others				
...				
....				

APPENDIX H

CHECK LIST OR DISCUSSION GUIDELINES FOR CFUG

Date: Sample No: Village Development Committee:

Forest User Group/Committee:

Village: Ward:

1. Is the User Group pruning/cutting branch wood and thinning trees? Yes ( ) No ( ) and supplying fuel wood among the user members?

Section 1

Index of the Process of Decision-making

This index is created combining four variables. The method used to derive this index is described in chapter V. The descriptions of the four variables are as follows:

2. Is at least one household from each of the castes of general members represented in the executive committee?

3. Is at least one woman represented in the executive committee?

Each of these variables is dichotomous, with 0 signifying no representation and 1 signifying representation.

4. Total number of monthly and annual meetings during 1996-1999

Years	Monthly meeting		Annual meetings
	Number	Number of members who attended the meeting	
1999/98			
1998/97			
1997/96			
1996/95			

1 for four years' average number of the total of the monthly and annual meeting of 6 and above, other wise 0.

1 for four years' average number of members' attendance of 50% and above of the total executive members, otherwise 0.

5. Decision -making for the harvest and distribution of fuel wood, sita, litter, grass and tree fodder.

This variable is dichotomous, with 1 signifying decision-making by executive committee or assembly or both, otherwise 0.

Index of the Enforcement of Property Rights

This index is worked out combining six variables. The description of each of these variables is given below.

6. Do you specify membership fee from the user members? (Note down the rates of membership fee from office records)

This variable is dichotomous, with 1 signifying if membership fee specified, zero otherwise.

7. Do you specify following harvest rules for fuel wood, sita, litter, grass and tree fodder?

Specification of harvest rules	Fuel wood		Sita		Litter		Grass		Tree fodder	
	yes	no	Yes	No	Yes	no	yes	No	yes	No
Produce										
Day/date										
Time										
Quantity										

Each of the above mentioned harvest rules is dichotomous, with 1 signifying yes, otherwise 0.

Please provide information about the specification of produce, day/date, time of entry into and exit from forest and quantity of fuel wood, sita, litter, grass and tree fodder from office records.

8. Do you weigh and then distribute fuel wood, sita, litter, grass and tree fodder?

This variable is dichotomous, with 1 signifying weighing of each of these products, otherwise 0.

Index of the Monitoring of Implementation

The index of this variable is created combining the four variables. The following is the description of each of these variables.

9. What forest protection system do you have? Forest guard ( ), Group rotation ( ), No system ( ).

This variable is dichotomous, with 1 signifying forest guard or group rotation, otherwise 0.

10. Whether the CFUG adopt group or individual harvest of fuel wood, sita, leaf litter, grass and tree fodder?

Products	Group harvest	Individual harvest
Fuel wood		
Sita		
Litter		
Grass		
Tree fodder		

11. What are the punitive measures applied on rule breakers? Warning ( ), fines ( )

Provide the information about the amount of fines collected from the rule breakers. The index of fines is created signifying 1 if the fine is collected, otherwise 0.

12. Do you mobilise group fund in village development activities? Yes ( ) No ( )

If yes, provide the information about the fund (in rupees) mobilised in village development activities. The index of mobilisation of fund is created signifying 1 if fund is mobilised in village development activities, otherwise 0.

Section 2

13. Name and official positions of the executive committee members
Name Position

14. How many households of different castes are included in the CFUG? This information gives the number of castes in the group.

15. Criteria for the Selection of the Members of the Executive Committee

1. How are the members of the executive committee selected?

(a) Election ( ) (b) selection by general members through consensus ( ) (c) selection in the meeting of executive committee ( ) (d) others (specify)

16. How long do the members of the executive committee hold a post?

17. How long have the current members of the executive committee been in office?

18. What are the roles and responsibilities of the general assembly and executive committee?

19. Rules of fines and punishments for unauthorised harvest of fuel wood, sita, litter, grass and tree fodder.

Section 3

21. Provide information about the quantity of fuel wood, leaf litter, grass, and tree fodder supplied among the member households during the following three years.

Year	Fuel wood		Sita		Litter		Grass		Tree fodder	
	bundle	kg	Back loads	Kg	Back loads	kg	Back loads	kg	Back loads	kg
1999/98										
1998/97										
1997/96										

22. How much does a back load of fresh fuel wood, sita, litter, grass, and tree fodder carried by child and adult weigh?

Produce	weight of a bundle carried by a child	weight of a bundle carried by an adult
Fuel wood		
Sita		
Litter		
Grass		
Tree fodder		

23. Provide information about the fuel wood, sita, litter, grass, and tree fodder harvesting months/seasons for the community forest, own farmlands and government forest.

Produce	Months	Seasons
Fuel wood		
Sita		
Litter		
Grass		
Tree fodder		

Section: 4

24. Forest area in hectare:

25. types of forest:

Section: 5

26. Provide the information about the prices of input for the cultivation of paddy, maize, wheat, and potato (including the prices of seed, for a pair of bullock/day, manure (kilogram/ropani), and fertiliser per kilogram and pesticides).

Input cost of cultivation of major crops per ropani					
Seed	Rupees	Pair of bullock/day	Manure/kg/ropani	Fertiliser/ropani	Pesticides/ Ropnai
Paddy					
Maize					
Wheat					
Potato					

27. Provide the information about the prices of the following farm products (rupees/kilogram).

Farm Products	Price/kg
Rice	
Maize	
Wheat	
Potato	
Tomato	

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