WORKING PAPER

No. 1-03

Property Rights and Natural Resources: Socio-Economic Heterogeneity and Distributional Implictions of Common Property Resource Management

Bhim Adhikari

SANDEE

South Asian Network for Development and Environmental Economics

June, 2003

Property Rights and Natural Resources: Socio-Economic Heterogeneity and Distributional Implications of Common Property Resource Management

BHIM ADHIKARI

Environment Department,
University of York, Heslington,
York YO10 5DD
United Kingdom

June 2003

South Asian Network for Development and Environmental Economics (SANDEE)
PO Box 8975, EPC-1056
Kathmandu, Nepal

Working Paper No. 1-03

Published by theSouth Asian Network for Development and Environmental Economics (SANDEE)
PO Box 8975, EPC-1056 Kathmandu, Nepal.
Telephone: 977-1-552 8761, 552 6391
Fax::977-1-553 6796

SANDEE research reports are the output of research projects supported by the South Asian Network for Development and Environmental Economics. The reports have been peer reviewed and edited. A summary of the findings of SANDEE reports are also available as *SANDEE* Policy Briefs.

National Library of Nepal Catalogue Service:

Bhim Adhikari
Property Rights and Natural Resources: Socio-Economic Heterogeneity and Distributional Implications of Common Property Resource Management.

ISBN 99933-826-1-2

1. Property rights,
2. Common property resources,
3. Socio-economic heterogeneity,
4. Community forestry,
5. Equity,
6. Distribution of forest income,
7. Nepal.

The South Asian Network for Development and Environmental Economics

The South Asian Network for Development and Environmental Economics (SANDEE) is a regional network that brings together analysts from different countries in South Asia to address environment-development problems. SANDEE's activities include research support, training, and information dissemination. SANDEE is supported by contributions from international donors and its members. Please see www.sandeeonline.org for further information about SANDEE.

Technical Editors:
Herath Gunatilake
Priya Shyamsundar

English Editor:
Carman Wickramagamage

Comments should be sent to Bhim Adhikari, Environment Department, University of York, Heslington, York YO10 5DD, United Kingdom. *E-mail: bpa100@york.ac.uk*

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

Poverty, property rights and distributional implications of community-based resource management have become major topics of discussion and debate in recent years. This study tries to examine the contribution of community forestry to household-level income with particular emphasis on group heterogeneity and equity in benefit distribution. The assessment of household level benefits suggests that poorer households are currently benefiting less in absolute terms from community forestry than less poor households. In terms of the contribution of forests to household income, the study results suggest that the poor are not necessarily more dependent than the rich, a finding that contradicts results from other similar studies. Econometric analysis suggests that income from community forests is related to socio-economic attributes and private resource endowments of households. Households with land and livestock assets, as well as upper caste households gain more from the commons, while better educated households depend less on forest resources. Female-headed households benefit less from community forests, further aggravating the inequity in distribution of benefits. The study makes a number of recommendations to improve community forest management in Nepal, which include, due consideration for community needs in selecting species for community forestry, transferability of user rights, which would allow less endowed households to benefit more, and more and equitable representation of women and disadvantaged groups in forest management committees (JEL Q2, Q23).

Key words: property rights, common property resources, heterogeneity, community forestry, forest user groups, equity, distribution, forest income.

Property Rights and Natural Resources: Socio-Economic Heterogeneity and Distributional Implications of Common Property Resource Management

BHIM ADHIKARI

1. Introduction

Community management of local natural resources has become an integral part of sustainable development policy in the last few years. There is now considerable evidence that centralised management is unable to provide the right incentives for sustainable resource use. Thus, it is increasingly argued that organised civil society can play an important role in overcoming many economic problems related to internalisation of externalities, provision of local public goods, and access to credit by the poor — problems that neither the market nor the state can reliably solve (Molians, 1998). Recognising the importance of organised civil society, many developing country governments have begun to support community-based resource management. In Nepal and other south Asian countries, this attempt has focused on poverty alleviation, local level economic development and forest conservation.

Participatory resource management is viewed as a solution to a number of problems linked to state management of natural resources such as information asymmetries, incentive incompatibility, lack of effective monitoring and maintenance etc. However, results emerging from experiments in community management suggest that there may be a number of distributional problems associated with structured attempts to manage common pool resources (CPRs) (Kumar, 2002). Mixed results have been observed on the potential of CPR systems to have a positive impact on the livelihood of the very poor and marginalized sections of communities (Campbell *et al*., 2001; Beck and Nesmith, 2001). Thus, the success of CPR management appears to be dependent on the existence of a well-specified rights structure and the congruence of this regime with its ecological and social context (Hanna and Munasinghe, 1995).

The CPR literature argues that poor people extract more resources from the commons due to greater reliance on natural resources and also due to their high individual rate of time preference. If poverty increases the marginal rate of time preference to very high levels, then future environmental effects of current resource use are optimally ignored. High rates of time preference and shorter time horizons may also prevent poor people from investing in environmental conservation. Consequently, the poor disregard the need for conservation of resources and adopt strategies that yield more immediate results (Holden *et al*., 1998). Some scholars posit that compared to the non-poor, the poor may depend more on the commons in relative terms but in absolute terms their dependency is lower (Dasgupta, 1993). While the poor may attempt to minimize risk by using forest resources to mitigate shortfalls in consumption levels, the rich or the less poor may be interested in enhancing their earnings by selling these resources, particularly, when there are good market opportunities.

Though there have been a number of theoretical and empirical studies on the successes or failures of collective action, relatively few have paid attention to equity and distributional implications of common property institutions. Existing empirical studies have focussed mainly on communities as opposed to households in describing the success of CPR management. It is assumed that communities will

collectively manage local resources because of the substantive benefits to be derived from these resources. Moreover, when the responsibility of allocating natural resources is delegated to local organizations, communities are expected to distribute these resources more or less equitably among the members. However, there is now some evidence that formalized systems of community property rights may lead to a gradual but systematic exclusion of poorer households from CPRs (Beck and Nesmith, 2001). This paper examines this broad concern by investigating whether recent policy shifts towards community-based forest resource management in Nepal have increased access of poorer households to community forest (CF) resources. The working hypotheses of the paper are: 1) the poor are, in absolute terms less dependent, but, in relative terms more dependent, than the 'less poor' on forest resources; 2) there are differential impacts of CF management and the poor benefits less than 'less poor,' and 3) ability to use the CF resources is directly linked to heterogeneity in the private resource endowments of households.

The rest of the paper is organised as follows. Section two reviews some theoretical and empirical work on inequality and distributional aspects of CPR management. In addition to a description of the problems associated with CF management in Nepal, section three discusses the property rights structure over forest resources. Section four discusses methodological issues and survey design. Section five reports the results obtained from economic and econometric analysis. The final section concludes with policy recommendations.

2. Poverty, heterogeneity and Common Property Resource use

Research on CPR management has become increasingly concerned with the contested role of group heterogeneity in determining the success of institutions (Baland and Platteau, 1996; Bardhan and Dayton-Johnson, 2000; Bardhan, 1993; McKean, 1992; Kanbur, 1992; Keohane and Ostrom, 1995; Wade, 1994; Velded, 2000; Dayton-Johnson, 2000; Varughese and Ostrom, 2001; Karaivanov, 2001; Adhikari, 2001). The term heterogeneity is used to describe asymmetric distributions of wealth and power, different preferences and opportunity costs, unequal claims to natural resources, and caste and ethnic divisions within a community. Bardhan and Dayton-Johnson (2000), for example, consider both economic and social inequalities that may bear upon the success of collective action. In their work heterogeneity includes inequalities in income among the members of the group, inequalities in the sacrifices made by community members in cooperating with CPR management, inequalities in benefits derived from CPR management, inequalities in outside earning opportunities, cultural heterogeneity, and, locational differences that might influence an individual's incentive to cooperate. As Kant (2000) proposes, heterogeneity with regard to CPR management is at three different levels. First, economic, socio-cultural, and other social differences form a basic level of heterogeneity. Due to this basic heterogeneity, members of the user group may have diverse preferences for timber and non-timber forest products and hence prefer to harvest different mixtures of products. Further, preference over diversified forest products often leads to different preferences for resource management regimes. The preference for different resource management regimes forms the third-level heterogeneity.

While there is consensus that heterogeneity is a factor in community-based resource management, there are no clear answers as to how and to what extent heterogeneity contributes to or diminishes the likelihood of successful CPR management. Several decades ago, Olson (1965), hypothesized that heterogeneity may enhance the likelihood of collective action as economic agents with larger endowments and power may bear a larger portion of costs associated with cooperative action. By bearing a larger proportion of costs, this group can better internalize the positive externalities generated from the management of public goods. Baland and Platteau (1997) reinforce the theoretical possibility

of Olson's hypothesis especially when management of CPRs involves important "non-convexities" in its production function. Nevertheless, Bardhan and Dayton-Johnson (2000) note a U-shape relationship between inequality and commons management. Very high and very low levels of inequality are associated with better commons performance while mid-range levels of inequality are associated with poor outcomes.

Heterogeneity can have discernible negative effects on CPR management in two different ways. First, socio-economic inequalities within communities are reflected in the form of heterogeneous preferences for forest resources; consequently, management objectives become more diverse and challenging to effectively implement (Kant, 2000). Second, a high degree of heterogeneity can provide opportunities for powerful minorities to impose management rules that serve their own interests (Eder, 1987; Guggenheim and Spears, 1991). Individuals with higher power influence the 'operational rules' that affect day-to-day operational modes of forest user groups, which in turn affects individual or group incentives for collective action. Thus, socio-economic differentiation can decrease the likelihood of successful collective action because of disincentives that result from divergence of interest among heterogeneous economic agents.

Consistent with the growing theoretical literature, there is a large amount of empirical research, especially in India, dealing with poverty, inequality and the dependence of rural households on CPRs (Jodha, 1985, 1986, 1990, 1995; Iyengar, 1989; Beck, 1994, 1998; Singh *et al*., 1996; Iyengar and Shukla, 1999). Beck and Nesmith (2001) note that CPRs currently contribute some USD 5 billion a year to the income of poor rural households in India, or about 12% to the household income of poorer households. Jodha's (1986, 1995) study from 80 villages in 21 districts in India concludes that CPRs contribute 15-25% of the total income of poorer households.

Studies from different states of India have found that CPRs contribute 1.1 per cent to 29 per cent of the income of poorer households. The average contribution at the state level are 0.1 to 22 per cent, 10 per cent, 22 to 27 per cent and 19 to 29 per cent in Gujarat, Karnataka, Punjab and West Bengal respectively (see Iyengar and Shukla, 1999; Pasa, 1992; Beck, 1994; Singh *et al*., 1996; Beck and Nesmith, 2001 for details). These figures for non-poor/cultivating households are 0.1 to 11.4 per cent, 6.2 per cent, 22 per cent and 0.13 to 5.62 per cent. In a study of 29 villages in Southeastern Zimbabwe, Cavendish (1998, 1999) arrived at even larger estimates. He observed that the proportion of income based directly on the commons is about 35 per cent. Moreover, the figure for the poorest quintile is 40 per cent. Based on a qualitative assessment of babassu products in Maranho, Brazil, Hetch *et al*., (1988) also conclude that the products offer support to the poorest of the poor, especially women. There appears to be a general consensus that poorer household are dependent more on CPRs and consequently derive higher income from these resources.

On the other hand, there is evidence that the wealth endowment of households affects private benefits from commons since productive wealth creates opportunities for better-off households to use biomass resources. While wealth directly affects the ability to appropriate resources from commons, the social reputation of wealthy individuals indirectly provides opportunities to access CPRs through leadership and influence on public decision-making processes. There are several examples of this positive correlation between private wealth and use of public resources. For instance, Singh *et al.*, (1996) observe that the use and exploitation of CPRs in Punjab was directly proportional to the ownership of private resources. McKean (1992) in a study on a heterogeneous village society in Japan concludes that distribution of benefits of collective action reflects inequalities in private wealth. Chopra *et al*., (1990) found that endowments of cultivable land, cattle and particular machines or harvesting tools

determine a household's ability to use CFs and grazing lands in India. In a study of CF management in Nepal, Richards *et al*., (1999) observe that household members with bigger land holdings benefit proportionally more from CF than members with smaller holdings.

In recent years, some studies have shown that formalisation, commodification and privatisation of CPRs in heterogeneous communities may marginalize weaker sections of society. Thus, these studies posit that poor households who enjoyed certain benefits from CPRs under traditional systems of resource management may actually lose out when the system is formalized. For example, Bokil (1996) observed that the individualization of common land has benefited the economically privileged sections of the society and in the process the poor has been deprived of resource appropriation and benefit sharing. In the first systematic study of CPRs in West Bengal, Beck and Ghosh (2000) have found that poor people are being systematically excluded from customary access to CPRs due to agricultural intensification, commodification and formalisation of property rights, population pressure and environmental degradation. Hill and Shields (1998) observed that community incentives in joint forest management (JFM) in India are not so clear-cut and the main losers in JFM are fuel-wood head-loaders who are often form the poorest subgroup within the village. Moreover, it is the richer members of the community who tend to dominate local politics and organizations in India. Thus, benefits from local institutions such as JFM accrue mainly to richer sectors of the community (Saxena, 1989).

While local level CPR management appears to enhance efficiency of resource use by making the overall cake bigger, it is not clear that all local households gain from this increase in natural assets. Thus, in some scenarios, it may be more appropriate to gauge CPR management success not only by reference to its efficiency, but also by the sustainability of resource use and its success in promoting equitable distribution of benefits (Adger and Luttrell, 2000). Though the management of CPRs and the implications for environment and poverty has been well studied in India, no systematic effort has yet been undertaken in Nepal. Moreover, despite some cost-benefit analyses of CF management, little attention has been paid to the differential nature of returns to different interest groups within resource-using communities. This study seeks to bridge this gap in understanding about how and to what extent the poor are dependent on community forests in Nepal.

3. Property rights and forest resources in Nepal: An overview

Property rights structures over forest resources have frequently changed in Nepal. Under the Forest Nationalisation Act of 1957, a very controversial step in the history of forest management in Nepal, huge tracts of forest previously managed as private and common property were brought under state control. Though there is still a huge debate on forest nationalisation and the deforestation hypothesis in Nepal (Ives and Messerli, 1989; Fisher, 1990), many scholars believe that local communities throughout the country reacted negatively to forest nationalisation believing that their traditional rights of access and use had been curtailed (Bromley and Chapagain, 1984; Bromley, 1991). As a consequence, this act increased the rate of deforestation as villagers hurried to convert affected lands into agricultural use so as to exempt them from the transfer (Bromley, 1991). In response the government introduced another act, the Forest Act of 1961, which was more focussed on forest administration. This Act, which further consolidated the notion of forest nationalisation, was amended in 1978 to include different forest management regimes such as Panchayat Forests (a local level political unit), Panchayat Protected Forests, Private Forests, Leased Forests, and Religious Forests.

By the mid 1970s, it was clear that local people had to be involved in every aspect of forest management. As a result the new and far-sighted Community Forestry Legislation and Decentralization Act was passed in 1982. The Forestry Master Plan (HMGN/MPFS, 1988) spells out a comprehensive policy statement for CF management, and emphasizes that control of forest should be turned over to forest user groups (FUGs).

After democracy was restored in 1990, the government framed the Forest Act of 1993, which focussed on sustainable management of forest resources under community-based property rights regimes. The Forest Act vested more legal authority in FUGs. This legislation was given greater coherence by the 1995 Forest Rules, which clarified the powers and duties of FUGs. As per these policies, local communities are organised as FUGs and accept the responsibility for protection, management and sustainable utilization of forest areas under community-based property rights regimes. To date, more than 11,000 FUGs manage about 848,159 hectares of community forest in Nepal (HMGN/CPFD, 2001). Based on a conceptual schema proposed by Schlanger and Ostrom (1992), the following collective rights can be described in the context of CF management in Nepal.

1) Operation-level property rights

Access rights

- All defined users have a right to enter into community forestry as per specified rules and an agreed-upon operational plan, i.e., block, time, months, season, etc.

Withdrawal rights

- All users are entitled to harvest pre-defined types and units of forest products from CF.

2) Regulation rights: Regulation rights consist of the following:

Management rights

- Decisions regarding operational rules on forest protection, harvesting, utilization and sanctioning for rule infractions are made by FUGs.
- FUGs can plant long-term cash crops like medicinal herbs and other non-timber forest products (NTFPs) without disturbing the main forestry species (collectively owned) and they can establish forest-based industries.
- Users can amend the Operational Plan by simply informing the forestry authority and they can fix the price of the forest products irrespective of the government royalty and they can use surplus funds for community development work.

Exclusion rights

- Users themselves identify the traditional users of CF and they reserve the right to form FUGs and Committees through consensus within the community. They define who are the included users and who are excluded persons. FUG can provide membership to new entrants (migrating households) under certain conditions.

Alienation rights

- There is no mechanism by which user group members can sell or lease his/her share of rights to other users of the same group. Products from CF can only be used for subsistence needs; not for commercial purpose. Users are not allowed to sell their private share of the produce in the market.

Despite being one of the most innovative policies in place to promote community-based resource management, some authors have noted that CF may not have helped needy people, but rather may have often worked to their disadvantage (Garner, 1997). In his study on the effectiveness of CF management in Nepal, Adhikari (1996) argues that distributional aspects of the CF program in the middle hills of Nepal is dictated by the socio-economic conditions of resource users. Although improvement in the physical stocks of trees and other resources on both public and private lands have been evident (Branney *et al*., 1994), equitable use of forest products such as fuel-wood, fodder, timber and other non-timber forest products within the community has not been clearly demonstrated (Malla, 2000). The landless, and households belonging to particular ethnic groups such as the blacksmiths, and other politically and economically marginalized people are not able to take advantage of incentives for tree growing. Many scholars argue that the restriction posed on the collection of various non-timber products after the institutional change actually *hurt* poorer households whose livelihoods were traditionally closely linked to the collection of these forest products (Springate-Baginski *et al*., 1999; Richards *et al*., 1999; Adhikari, 2002a).

4. Study sites, methods, and data collection

4.1 Data collection

This study was undertaken in two selected districts of the mid-hills of Nepal where CF interventions have been implemented for the last two decades. In order to address the research hypothesis posed in section one, four FUGs (Saradadevi, Jyala Chiti, Mahavedsthan and Thuli Ban) in Kavre Palanchok districts and four FUGs (Gaurati, Shree Chhap, Janghare and Karki Tar) in Sindhu Palanchowk district were selected.

The middle hill region occupies the great central belt of Nepal where the country's origins and character are mostly rooted. This area comprises approximately 30 percent of the whole area of the country (HMGN/MPFS, 1988). The land-uses of the Middle Mountains are categorized as cultivated land, non-cultivated inclusions, grasslands, forestland, shrub lands and other types of land uses. Based on Dobremez, (1976), Jackson (1994) identifies 8 different forest types in the middle-hills using altitude as the main criterion. However, only three different forest types, i.e., coniferous forest (dominated species *Pinus roxburghii*), broad-leaved forest (dominated species *Schima wallichii* and *Castanopsis indica*) and broad leaved and coniferous mixed forest, were observed in the study sites. Caste and ethnic diversity is a characteristic of the middle hills with a significant number of people belonging to such ethnic groups as *Brahmins, Chhetris, Newars, Tamangs, Thakalis, Magars, Gurungs, Rais* and *Limbus*. Most of the population in this area are subsistence farmers with few options for other livelihood opportunities. All accessible hill forests in the study area are surrounded by agricultural land and are under heavy pressure to meet the primary forest product needs of the households. Livestock, an integral part of the subsistence farming system, is a source of protein (milk and meat) and draft power.

A stratified sample of households was chosen by compiling a census of village households with participatory rural appraisal (PRA) techniques. Participants in the PRA exercise were asked to categorize all households into three different stakeholder groups, poor, middle wealth and richer households, based on criteria that villagers consider as important for assessing an individual's socio-economic position in the village. Fox (1983) and Richards *et al*., (1999) have used similar criteria for categorizing households into different income groups. The main criteria used for the categorization were the extent of land owned, loans given and taken, and income from off-farm agricultural activities. In addition, land quality and household food sufficiency were also considered. Poor households own 0 to 0.25

hectare of land, with a mean of 0.15 hectare. Middle-wealth households own between 0.28 hectare to 0.75 hectare with a mean of 0.51 hectare. Richer households own between 0.78 to 4.25 hectare, with a mean of 1.33 hectare. This categorization should be understood in relative terms since all households in the study area are subsistence farmers with few households having earning opportunities outside agriculture and CPRs.

Primary data on household level variables, and the use and management of CF was collected through a survey of 330 households. The sample represents 20 per cent of households from each group in eight villages. The Survey was conducted for a period of 4 months from September to December 2000. Questions were asked to obtain information on four general areas: 1) demographic information; 2) land holding, tenure and off-farm production systems; 3) CPR management and utilization; and 4) household awareness/participation in CF management. The main fieldwork was supplemented by two short visits: September-October 2001 (by two research assistants) and February 2002 (PI with research assistants) to clarify various concerns raised during the main survey. Twenty one out of 330 questionnaires were discarded from the final analysis since they were incomplete. Since these are all subsistence farm households, they adequately represent a typical forest-dependent rural household in the mid hills of Nepal.

4.2 Household benefits from CF

Household benefits from community forests were assessed by valuing the goods collected and harvested from forests. The economic values of different forest products such as firewood, tree fodder, cut grass, leaf litter, medicinal herbs and plants, timber and some other direct and tangible benefits by user households were estimated. Despite the fact that there are many potential forest products, only firewood, tree and grass fodder, and leaf litter significantly contribute to the household economy. In all study sites, about 5 respondents (i.e., *Ayurvedic* Doctors or traditional healers) reported that they collected some medicinal herbs from community forests. Though the high-altitude forest of Kavre Palanchowk and Sindhu Palanchowk districts contain a variety of NTFPs (mainly medicinal plants), none of these products seem to contribute to either household or forest user group income. The following procedure was adopted to value the household-level income from CF.

a. Calculation of gross value (income) of forest products: Gross income is calculated by multiplying the quantity of forest product harvested by the price of the product minus cash costs like hired labor costs, direct cash payment to FUG as monthly membership fee, etc. Since the amount of forest products collected varies with the seasons (due to climate changes, user group regulations, and seasonal agriculture work), information was collected for 12 consecutive months. In all the sites considered, green fuel-wood harvesting was a restricted activity that could only be harvested once or twice a year for a fixed period of time. Fuel wood and other forest products cannot be harvested for commercial purpose.

The market price, barter method and opportunity cost approach were used in valuing forest products. Firewood consumed at home or exchanged with kin was valued at retail purchasing price in the village or forest-gate price (Gunatilake, 1998). Non-marketed NTFPs and tree and grass fodder were valued by the barter game method (Godoy *et al*., 1993, Richards *et al*., 1999). In order to perform the barter game method, the participants of discussion groups were divided into two groups, i.e., buyers and sellers, with buyers purchasing tree or grass fodder in exchange for a local commodity which has a well-known market value (Richards *et al*., 1999). In this exercise, buyers were given a bag of rice and the sellers were given a bundle of fixed unit (*bhari* or head load) of tree and grass fodder. The participants were asked to discuss within their group the quantity of rice they deserved

in exchange for forest products. Finally, they actually exchanged the products for a fixed quantity of rice after a consensus was formed between all members within the group. The value of tree and grass fodder was derived from this exercise since the market value of rice is well established. Leaf litter was valued based on the labour cost of time spent in collecting and transporting a *bhari* of leaf litter from CF. This cost information was obtained during group discussion with key informants. Since village wage rates vary with season, the average wage rate throughout the year was used. Differences in wage rates between villages were also considered since wage rates were not identical for all study sites. Care was taken to avoid unrealistic estimation because the accuracy of recall information drops when people are asked to remember events in the distant past (Bernard *et al*., 1984).

b. **Calculation of net income:** Forest net income refers to revenues less cash and imputed costs of labor as well as the cost of tools and equipment and their depreciation costs (Wollenberg and Nawir, 1999). So the costs here include labor costs of time directly associated with finding, extracting, processing and transporting forest goods from the forest to the village, the cost of tools and equipment (including depreciation) and the transaction costs incurred by households. During the field survey, respondents were asked to report on ownership of tools used in forestry operations, their costs and economic life, and the percentage used on forestry and non-forestry activities. Based on this, total costs of tools and equipment used in forestry operation were derived (see Richards *et al*., 1999 for similar methodology). The net income from forest products was, thus, calculated as gross income ('a' above) minus imputed costs, including transaction costs incurred by households.

Three broad types of transaction costs were considered—costs of decision-making (TC_D), costs to implement those decisions (TC_I), and costs of monitoring (TC_M) the implemented decisions. The TC_D refers to costs incurred during the process of acquiring information about forest and community, and the costs of co-ordinating the activities such as identification of potential users, preparation of forest management plan, and negotiating with the forest department. These costs are mainly the time spent for community meetings, conflict resolution, and so on. TC_I includes costs incurred in carrying out obligatory activities such as thinning, pruning, fire protection, and forest road repair and maintenance, etc., in order to comply with management decisions. TC_M refers to those costs incurred for monitoring and enforcement of agreed-upon rules, record-keeping, and minute book maintenance, financial monitoring of FUG, and other monitoring-related activities. Transaction costs, therefore, were simply measured in terms of labour opportunity costs of time spent in these community activities. Transaction costs for CF management as a percentage of total costs were higher for poorer households (14%) than those for middle-wealth (12%) or rich households (9%) (see Adhikari, 2002b for detail).

4.3 Forest use and socio-economic heterogeneity

An econometric model was developed to understand the relationship between forest dependency (household level income from CF or value of outputs) and socio-economic determinants (Yanggen and Reardon, 2001). Outputs refer to various forest products such as firewood, tree fodder, grass fodder, timber, leaf litter and other non-timber products that households collect from community forests. As discussed earlier, it was hypothesized that household-level benefits from common property forests would be inextricably associated with household and community attributes. So variation in forest dependency among households can be explained by the socio-economic status of user-household. This relationship can be represented as:

(1)

$$Output_i = f(household\ labour_i, land\ holding_i, livestock\ unit_i, caste_i, education_i, age_i, gender_i, forest\ product\ price_i, distance\ to\ cpr_i, transaction\ costs\ days_i, forest\ type, distance\ to\ nearest\ market_i (exit\ option), technology\ of\ harvesting, income\ status_i)$$

The corresponding regression equation (2) is defined as a log-linear model and is based on a similar model by Di Falco and Perrings (2002) used to understand the effect of cooperative production on intra-specific crop genetic diversity. The dependent variable, Y_i, measures household-level return from CF (gross value of outputs). The independent variables, $X_{ij,}$ refer to household and the community attributes.

$$\ln Y_i = bi_1 + \sum_{j=2}^{15} b_{ij} \ln X_{ij} + e_i \quad (2)$$

The quantity of different forest product harvested is an alternative method to measure forest dependency. However, it is not possible to aggregate different quantities of forest products into a single measure. Therefore, the gross value of output is preferred. In addition to equation 2, the link between socio-economic variables and specific important forest products is explored by estimating three more regressions. Equations 3a to 3c analyse the relationship between the gross value of tree and grass fodder, leaf litter, and fuel wood respectively, and socio-economic and community attributes. Table 1 describes the explanatory variables used in the empirical estimations.

$$\ln y_1 = b_0 + b_1 \ln HSIZE + b_2 \ln LANDHO + b_3 \ln LIVESTO + b_4 CASTE + b_5 \ln EDUCATION + b_6 \ln AGE + b_7 GENDER + b_8 \ln PVTREE + b_9 \ln TCOST + b_{10} \ln DISTANCE\ TO\ CPR + b_{11} \ln TRANSDAY + b_{12} INCOMPOOR + b_{13} INCOMRICH + b_{14} VILLAGE\ DUMMY\ 1 + b_{15} VILLAGE\ DUMMY\ 2 + b_{16} PFOREST + b_{17} BFOREST \quad (3a)$$

$$\ln y_2 = b_0 + b_1 \ln HSIZE + b_2 \ln LANDHO + b_3 \ln LIVESTO + b_4 CASTE + b_5 \ln EDUCATION + b_6 \ln AGE + b_7 GENDER + b_8 \ln PVTREE + b_9 \ln TCOST + b_{10} \ln DISTANCE\ TO\ CPR + b_{11} \ln TRANSDAY + b_{12} INCOMPOOR + b_{13} INCOMRICH + b_{14} VILLAGE\ DUMMY\ 1 + b_{15} VILLAGE\ DUMMY\ 2 + b_{16} PFOREST + b_{17} BFOREST \quad (3b)$$

$$\ln y_3 = b_0 + b_1 \ln HSIZE + b_2 \ln LANDHO + b_3 \ln LIVESTO + b_4 CASTE \quad (3c)$$
$$+ b_5 \ln EDUCATION + b_6 \ln AGE + b_7 GENDER + b_8 \ln PVTREE$$
$$+ b_9 \ln TCOST + b_{10} \ln DISTANCE\ TO\ CPR + b_{11} \ln TRANSDAY$$
$$+ b_{12} INCOMPOOR + b_{13} INCOMRICH + b_{14} VILLAGE\ DUMMY\ 1$$
$$+ b_{15} VILLAGE\ DUMMY\ 2 + b_{16} PFOREST + b_{17} BFOREST$$

While most of the variables in Table 1 are self-explanatory, some clarification is required on the dummy variables used. Distance to the market appears as village dummy 1 and 2, which are the nearest and furthest villages from the nearest market. TCOST refers to technology employed in harvesting. As discussed, the sample was divided into three income groups based on the wealth level of households. Thus, income status is represented by the dummy variables INCOMPOOR and INCOMRICH.

Ethnicity or occupational caste may affect the preferences of the household and thus influence labour allocation and consumption decisions. It may also be that occupational caste households have different access to local environmental resources than higher caste households (Cooke, 2000). Power dynamics in communities are related to caste and this has implications for resource use. Beteille (1983) points out that in Indian villages access to local common-property resources is often restricted to the privileged (for example, Brahmin and Rajput) caste groups. The outcasts or scheduled castes are often among the poorest of the poor and are frequently deprived of entitlement to these resources due to social exclusion and marginalization. In such a setting, lower caste households of the community may not have equal access to the village commons as the households belonging to upper castes. Therefore, it is assumed that lower caste households derive lower income from CF compared to the higher caste households.

It is argued that higher education in the rural community leads to extraction of fewer forest resources since education opens up better employment opportunity and diverts people from subsistence agriculture and gathering activities (see Gunatilake, 1998). In this respect, it is assumed that education may be negatively related to household-level benefits from community forests. Allocation of household labour among different activities may change over the life-cycle of the head of the household (Godoy *et al*., 1998). To assess the extent to which forest labour allocation changes over time and its relationship with household level income from CF, the age of household head (AGE) was incorporated in the model. The higher levels of income from CPRs are expected to be associated with the younger age of the household head because older age reduces the probability of collection and thereby income as older people have less mobility (Kohlin and Parks, 2001). On the hand, the age of household head is also related to the household's experience in managing common resources as well as accumulation of social capital. Older people have better experience in local resources than younger ones and this may enhance the quantity of harvesting from CF. So the effect of age of household head on income is indeterminate.

In common literature, gender is often used to test the effect of gender difference on the level of cooperation in CPR management (Grossman, 1996). Some experimental studies on gender and cooperative behaviour indicate that women contribute more than men to managing commons due to greater interdependent utility and altruism (Folbre, 1994). However, in this study, one of the aims was to see whether access to and income from CPR is significantly different between male-headed and female-headed households. This is of particular importance in rural Nepal, where male members often enjoy greater freedom, income earning opportunities and control of resources. It is, therefore, hypothesised that male-headed households derive more income from community forestry than female-headed households.

Table 1. Explanatory variables and hypotheses

Variables	Expected sign	Description
Caste (CASTEL)	-	Lower caste dummy (if so called untouchable caste =1, 0=otherwise)
Caste (CASTEH)	+	Higher caste (If Brahmin =1, 0=otherwise)
Education (EDU)	-	Average education of family members (number of school years)
Age of household head (AGE)	?	Age of household head
Gender (GEND)	+	Sex of respondents (If male = 1, 0=otherwise)
Landholding (LANDHO)	+	Land area under household management (in ropani)
Livestock (LIVESTO)	+	Number of livestock owned by a household
Distance to forest (DIST)	-	Distance between community forests and house (km)
Transaction days (TRANSDAY)	+	Number of days spent in various obligatory forestry activities (proxy for leadership quality of household)
Technology of harvesting (TCOST)	+	Tool cost (proxy for technology of harvesting)
Household size (HSIZE)	+	Number of people in household
Trees on private land (PVTREE)	-	Number of trees grown on private land
Forest quality (PFOREST)	-	Dummy for pine dominating crown cover (1= If more than 75% crown cover dominated by pine trees)
Forest quality (BFOREST)	+	Dummy for broadleaved forest (1=if more than 75 % crown cover dominated by broad-leaved species)
Poor income group (INCOMPOOR)	-	If households belong to the poor income group = 1
Rich income group (INCOMRICH)	+	If households belong to rich or "less poor" income group=1
Market Distance (VILLAGE DUMMY 1)	-	Dummy for a village nearest to the market (<1 km)
Market Distance (VILLAGE DUMMY 2)	+	Dummy for a village farthest from the market (>5 km)

Household members with bigger land ownership and livestock holding (or less poor households) are expected to benefit proportionally more from CF because the management regime of CF is mainly oriented to the production of intermediate products that serve as inputs in the farming system (Richards *et al*., 1999). The difference in the extent of use of local forests may be associated with the number of livestock units raised by the households. Wealthier households with larger herds and more lands have greater need for animal fodder and agriculture compost (Varughese, 1999), which, in turn, results in inequitable use of the community resource base. In many rural settings, households invest surplus income to increase the size and scale of production systems. Rural households may invest a substantial amount of their income for either buying agricultural land or improved breeds of cattle. Since CFs provide inputs for expanding agriculture activities, dependency on forest does not necessarily reduce as household income increases. Under such circumstances, forest extractive activities continue to remain as important for the household economy as off-farm income opportunity and agriculture itself (Hetch *et al*., 1988). In this study, the extent of land and the number of units of livestock are assumed to be positively related to the benefits from CFs.

Harvesting forest product is labour-intensive because people have to walk, search and spend time harvesting such products. Household size has a direct influence on the capacity of a household to harvest forest products when there is very low level FUG restrictions on collecting products. A larger household therefore has more labour to spread across various collecting and gathering activities and such households may derive more resources from the commons. More labour in the family means the household's time constraints are set at a higher level as per the time allocation framework and that may lead to extra extraction (Gunatilake, 1998). Therefore, the effect of household size on CPR income is expected to be positive.

In many forest resource systems, users who live closer to the forest have a more secure and accessible supply of produce regardless of whether or not there are allocation rules in place (Varughese, 1999). As Gunatilake (1998) describes, families living close to the forest have the advantage of less time being required to reach a particular forest resource and their links with forests are, therefore, expected to be high. Those who live closer might be tempted to sneak into the forest at unauthorized times or harvest unauthorized amounts of forest products even though management institutions are in place (Varughese, 1999). Therefore it is hypothesized that distance to the forest is negatively associated with forest dependency.

Household position in decision-making level or time spent in leadership activities of community forestry could also affect the extent of forest use and thus economic benefit from the commons. Awareness of the potential gains achievable from CFs may be enhanced by regular meetings and discussions through which relevant information is conveyed or even generated (Gaspert *et al*., 1999). This information may not circulate well in a village to economically and politically weaker members due to the presence of either physical or psychological barriers. Users with membership in executive committees are better informed about the potential benefits of collective action. As a result, they may have opportunities to derive comparatively higher benefits from commons. Therefore, economic benefit from CPR is assumed to be positively associated with an individual's leadership status in decision-making levels. In this study, transaction cost days spent in community forestry activities is used as a proxy for leadership status.

In a subsistence system, the number of trees on the private land may also contribute to household needs of forest products. Hence, households owning more private trees may rely less on community forests. Therefore, the number of trees on private land is expected to have a negative impact on CPR income.

Better technology may also enhance the efficiency of harvesting forest products. For example, Velded (2000) posits that households employing better technology, knowledge and skills also benefit more from the common grazing land in the Fulani village of Mali. Following this argument, this study also assumes a positive relationship between better technology and CPR income.

In order to capture whether forest types influence household level income from CFs, two additional dummy variables, i.e., pine forest and broad-leaved forests, were included in the model. Villagers generally perceive coniferous forests to be less useful since they do not provide much fodder. There is low ground flora diversity in pine forest and they are not suitable for ground grass collection. Moreover, pine needles are a very inferior source of manure. In contrast, broad-leaved forest is much preferred since it provides both fire wood, fodder and leaf litter. In case of forest type variable, mixed forests with broad leaved and coniferous species (dominated species were *Pinus roxburghii*, *Schima wallichii, Castanopsis indica* and other broad-leaved species) was considered a reference forest type. Household income from CF is expected to be positively and negatively related to broad-leaved and pine forests, respectively.

Access to markets may reduce the dependency of households on the local commons since community members may have some exit options in terms of outside earning opportunities. In contrast, villages far from the market are more likely to be dependent on CPRs due to lack of alternate livelihood opportunity. For the village nearer to market, the sign of coefficients for forest income is expected to be negative while it is positive for the villages far from the market.

5. Results and discussion

In this section, the use of forest products and rules governing their use will be first discussed. This is followed by summary statistics for the surveyed households. Forest income and the distribution of income is then presented. Socio-economic heterogeneity and its implications for forest use are in the last section

5.1 Forest use under forest user groups

Each FUG has its own institutional arrangement with regard to appropriation and provision rules, detection and graduated sanctions, collective-choice arrangements, conflict-resolution mechanisms and monitoring systems. The assembly, which is the highest authority of FUG, makes decisions with regard to rules for governing forest use and management. The assembly prepares the constitution of the FUG and forest operational plans, defines user rights, and determines rules for forest product collection and distribution. In addition, it decides the use of community funds and implementation of various community development activities. The executive committee of the FUG implements decisions on behalf of the user's assembly. All FUGs have written norms about penalties, fines and graduated sanctions for those who violate the rules and regulations of CF. However, in some cases written documents or minutes regarding rules cannot be identified since some rules are embedded in local culture and practice. Since the operational rules of CF vary from one to another and it is difficult to document them all. In the following discussion, I present some of the general rules, based on field observation, that are common to most FUGs considered in this study.

Most FUGs employ a forest watcher or use a rotational watching system in which every household is responsible for providing an adult man to watch the forest on a specified day of the month. In some cases, a household contributes in cash or kind to the FUG if they cannot provide an adult member for

this purpose. There are strict rules that guide and shape individual behaviour in harvesting fuel-wood and other products from CF. Conflicts related to illicit collection of forest products and cutting of trees is resolved through cautioning the offender if it is a first-time offence. If the same offence is committed a second time, the cutting and felling tools are confiscated. If the offender commits the same action a third time, the FUG takes stern actions such as cash fines and some sort of social exclusion. User households are not allowed to collect firewood throughout the year. In most of the study sites, *Kacho Daura* (green cut wood) is distributed once or twice a year from February to April after the major thinning and pruning operation. This is a feasible time to undertake various forestry operations (i.e., bush cutting, thinning, and pruning) and cutting of firewood, since it corresponds to reduced agricultural activities. This period is also good for drying green firewood given that it is the hottest period of the year. During this time, user households participate in various forms of forestry activities. Unwanted trees and shrubs are cut, chopped into burnable sizes and distributed to local users in accordance with the decisions of the Products Distribution Committee (office bearers of FUG committee). In some FUGs, *Sukay Daura* (dead branches & fallen twigs) and *Jhikra* (plant residue) are collected throughout the year. *Jhikra* is used to support climbing vegetables and to make fences each year. Since *Jhikra* comes mostly from bushes, its use is not restricted. However, user households are not allowed to chop standing trees (green and dry) and gather firewood from CF as and when they wish. Green firewood harvesting is a collective activity and households are required to pay a small fee to the FUG for the green firewood allocated to them by the FUG.

Ground grass or grass fodder (*ghans*) refers to all non-woody herbaceous plants cut for animal feeding. It includes members of the grass and sedge families, a variety of legumes, and other broad leaf plants (Fox, 1983). Tree fodder (*Syaula*) comes from a wide variety of trees found on community forests. *Syaula* collection in CF occurs primarily at the end of the dry season, mainly from April to June. During this period, crop residues from the preceding year have been exhausted and less grass fodder is available on private land or in the CF due to very low rainfall and relatively dry weather. Though everyone who is a legitimate user is allowed to collect tree and grass fodder from a CF, poorer households' requirements for fodder and grass is always minimal or zero compared to those of the less poor. Households that do not use grass and tree fodder are not allowed to harvest these products for commercial purposes.

Since most households are unable to buy chemical fertilisers to maintain soil fertility, collection of leaf litter (*Patkar*) from CF for animal bedding and mulching is a common practice. Households in the study area use a combination of dry leaf litter, non-palatable green vegetative material, crop residues and remains of uneaten fodder as animal bedding. The majority of bedding materials originate from CF, shrublands and grasslands. It is harvested by lopping and is gathered as litter. Many user groups allow a more or less unrestricted collection of dry *Patkar* (even while the use of firewood and NTFPs are rigidly controlled). Although the actual harvested quantities of *Patkar* may be low in some FUGs, they are important to the subsistence economy because they remain as a major source of compost fertiliser in order to maintain soil productivity. There are no limits on quantities and no fees to be paid for this product. The time to collect fallen and rotten products and grass from CF is not strictly regulated.

Timber (*Kath*) is supplied to build houses as per the request of households who need to construct a new house. The number of trees supplied for building a house varies from one to three depending upon the size of the house and the tree. Generally, the building of new houses in the village is a known event in the village and everyone co-operates in such work. There is a small fee that the household needs to pay to get *Kath* from CF. Sale of timber, poles and firewood from CF is strictly prohibited. In most FUGs, users are prohibited from cutting fruit trees and certain other special species. Livestock grazing is also

prohibited in CF, and they impose fines on those who transgress this rule. Access to CF with a major harvesting tool is not permitted unless the individual is authorised to do so by the FUG executive committee.

In summary, households directly use only fuel-wood and timber. All other biomass goes as input to complement other productive assets: paddy fields or livestock. This implies that a household's use of biomass is driven largely by agricultural land holding and cattle ownership. Villagers have varying degrees of access to and control over biomass resources. Most user rights are non-transferable. Cash income from CF is generally not distributed among the users. Further, as previously mentioned, users are not allowed to sell their private share of the produce in the market. Thus, there is a strong argument to be made that CF in Nepal is incentive-incompatible. Income from the sale of timber, NTFPs and other products is directly deposited in community funds and used for community development works. Among such development activities are construction of local school buildings and irrigation channels, walking-path maintenance in the village and other related works. Capturing the benefits generated from investments such as irrigation facilities is again a function of the socio-economic and private natural resource endowments of households. Poorer households were traditionally dependent on local forests for firewood and other NTFPs. However, with the formalization of property rights, the access of poorer households to forests has been reduced due to a restrictive management regime that discourages NTFP collection, charcoal making and other activities in which occupational households (i.e., blacksmith, local liquor makers, etc.) were involved in. During the field survey, some occupational households claimed that with the formalization of property rights, their traditional rights had been gradually curtailed. This curtailment was partially due to very restrictive and conservation-oriented management regimes and partly through restrictions on the harvest of certain products to which they previously had access.

5.2 Descriptive statistics

Descriptive statistics, presented in Table 2, provides evidence of socio-economic heterogeneity among households. One-way ANOVA suggests that the three income groups significantly differ in terms of land and livestock holdings and the number of trees on private land. Further, a large difference in income from different forest products (fuel- wood, grass and fodder and leaf litter) by these income groups is also evident. This provides a measure of inequality between income groups. In general, it can be said that the sample households belonging to the three income groups are fairly heterogeneous in terms of income and private asset holdings.

Table 2. Descriptive statistics

Variables	Minimum	Maximum	Mean	Std. Deviation
CASTEL	.00	1.00	.12	.33
CASTEH	.00	1.00	.38	.49
EDU	.00	10.20	3.84	2.38
AGE	22.00	84.00	43.73	12.88
GEND	.00	1.00	.92	.27
LANDHO	.00	85.00	12.87***	11.24
LIVESTO	.00	15.00	3.06***	1.98
DIST	.01	3.00	.72	.54
TRANSDAY	1.00	149.00	13.49	16.59
TCOST	.00	385.00	79.66	60.45
HSIZE	1.00	16.00	6.37	2.58
PVTREE	.00	1632.00	87.92***	142.42
FULABOUR	20.00	288.00	109.00	70.83
GRAFOLABOUR	.00	1620	517.80***	485.89
LEAFLABOUR	.00	3125.00	496.94***	577.89
PFOREST	.00	1.00	.19	.39
BFOREST	.00	1.00	.09	.29
INCOMPOOR	.00	1.00	.26	.44
INCOMRICH	.00	1.00	.30	.46
VILLAGE DUMMY 1	.00	1.00	.10	.30
VILLAGE DUMMY 2	.00	1.00	0.15	0.36
Total Annual Average Forest Income (in Nepalese rupees+)	1000.00	113280.00	16103.33*-**	17083.20
Annual Average Fuelwood Income (in Nepalese rupees)	800.00	13500	2068.80**	1878.47
Annual Average Grass & Tree Fodder Income (in Nepalese rupees)	.00	124320.00	10188.20*-**	15972.60
Annual Average Leaf Litter Income (in Nepalese rupees)	.00	51840	5752.53***	8427.96

*, ** and *** imply significance at 10 %, 5 % and 1 % probability levels (between income groups) respectively

+ 1 USD = 76.00 Nepalese Rupees

5.3 Cash income of household by activity

Table 3 highlights the importance of various income sources, including tree and forest products (from private land), to the economy of the sample households belonging to the eight different forest users groups. Agriculture, livestock and off-farm agricultural activities are the most important activities that contribute more than 60% of the total income of households followed by small business and cottage industries and wage labour. Forest products from private land actually contribute less in terms of direct cash generated by selling some timber and non-timber forest products. Of the eight forest user groups considered, the first four groups have a relatively higher level of income from livestock and agricultural activities. Markets for livestock products are well developed in these villages and the share of agriculture-related income is higher for those households. The relatively high-income shares from other sources in the first four villages reflects a high rate of employment since Kavre Palchowk district is near Kathmandu, the capital city. Households in the Kavre Palchowk district produce rice, maize, wheat, potatoes and different types of vegetables, which have a high market value in Kathmandu.

Table 3. Annual average cash income by activity (Nepalese rupees)

Forest User Groups	Foresta products	Agriculture	Livestock	Wage work	Business[b]	Other incomec	Total non-CF incom
Saradadevi	1485 (1.51)	15609 (15.87)	40027 (40)	8597 (8.74)	9440 (9.60)	23910 (24.31)	99068
Jayalachiti	270 (0.30)	11428 (12.88)	14598 (16.44)	4298 (4.84)	14623 (16.48)	43539 (49.06)	88756
Mahadevsthan	510 (0.61)	13342 (15.95)	36633 (43.80)	6039 (7.22)	4839 (5.79)	22284 (26.63)	83647
Thuli Ban	90 (0.07)	35523 (27.36)	34239 (26.37)	13676 (10.54)	8493 (6.54)	37800 (29.11)	128821
Gaurati	86 (0.19)	466 (1.03)	7169 (15.78)	13717 (30.20)	4759 (10.48)	19222 (42.32)	45419
Shree Chhap	0	1262 (3.39)	9514 (25.53)	1744 (4.68)	4429 (11.89)	20314 (54.52)	37263
Janghare	102 (0.20)	276 (0.53)	3611 (6.91)	10263 (19.63)	17361 (33.21)	20660 (39.52)	52273
Karki Tar	697 (0.76)	16439 (17.98)	30915 (33.81)	3021 (3.30)	8938 (9.77)	31441 (34.38)	91451
Average	338.67 (0.42)	12912.04 (16.04)	21435.92 (26.62)	7974.56 (9.90)	9559.23 (11.87)	28299.40 (35.15)	80519.82

a. Income deriving from selling forest products from private land (excluding subsistence use)

b. Includes business, small craft and cottage industries

c. Government/private services, remittance, and pension

* Percent income from each activity to total income in parenthesis

5.4 Contribution from community forests

Average gross value per household and per hectare of CF is illustrated in Table 4 along with an estimate of average gross margin per person per day from CF. There appear to be four distinct FUGs based on the gross value of products for each household. Shree Chhap and Karki Tar FUGs get considerably higher gross values per household than the remaining user groups. This implies that the households are more dependent on forests in these sites despite the low level of gross value per hectare of forest. A very low return for labour in Shree Chhap and Karki Tar FUG is observed despite a very high level of gross value per household. This can be explained by the fact that subsistence forestry activities are very attractive in these two sites where the opportunity cost of labour is relatively lower compared to other sites. FUG members had very few alternatives in spite of the low per hectare value of their forest. One way ANOVA suggests that the gross margin per person day is significantly different {$F(7,298) = 5.06$, $p < 0.001$} between the sites considered in this analysis. There is also noticeable variation in the values per hectare of forest. This is due to the forest type, which may influence forest productivity.

Table 4. Gross values from CF (in Nepalese rupees*)

FUG	Gross value/household/year	Gross value/hectare of forest	Gross margin /person/day
Saradadevi	5589	3810	125
Jayala Chiti	5828	9668	111
Mahadevsthan	13917	5971	106
Thuli Ban	9875	10607	100
Gaurati	16398	5355	98
Shree Chhap	33177	6300	93
Janghare	17418	6602	97
Karki Tar	29857	4674	94

* $F(7, 298) = 5.06$, $p = 0.000$

5.4.1. Gross and net income per household from CF

Table 5 presents the average gross and net income derived from community forests by households in different income categories. Table 5 shows that poorer households are getting lower gross value from CF. Income from CF increases gradually as one moves from the lowest to the highest income group. This may be due to the fact that poorer households have less land and livestock ownership and so cannot not use intermediate forest products like fodder, leaf litter and grasses. These findings are similar to that of Richards *et al*. (1999), which confirm that poorer households are currently benefiting less from CF mainly because they have less livestock and farmland, which provide the main demand for forest products as inputs.

Table 5. Annual average gross and net income per household from CF (Nepalese Rupees)

Income Group	N	Gross Income	Net Income
Poor	81	7,756	2,701
Middle	136	14,815	5,731
Rich	92	24,466	4,335

In order to see whether the gross margin values between the three income groups differ significantly, an ANOVA was carried out to compare the true means between the three groups. The null hypothesis for the one-way ANOVA was that all the underlying true means are identical ($m_1 = m_2 = m_3$) against the alternate hypothesis that there are differences between some of the true means (m_1 @ m_2 @ m_3). It appears that the gross value of household level income from CF is significantly different {F (2,306)= 24.165, p <0.001} between the three income groups.

The average net income per household from CF is presented on the last column of Table 5. Less poor households are still better off than poorer households from CF. It, however, appears that the net income from CPR is an increasing function of wealth only up to a certain level, and then it declines. Though gross income is significantly different between income groups, comparison of net income suggests that the three income groups are not statistically different {F (2,306)= 0.943 p = 0.391}.

5.4.2 Percentage contribution from CF to total household income

Table 6 presents the percentage of total household income from CF to total household income for the three different income groups. In contrast to claims made in the literature, this study shows that the percentage of total household income from CF is lower for poorer households compared to middle wealth and richer or less poor households. As Table 6 demonstrates, gross income from CF as a percentage of total income is lower for poorer households (14%) than those for middle-wealth (20%) or richer households (22%). However, if we look at net income, the percentage of net CF income relative to total household income of poorer households is slightly higher (5%) than that of richer households (4%). The results also suggest a possible inverted U shaped relationship between net CPR income and wealth. Since this phenomenon should be analysed using time series data, what is shown here is more suggestive than conclusive.

Table 6. Percentage of gross and net income from CPR to total household income

Income group	% Gross CPR Income	% Net CPR Income
Poor	14	5
Middle	20	8
Rich	22	4

5.4.3. Share of livestock-related products

Community forests contribute to households by providing either fuel-wood or livestock-related products such as tree fodder, cut grass and leaf litter. Table 7 shows the percentage of CF gross income from livestock-related products for each stakeholder group. In most cases, livestock-related products represented more than 60 percent of the gross value of production. The proportion of gross value from livestock-related products increases with wealth as richer households derive higher income from tree fodder, grass fodder, and leaf litter.

Table 7. Percentage of CF gross income from livestock related products

Income group	N	% CF Income
Poor	80	63
Middle	134	78
Rich	92	85

5.5 Determinants of income from CF

This section analyses the determinants of household-level income from CF. Theory and empirical evidence on the socio-economic factors influencing household-level income from community-based forest management have drawn little attention in social science literature. Moreover, there is limited prior knowledge on socio-economic determinants of forest dependency and the nature of their impacts (Gunatilake, 1998). Hence the scatter plot method was used to scrutinize independent variables. The covariance matrix of independent variables was examined to find whether there is multicollinearity among the independent variables. Land holding was found to be highly correlated to both livestock holdings and the number of tress in private lands. Though land holding was preferred to livestock ownership in estimating equation 2, this variable drastically reduced the significance and magnitude of income status variables (INCOMPOOR and INCOMRICH). So it was dropped in the regression analysis for all empirical equations. Examination of a scatter plot of residual against predicted values showed limited possibility for heteroscedasticity in the data (Gujarati, 1995; Field, 2000). The diagnostic analysis indicates that heteroskedasticity is not significant and the assumption of homoscedasticity has been met.

The results for determinants of household income from CF are given in Table 8. The R-square and adjusted R-square for the estimation is as high as 50% and 47% respectively. The F-statistics for overall goodness of fit of the model is 16.09, which is highly significant at $\mu = 0.000$. It is evident from the analysis that most of the important variables are significant with the expected sign. In particular, household level income from CF is significantly influenced by the number of livestock, the caste of the household, education, gender, technology of harvesting, income status, quality of forests and distance to nearest market and transaction cost days spent by households in various community forest-related activities.

Differences in benefits from CF are thus correlated with differences in productive assets. For instance, cattle ownership is positively and significantly related to household income from CF. More importantly, forest income for those households belonging to the higher income group, i.e., "INCOMRICH," is positive and significant. Conversely, there is a negative and significant relationship between income from CF and the variable "INCOMPOOR," which is a dummy variable for the lower income group. This indicates that resource usage from CF is directly proportional to private endowments since the poorer segments of the community are not benefiting as much as the less poor.

Table 8. Determinants of income from community forests

Variables	Coefficients	Std. error	t-ratio	p-value
CONSTANT	7.704	.821	9.384**	.000
CASTEL	-.392	.172	-2.281**	.023
CASTEH	.331	.112	2.949**	.003
EDU	-.541	.122	-4.434**	.000
AGE	-.185	.187	-.989	.324
GEND	.756	.177	4.280**	.000
LIVESTO	.292	.088	3.302**	.001
DIST	4.859E-02	.049	.991	.323
TRANSDAY	.247	.052	4.716**	.000
TCOST	.277	.065	4.244**	.000
HSIZE	1.213E-02	.135	.090	.928
PVTREE	-5.697E-02	.045	-1.254	.211
PFOREST	-.195	.135	-1.439	.151
BFOREST	.515	.177	2.911**	.004
INCOMPOOR	-.382	.144	-2.656**	.008
INCOMRICH	.442	.121	3.644**	.000
VILLAGE DUMMY 1	-.436	.177	-2.461**	.014
VILLAGE DUMMY 2	.187	.159	1.171	.243

R^2 = .50 Adjusted R^2 = .47

** and * indicates 5% and 10% significant levels

It appears that higher caste households benefit more from CF than lower caste households. This can be explained by the observation that poor and lower caste households, especially the landless who do not keep large livestock herds, do not benefit considerably from products such as tree and grass fodder and leaf litter. Most FUGs have also introduced controls limiting extraction of forest products and introduced payments for extraction rights to some of the products on which landless people were dependent. Moreover, lower caste households have very little influence in the decision-making process so they cannot influence forest management decisions in their favour.

Education is negatively and significantly related to forest income. Better-educated households may have better earning opportunities outside the village commons and forest extraction activities may be less attractive for those households. This finding is similar to that of Gunatilake (1998) who observes that education of the family members is negatively related to forest income in the tropical biosphere reserves in Sri Lanka. Higher educational levels may also be associated with greater opportunity costs for labour (Yanggen and Reardon, 2001). Regarding gender, it is noteworthy that those households headed by male members benefit more from CF than those with female heads. Women generally have very low levels of involvement in the entire decision-making process of FUG. Women's absence from FUG decision-making means that they have little contribution to development of distributional rules. Moreover, women may not travel as far as men to extract forest products due to the additional travel time involved, and other household responsibilities. This observation is also similar to that of Amacher *et al.* (1993), who observed that women are not the sole collectors of fuel wood from commons.

Technology of harvesting "TCOST" is positive and significantly related to household income indicating that those households who are employing better technology derive higher income. In his empirical study of Fulani village in Mali, Velded (2000) also observes that benefits from common grazing land are exclusively related to capital, technology, and skills of individuals. With regard to the 'transaction costs day' variable, households who spent more time on decision-making activities appear to obtain more forest product income. This maybe because households get correct information by engaging in the decision-making process about when and where to collect.

While the dummy variable for broad-leaved forest is positive and significant, pine forest *(Pinus roxburghii)* dummy is negatively associated with forest income. This indicates that forest types influence the amount of harvest and income level by their effect on productivity of labour used in collection and gathering. Pine trees suppress the ground flora vegetation and make the sites unfavourable for ground grass collection. Further, they are useless for fodder and pine needles are an inferior source of manure (as well as being less effective in preserving the water supply) (Somanathan *et al.*, 2002). The dummy variable for village 1, which is less than 1 KM from the nearest market, is negatively and significantly related to forest income. The availability of market near to the village may divert people from forest dependent activities due to alternate earning opportunities. Further, the dummy for village 2 is positively related to income from the forest. This indicates that people who are living far away from the market depends more on the local commons to sustain their livelihoods. Gunatilake (1998) show similar result in the Sinharaja forest of Sri Lanka.

In order to understand the relationships between income from each forest product and socio-economic variables, three more regression models i.e. regression for gross value of outputs from tree and grass fodder, leaf litter and fuel wood (equation 3a, 3b, and 3c) were estimated. The results are presented in Table 9. The overall significance of three models is reasonably good for this type of cross-sectional data (R^2 = .53, .36 and .26 respectively). As discussed earlier, most of the independent variables show the expected signs and are statistically significant. Therefore, the following section discusses only the results, which are different to those of the aggregated model presented earlier.

Villagers generally perceive coniferous forests to be less useful since they do not provide much fodder and even there are very few ground flora diversity in pine forest and not suitable for ground grass collection. Pine forest dummy is negatively and significantly associated with income from grass and tree fodder. During the fieldwork, many villagers reported that plantation of pine trees in CF brought various negative consequences such as reduction of ground vegetation, lack of fodder and ground grasses, and extinction of some medicinal plants. It is interesting to note that broadleaved forest is again positively and significantly related to forest income.

Village 1 dummy is negative and significant for tree and grass fodder and leaf litter regression. This implies that households who are living near to the local market rely less on community forests. However, this variable is positive and significant for fuel wood regression. This is just opposite what was observed before. Village 2 dummy is positive for all regression with being significant for fodder and fuel wood regression. It is apparent that households living far away from markets are more dependent in terms of income from community forests. Overall, the results show a direct relationship between household level income from CF and socio-economic variables such as ethnicity, gender, education, livestock holdings, transaction days spent in CF activities, and technology of harvesting.

Table 9. Determinants of income from CF by forest product

Variables	Grass & fodder	Leaf litter	Fuel wood
Constant	6.806*** (1.002)	6.721*** (1.245)	6.759*** (.791)
CASTEL	- .218 (.216)	- .775*** (.281)	-.410** (.167)
CASTEH	439*** (.123)	.184 (.169)	.166 (107)
EDU	-.585*** (.149)	-.574*** (.184)	-.572*** (.117)
AGE	-.227 (.230)	-.236 (.282)	-.190 (.179)
GEND	1.046** (.222)	.528* (.271)	.610*** (.172)
LIVESTO	.377*** (.113)	.233 (.145)	1.774E-02 (.085)
DIST	.5.288E-02 (.061)	2.665E-02 (.075)	6.965E-02 (.047)
TRANSDAY	.228*** (.065)	.236*** (.080)	.124** (.051)
TCOST	.233*** (.084)	.312*** (.103)	.130** (.064)
HSIZE	-8.897E-02 (.173)	-2.961E-02 (.211)	.196 (.130)
PVTREE	1.738E-02 (.057)	-3.099E-02 (.071)	-5.095E-02 (.044)
PFOREST	-.386** (.161)	-9.133E-02 (.200)	.112 (.131)
BFOREST	.990*** (.214)	.462* (.261)	.524*** (.168)
INCOMPOOR	-.304* (.176)	-.483** (.221)	-.258* (.140)
INCOMRICH	.298** (.146)	.660*** (.182)	.187 (.116)
VILLAGE DUMMY 1	-.598** (.246)	-.496* (.263)	.522*** (169)
VILLAGE DUMMY 2	1.190*** (.201)	.141 (.273)	.358** (.158)
R^2	0.53	0.36	0.26
F-statistics	16.364	11.31	5.38

*, ** and *** imply significance at 10 %, 5 % and 1 % significance levels respectively, standard error in parenthesis

6. Conclusions and policy implications

This paper seeks to understand the relationship between household socio-economic characteristics and income from CFs in order to investigate whether granting property rights of forests in Nepal to local communities has enhanced the access of poorer households to the local commons. Towards this end, this research compares income from CF that accrues to poor and non-poor households. The results clearly show differences in gross income derived by households in different income classes. Poorer households in forest dependent communities obtain much less value from community forests than middle income and rich households. The average 'poor' household obtains NRS 7,756 from CF annually, while the more 'rich' households obtain in average NRS 24,466 per year from the community forests. Thus, in terms of absolute contribution to the total household income, community forests contribute more to less poor households compared to the poor.

The greater absolute dependence of richer households relative to the poor appears to be a function of the way FUGs have been institutionalized. FUG devised rules appear to be biased toward meeting the needs of wealthier households. For example, households that benefit more from CFs are members with large land holdings and herds of livestock who have the capacity to use intermediate forest products such as leaf litter, fodder and grass products. In our study we find that on average 85% of CPR related income accruing to rich households is from collecting of livestock related forest products. In contrast, approximately 63% of CPR income accruing to poor households is related to livestock. Fodder and grass are the products that become available right from the beginning when forests are enclosed for regeneration purpose. These intermediate goods are allowed to be extracted without restrictions. These intermediate goods are clearly not very important for landless and other poor households who do not have productive assets that can use biomass based resources as inputs (see Richards *et al*., 1999 for similar findings).

In terms of relative dependence, i.e., in terms of the percentage contribution of forests to household income, the study results are quite contrary to the previous findings. If gross CPR income as a percentage of household income is considered, the results suggest that wealthier households are more dependent on CPRs than poorer households. This finding is different from other studies such as Gunatilake *et al*. (1993), Cavendish (1998, 1999), who find that in relative terms the poor are the most dependent on forests resources. Again, this relationship between CPR income and household income is likely to be because of easier access to intermediate forest products, which benefits wealthier households.

Another interesting result from this study is the distributional significance of comparing net and gross income from CF. A straightforward comparison of gross income shows that the richest class of households gain the most from CF, the middle-income classes gain less than the rich and the poorest households gain the least. However, when net income from CF across these income categories is compared, then an interesting inverted U shaped relationship emerges. In terms of net income (taking all costs into consideration), the poor, on average, obtain 5% of total household income from CPRs, middle-income households obtain 8% of total income from forests, and, the most well off households obtain 4% of their total income from forests. It seems that the relative dependence on forest resources declines as income increases. This study, however, uses cross sectional data and categorical data on income. Therefore, strong conclusion on this aspect is not warranted.

Overall, the study findings seem to suggest that because of the dependence on intermediate products, household with assets gain more from CF than the poorest households in villages. However, once all

costs associated with forest product collection and use are taken into account, the results are ambiguous in terms of the contribution of CF resources to different stake-holder groups. Since this study could not compare pre and post impact of CFs on household income, further comparative study on this issue may help understanding the complexity involved in poverty, inequality and distributive consequences of regulated forms of CPR regime.

The econometric analyses undertaken in this paper reinforces the notion that households with land and livestock assets gain the most from CFs. Analysis of the determinants of household level income through regression analysis indicates a strong relationship between private endowments of households and dependency on CFs. In other words, heterogeneity does matter — household wealth, education, caste and gender exert considerable influence on household collection of forest products. It is also clear that male-headed households derive higher income from commonly managed forests than female-headed households. This is in contrast with the traditional view that producing environmental goods from forests is mainly a female activity. This may be linked to the involvement of women in the FUGs as office bearers. Analysis of the nature of representation in executive committee of FUG reveals that only 15.7 per cent female were represented in FUG committee and the rest are all men usually from the upper caste. Even if they are represented in the committee, women and members of disadvantaged groups have less bargaining power at the community meetings and assemblies (Thapa *et al*., 1998). The household survey revealed that about 40% of women are not aware of and familiar with forest operational plans, or with rules and regulations, policy, goal and processes of CF. If women are not a part of decision-making process they are likely to benefit less.

On the other hand, education and caste are negatively related to forest income. More educated households may have better earning opportunity outside the commons so that forestry activities seems to be less attractive for those households owing to high opportunity costs of their time. Thus, availability of Government and private sector jobs and self-employment opportunities may well divert people from forest dependent extractive activities. The forest type also determines household income, as broadleaved forests are more productive than pine forests. Since plantation of pine trees do not serve requirements of villagers, tree planting on commons should be understood in light of local systems of livelihood and importance of tree species in meeting diverse needs of villagers. Thus, FUGs should devise output sharing rules that address the special needs of the marginalised and occupational households in the community who have relatively a high level of dependence on CPRs. Access to markets seems to provide people with alternative livelihood opportunities and thus reduce dependence of households on CPRs.

This study raises the issue of whether conservation-oriented measures that promote regulated systems of forest management in Nepal under-mine social goals such as equitable distribution of benefits. It is reasonable to require that policies aimed at allocating natural resources should not eschew equity considerations altogether (Tsur and Dinar, 1995). Some scholars such as Majone (1993) argue that policy changes in CF management should not be precipitated by ideas about conservation and efficiency, rather, they need to be fully cognizant of redistributive concerns. CF interventions, to some extent, are unable to recognize that resources often have multiple users, who are characterized by different use patterns and divergent interests. Thus, there is a risk that CF will focus on long-term accumulation of timber and ecological service values in order to meet the need of rural elites, whereas this might reduce opportunities available for the poor.

One feasible option would be to include leasehold and private property rights provisions within CF management regimes. There may be possibilities for an equitable and efficient system of transferability of property rights. The existing system of CF management does not allow a user group member to sell her/his use rights or rights to a particular forest product to outsiders or other members within the same community. If property rights cannot be transferred, households poorly endowed with lands and livestock benefit less from commons. Voluntary exchange of rights within overall restrictions on resource-use may increase benefits to poorer households. (Posoner, 1977 as quoted in Bromley, 1989 and Baland and Platteau, 1996). Thus, private property options within a common property arrangement may be one way to move toward more equitable distribution of benefits among heterogeneous social groups.

This study suggests that household and community characteristics and respective management regimes need to be carefully considered when handing over the forests from government ownership to community management. Since poor people do not get substantial benefits from agricultural related forest products, forest management policy needs to be directed at increasing alternative forest products, mainly NTFPs that played a significant role in supplying livelihood needs in the past. In order to ensure that the interests of poorer households are fairly represented in an operational regime, it may be necessary to require that the number of poorer and occupational households as well as women on the FUG *committee* should at least be proportional to their numbers in the community. Equally important is supporting and empowering FUGs in various aspects of CF management that especially focus on poorer forest-dependent households so that their interests are adequately represented in forest planning and management decisions.

Finally one of the limitations of this study is that it could not compare pre- and post impact of community forests on household income. It was difficult to get historical data (especially on labour time allocated to gathering and collection) when forests were under the government control. Time series information would contribute to a richer analyses of distributional issues.

Acknowledgements

This paper has highly benefited from three research workshops on property rights structures and environmental resource management organized by Beijer International Institute of Ecological Economics in Egypt, South Africa and Italy. Comments on earlier version of this paper from participants of SANDEE research and training workshop in Nepal, India, Thailand and Bangladesh are also highly acknowledged. Thanks are due to Jon Lovett, Priya Shyamsunder, Sushenjit Bandyopadhyay, Herath Gunatilake, Doriana Delfino, Kenneth Arrow, Charles Perrings, Randy Bluffstone, Jean-Phillippe Platteau, Partha Dasgupta, Karl-Goran Maler, Rabindra Nath Chakraborty, E Somathanan, and Rimjhim Aggarawal for their comments and suggestions to improve this manuscript. An earlier version of this paper was presented at the second world congress of environmental and resource economists, June 24-27, 2002 California, USA. The final version of this paper was prepared while the author was visiting fellow at the Abdus Salam International Center for Theoretical Physics (UNESCO/ICTP), Trieste, Italy. The research received generous financial support from the South Asian Network for Development and Environmental Economics. The usual disclaimers apply.

REFERENCES

Adger, W.N. and C. Luttrell (2000), 'Property rights and the utilization of wetlands', special issue on the values of wetlands: landscape and institutional perspectives, *Ecological Economics* 35: 75-89.

Adhikari, B. (1996), 'Common property resource management by user groups: an experience from the Middle Hill of Nepal', In Proceedings of International Symposium on Geology and Environment, 31 January-2 February 1996, Chinag Mai University, Thailand.

Adhikari, B. (2001), 'Socio-economic heterogeneity and income distribution: evidence from common property resource management', *Journal of Forestry and Livelihoods* 1: 22-24.

Adhikari, B. (2002a), 'Household characteristics and common property forest use: complementarities and contradictions', *Journal of Forestry and Livelihoods* 2:3-14.

Adhikari, B. (2002b), 'Transaction costs and common property resource management: empirical evidence from Nepal', Working Paper of South Asian Network for Development and Environmental Economics (SANDEE), Kathmandu, Nepal.

Amacher, G., W. Hyde and B. Joshee (1993), 'Joint production and consumption in traditional households: fuelwood and crop residues in two districts in Nepal', *Journal of Development Studies* 30: 206-225.

Baland, J. and J.P. Platteau (1996), *Halting Degradation of Natural Resources: Is there a Role for Rural Communities?* FAO, Oxford University Press.

Baland, J. and J. Platteau (1997), 'Wealth inequality and efficiency in the commons Part I: the unregulated case', *Oxford Economics Paper* 49: 451-482.

Bardhan, P. (1993), 'Symposium on management of local commons', *Journal of Economic Perspectives*

Bardhan, P. and J. Dayton-Johnson (2000), 'Heterogeneity and commons management', Department of Economics, University of California, Berkeley, USA.

Beck, T. (1994), *The Experience of Poverty: Fighting for Respect and Resources in Village India*, London

Beck, T. (1998), 'Excluding the poor from their rights: the case of natural resources in West Bengal', Paper Presented at the International Association for the Study of Common Property, Vancouver.

Beck, T. and M. Ghosh (2000), 'Common property resources and the poor: findings from West Bengal', *Economic and Political Weekly* 35: 147-153.

Beck, T. and C. Nesmith (2001), 'Building on poor people's capacities: the case of common property resources in India and West Africa', *World Development* 29: 119-133.

Bernard, H.R., P. Killworth, D. Kronenfeld and L. Sailer (1984), 'The problem of informant accuracy: the validity of retrospective data', *Annual Review of Anthropology* 13: 495-517.

Beteille, A. (1983), *Equality and Inequality: Theory and Practice*, Delhi: Oxford University Press.

Bokil, S.M. (1996), 'Privatisation of commons for the poor, emergence of new agrarian issues', *Economic*

and Political Weekly 31: 2254-2261.

Branney, P, G.C. King and Y.B. Malla (1994), 'Mid-term review of Nepal's hill community forestry project', World Bank, Washington, DC. USA.

Bromley, D.W. (1991), *Environment & Economy: Property Rights and Public Policy*, Oxford: Basil Blackwell.

Bromley, D.W. (1989), *Economic Interest and Institutions: The Conceptual Foundation of Public Policy*, Oxford: Blackwell.

Bromley, D.W. and D.P. Chapagain (1984), 'The village against the centre: resource depletion in South Asia', *American Journal of Agricultural Economics* 66: 868-873.

Campbell, B., A. Mandando, N. Nemarundwe, W. Jong, M. Luckret, and F. Matose (2001), 'Challenges to proponents of common property resource systems: despairing voices from the social forests of Zimbabwe', *World Development* 29: 589-600.

Cavendish, W. (1998), 'The complexities of the commons: environmental resource demands in rural Zimbabwe', Centre for the Study of African Economies, Oxford University.

Cavendish, W. (1999), 'Poverty, inequality and environmental resource demands in rural Zimbabwe', T H Huxley School, Imperial College of Sciences, London.

Chopra, K., G. Kadekodi and M. Murthy (1990), 'Participatory development: people and common property resources', Studies on Economic Development and Planning, No. 52, Delhi, India: Institute of Economic Growth and Sage Publications.

Cooke, P.A. (2000), 'Changes in intrahousehold labour allocation to environmental goods collection: a case study from rural Nepal, 1982 and 1997', FCND Discussion Paper No. 8, International Food Policy Research Institute, USA.

Dasgupta, P. (1993), *An Inquiry into Well-Being and Destitution*, Oxford: Clarendon Press.

Dayton-Johnson, J. (2000), 'Determinants of collective action on the local commons: a model with evidence from Mexico', *Journal of Development Economics* 62: 181-208.

Di Falco, S. and C. Perrings (2003), 'Crop genetic diversity, productivity and stability of agroecosystems: a theoretical and empirical investigation', *Scottish Journal of Political economy* 5 (2): May 2003

Dobremez, J.F. (1976), *Le Nepal, Ecologie et Biogeographie*, Paris: CNRS.

Eder, J.F. (1987), 'Tribal Filipinos, ancestral lands & cultural survival: or "negrito case" ', *Pilipinas* 9: 1-9.

Field, A. (2000), *Discovering Statistics Using SPSS for Windows*, London: Sage Publications.

Fisher, R.J. (1990), 'The Himalayan dilemma: finding the human face', *Pacific Viewpoint* 31: 281-286.

Folbre, N. (1994), *Who Pays for the Kids: Gender and the Structures of Constraint*, New York: Routledge.

Fox, J.M (1983), 'Managing public lands in a subsistence economy: the perspective from a Nepali village',

Unpublished Ph.D. Dissertation, University of Wisconsin-Madison.

Gaspert, F., M. Jabbar, C. Melard and J.P. Platteau (1999), 'Participation in the construction of a local public good with indivisibilities: an application to watershed development in Ethiopia', CRED, University of Namur, Belgium, mimeo.

Godoy, R., R. Lubowski, and A. Markandya (1993), 'A method for the economic valuation of non-timber tropical forest products', *Economic Botany* 47: 220-233.

Godoy, R, M. Jacobson, J. de Castro, V. Aliaga, J. Romreo and A. Davis (1998), 'The role of tenure security and private time preference in Neotropical deforestation', *Land Economics* 74: 162-170.

Graner, E. (1997), *The Political Ecology of Community Forestry in Nepal*, Saarbrucken: Verlag fur Entwickungspolitik.

Grossman, L (1996), 'The cultural ecology of economic development', *Annals of the Association of American Geographers* 71: 220-236.

Guggenheim, S. and J. Spears (1991), 'Sociological and environmental dimension of social forestry projects', in M.M. Carnea ed., *Putting People First: Sociological Variables in Rural Development*, New York: Oxford University Press: 305-309.

Gujarati, D. (1995), *Basic Econometrics*, Singapore: Mcgraw-Hill International Editions.

Gunatilake, H.M. (1998), 'The role of rural development in protecting tropical rainforests: evidence from Sri Lanka', *Journal of Environmental Management* 53: 273-292.

Gunatilake, H.M, D.A.M.H. Senaratne, and P. Abeygunawardena (1993), 'Role of non-timber forest products in the economy of peripheral villages of Knuckles national wilderness area of Sri Lanka: a farming systems approach', *Economic Botany* 47: 275-281.

Hanna, S. and M. Munasinghe (1995), 'An introduction to property rights in a social and ecological context', in S. Hanna and M. Munasinghe, eds., *Property Rights and the Environment: Social and Ecological Issues*, The Beijer International Institute of Ecological Economics and The World Bank, 3-11.

Hetch, S.B., A.B. Anderson, and P. May (1988), 'Subsidy from nature: shifting cultivation, success ional palm forests, and rural development', *Human Organization* 47: 25-35.

Hill, I. and D. Shields (1998), 'Incentives for joint forest management in India: analytical methods and case Studies', World Bank Technical Paper 394, World Bank, N.W., Washington, DC, USA.

HMGN/CPFD Database (2001), Department of Forest, Kathmandu, Nepal.

HMGN/MPFS (1988), 'Master plan for forestry sector in Nepal', Main Document, Ministry of Forest and Soil Conservation, Baber Mahal, Kathmandu, Nepal.

Holden, S., B. Shiferaw and M. Wik (1998), 'Poverty, market imperfections and time preferences: of relevance for environmental policy? *Environment and Development Economics* 3: 105-130.

Ives, J.D. and B. Messerli (1989), *The Himalayan Dilemma-Reconciling Development and Conservation*, London and New York: The United Nations University and Routledge.

Iyenger, S. (1989), 'Common property resources in Gujrat: some findings about their size, status and use', *Economic and Political Weekly*: A67-A77.

Iyenger, S. and N. Shukla (1999), 'Common property land resources in India: some issues in regeneration and management', Gujarat Institute of Development Research, Ahmedabad, India.

Jackson, J.K. (1994), *Manual of Afforestation in Nepal*, Vol. 1, Kathmandu: Forest Research and Survey Centre, 2nd Edition.

Jodha, N.S. (1985), 'Population growth and the decline of common property resources in Rajasthan', *Population and Development Review*, 11: 247-264.

Jodha, N.S. (1986), 'Common property resources and the rural poor in dry regions of India', *Economic and Political Weekly* 21: 169-181.

Jodha, N.S. (1990), 'Rural common property resources-contribution & crisis', *Economic & Political Weekly*

Jodha, N.S. (1995), 'Studying common property resources, biography of a research project', *Economic and Political Weekly* 30: 556-559.

Kant, S. (2000), 'A dynamic approach to forest regimes in developing economies', *Ecological Economics* 32: 287-300.

Karaivanov, A. (2001), 'Heterogeneity, returns to scale and collective action', Department of Economics, University of Chicago.

Keohane, R.O. and E. Ostrom (1995), *Local Commons and Global Interdependence, Heterogeneity and Cooperation in Two Domains*. London: Sage Publications.

Kohlin, G.& P.J.Parks (2001) 'Spatial variability & disincentives to harvest', *Land Economics*77: 206-218.

Kumar, S. (2002), 'Does "participation" in common resource management help the poor? a social cost-benefit analysis of joint forest management in Jharkhand, India', *World Development* 30: 763-782.

Majone, G. (1993), 'When does policy deliberation really matter?', EUI Working Paper SPS No 93/ 12.European University, Florence.

Malla, Y.B. (2000), 'Impact of community forestry policy on rural livelihood and food security in Nepal', *Unasylva* 51: 37-45.

McKean, M. (1992), 'Management of traditional common lands (Iriachi), in Japan', in National Research Council, Proceedings of the Conference on Common Property Resource Management (Washington DC: National Academic Press): 533-89.

Molians, J.R. (1998), 'The impact of inequality, gender, external assistance and social capital on local-level collective action', *World Development* 26 (3): 413-431.

Olson, M. (1965), *The Logic of Collective Action: Public Goods and the Theory of Groups*, Cambridge: Harvard University Press.

Pasa, S. (1992), 'CPRs and rural poor: a micro level analysis', *Economic and Political Weekly* XXVIII (46): 2499-2503.

Richards, M., K. Kanel, M. Maharjan and J. Davies (1999), 'Towards participatory economic analysis by forest user groups in Nepal', ODI, Portland House, Stag Place, London, UK.

Saxena, N.C. (1989), *Degraded Lands in India, Problems and Prospects*, Bangkok: FAO.

Schlager, E. and E. Ostrom (1992), 'Property-rights regimes and natural resources: a conceptual analysis', *Land Economics* 68: 249-262.

Singh, K., N. Singh, and R. Singh (1996), 'Utilization and development of common property resources – a field study in Punjab', *Indian Journal of Agricultural Economics* 51: 249-259.

Somanathan, E., R. Prabhakar, and B.S. Mehta (2002), 'Collective action for forest conservation: does heterogeneity matter?', Indian Statistical Institute, New Delhi, India.

Springate-Baginski, O., J.G. Soussan, O.P. Dev, N.P. Yadav and E. Kiff (2000), 'Community forestry in Nepal: impacts on common property resource management', School of Environment and Development, Series No. 3, University of Leeds, UK.

Thapa, S., R.N. Shrestha and K.P Yadav (1998), 'Socio-economic aspects of forest resource assessment study', Nepal-UK Community Forestry Project Report B/NUKCFP/55, Kathmandu, Nepal.

Tsur, Y. and A. Dinar (1995), 'Efficiency and equity considerations in pricing and allocating irrigation water', Policy Research Working Paper 1460, Washington, DC, World Bank.

Varughese, J. (1999), 'Villagers, bureaucrats, and forests in Nepal: designing governance for complex resource', unpublished PhD dissertation, Indiana University, USA.

Varughese, G. and E. Ostrom (2001), 'The contested role of heterogeneity in collective action: some evidence from community forestry in Nepal', *World Development* 29: 747-765.

Velded, T. (2000), 'Village politics: heterogeneity, leadership and collective action', *Journal of Development Studies* 36: 105-134.

Wade, R. (1994), *Village Republics: Economic Conditions for Collective Action in South India*. Cambridge University Press.

Wollenberg, E. and A.N. Nawir (1999), 'Estimating the incomes of people who depend on forests', in E. Wollenberg and A. Ingles eds., *Incomes from the Forest: Methods for the Development and Conservation of Forest Products for Local Communities*, Indonesia: Center for International Forestry Research (CIFOR): 157-187.

Yanggen, D. and T. Reardon (2001), 'Kudzu-improved fallows in the Peruvian Amazon', in A. Angelsen and D. Kaimowitz eds., *Agricultural Technologies and Tropical Deforestation*, CABI Publishing in Association with Centre for International Forestry Research (CIFOR): 213-229.

APPENDIX A

Questionnaire for the Household Survey

Researcher: Bhim Adhikari
Date of Interview:
Household Head Name:

Interviewer:
Village/Ward
Age…… Caste…….

A. Demographic Information

Q. 1a. Please read out and fill the following household information

S. No	HH Members	Age (year)	Sex (M/F)	Education (number of school years)	Occupation (code)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Occupation:
Agriculture = 1 Business = 2 Public Service = 3 Private Service = 4
Cottage Industry = 5 Agriculture + Business = 6 Agriculture + Service = 7
Wage Labour = 8 Other = 10 (Please Specify…)

Q. 2a. Has any members of your family has been out of home for more than three months?
( ) Yes: Go to Q. 3a ( ) No: Go to Q. 1b

Q. 3a Where and on what occupation they are working?

S.NO	HH member	Age	Sex (M/F)	Occupation	Place of Work
1					
2					
3					
4					
5					

B. Land Holding, Tenure and Production Systems

Q 1b. Please read out and fill the following landholding and tenure information

Land Characteristics	**Land Type and Area (Ropani)**		
	Own land	Shared crop in	Shared crop out
Irrigated Land			
Unirrigated Land			
Private land			
Others			

Q. 2b Which of the following assets does your household own?

S. No.	**Asset**	**Access**		
		Own	Hire	Borrow
1	Building/houses			
2	Agriculture tools			
3	Plough			
4	TV/radio			
5				
6				
7				

Q. 3b. What are the major crops you have produced in the past year and annual income from selling agriculture products?

S.N.	**Unit**	**Total Production**	**Unit Sold**	**Unit Price (Rs.)**	**Total Income (Rs)**
Rice					
Maize					
Millet					
Wheat Legumes					
Mustard					
Barley					
Fruits					
Potatoes Vegatables					
Others					

Q. 3b Which of the following livestock does your household own (now and before implementing the community forestry program)?

S. No.	Livestock species	Number of livestock	
		Before CF	Now
1	Cattle		
2	Buffalo		
3	Goat		
4	Sheep		
5	Pig		
6	Rabbits		
7	Chicken		
8	Others		

Q. 4b What are the benefits of livestock?

S.No	Benefits	Please tick
1	Draught power	
2	Source of cash income	
3	Milk	
4	Meat	
5	Wool	
6	Others (please specify)	

Q. 5b. Please mention the annual income from sale of following livestock products?

Product	Unit	Total Production	Unit Sold	Unit Price (Rs.)	Total income (Rs.
Milk					
Meat					
Egg					
Wool					
Others					

Q 6b. What was the income from the sale of live animals last year?

Livestock	Unit	Unit sold	Unit Price (Rs.)	Total income (Rs)
Cattle				
Buffalo				
Goat/sheep				
Pig				
Chicken				
Others				

Q. 7b How long the field crop production can meet your household food demand?
( ) < 3 months ( ) 3 to 6 months ( ) 6 to 9 months ( ) 9 to 12 months ( ) > than 12 months

Q. 8b What are the number of fodder/fuel wood trees in your private land now and before implementing the community forestry program?

S. No	Species	Before CF	Now
1			
2			
3			
4			
5			
6			
7			
8			

C. Off-farm Production System

Q 1c. Besides crop and livestock income, what are other sources of household income?

Sources	No. HH member involved		Annual Income (Rs.)	
	Men	Women	Men	Women
Business				
Service				
Cottage industry				
Wage labour				
Remittance				
Pension				
Others				

Q. 2c Does your family members involved in marketing of following products from private forest?

Products	Unit	Sale Quantity/year	No. HH members involved		Annual Income (Rs.)	
			Men	Women	Men	Women
Fodder						
Fuel wood						
Herbs/medicine						
Fruits/Nuts						
Thatch grass						
Other products						

D. Natural Resource Management and Utilization

Q. 1d What is your annual consumption of following forest products now and before the implementation of community forestry?

S. No	Products	Unit	Annual Consumption	
			Before CF	Now
1	Fuel wood			
2	Tree fodder			
3	Timber			
4	Leaf litter			
5	Grasses			
6	Thatching grass			
7	Fruits/Nuts			
8	Herbal medicine			
9	Others			

Q. 2d What are the quantities of forest products available for your household annually from community forest and what amount from your own private forest?

Product	Unit	Before CF	Now*			Private Forest
			CF1	CF2	CF3	
Firewood						
Tree fodder						
Timber						
Leaf litter						
Thatching grass						
Fruits/nuts						
Herbal medicine						
Grasses						
Others						

* CF1 = Community forestry 1, CF2 = Community forestry 2, CF3 = Community forestry 3 (In case, household deserve the membership of more than one forest user group)

Q. 3d Where and how many times do you take your livestock for grazing?

Grazing Area	Livestock Head	Season and Frequency				Grazing Time
		Summer	Winter	Monsoon	Spring	
Community Forest						
National Forest						
Grazing Area						
Private land						
Fallow Land						
Others						

Q. 4d How forest products are distributed?
( ) Family size/equity ( ) Equality

Q. 5d. Are you satisfied with existing distribution process?
( ) Yes ( ) No

E. Resource Harvesting/Utilization Costs

Q. 1e How much time do you spend in collecting a unit of following forest product?

S.N.	Forest Products	Unit	Collection Time			Remarks
			Men	Women	Children	
1	Firewood					
2	Tree fodder					
3	Timber					
4	Leaf litter					
5	Thatching grass					
6	Ground grasses					
7	Herbal medicine					
8	Fruits/nuts					
9	Others					

Q. 2e. How much time do you have to spend in travelling to and from your house in collecting following forest product?

S.N.	Forest products	Unit	Time	Responsible Person		
				Men	Women	Children
	Firewood					
	Tree fodder					
	Timber					
	Leaf litter					
	Thatching grass					
	Fruits					
	Herbal medicine					
	Grasses					
	Others					

Q. 3e How much do you have to pay (fees) for harvesting a unit of following commodities from the community forestry?

S.N.	Forest Products	Unit	Unit Price (Rs.)	Remarks
1	Firewood			
2	Tree fodder			
3	Timber			
4	Leaf litter			
5	Thatching grass			
6	Fruits			
7	Herbal medicine			
8	Grasses			
9	Others			

Q. 4e How much time you need to spend annually in following FUG obligatory activities?

S. N.	FUG Activities	Time Spent (Days)	Remarks
1	CF Protection (watching, monitoring etc.)		
2	Plantation		
3	Weeding		
4.	Thinning and pruning		
5.	Meetings		
6.	Communication		
7.	Travelling		

5e. Is there any direct cash incur to your household annually for communicating, information gathering and travelling for community forestry related activities? If yes, what is the tentative direct cash expenses (Rs.)

6e. What amount (User Group membership fee) you have to pay annually as a member of Forest User Group?

(Rs.) Pay ( ) Do not need to pay

7e. Do you hire any paid labour beside your family members in collecting or processing of those forest products from community forest? ( ) Number

8e. What is the hired labour rate per day? ( )

9e. What is the distance between your home and community forest? ( ) km

10e. How long do you have to travel to and from the community forest for animal grazing?

( ) Minutes ( ) Hours

Q. 11e Who in your family grazed? ( ) Men ( ) Women ( ) Children

Q. 12e What are the tools you owned that used in forestry operation and their costs and economic life?

S.No.	Type of Tools	Cost (Rs.)	Economic Life (Years)	% Use	
				Forestry	Non-Forestry
1	Axe				
2	Sickle				
3	Doko				
4	Namlo				
5	Rope				
6	Saw				
7	Khurpa				
8	Others				

F. Household Awareness/Participation/Policy issues in CPR Management

Q. 1f. When was the forest user group and executive committee formed? (BS 20……..)

Q. 2f. When was the community forestry handed over to the community (BS……)

Q. 3f. Do you participate in users annual/monthly assembly?

( ) Yes ( ) No

Q. 4f Are any women members from your household represented in users committee?

( ) yes ( ) No

Q. 5f How do you evaluate the performance of users committee?

( ) Highly satisfactory ( ) Satisfactory ( ) Neutral ( ) Not satisfied

Q. 6f. At what stage do you and your family members participate in organization activities?

( ) Planning and decision-making ( ) Implementation ( ) benefit sharing ( ) Evaluation

Q. 7f. How do you evaluate the rate of your and family members participation in FUG activities?

( ) Strong participation( ) Occasional participation ( ) Not very often ( ) Hardly ever

Q. 8f. How do you know when to collect various forest products?

( ) Attending committee meeting ( ) Informed by committee members
( ) Informed by neighbours ( ) FUG assembly

Q. 9f. What are the advantages and disadvantages of membership of the Forest Users Group?

S. No	Advantages of Membership	Disadvantages of Membership
1		
2		
3		
4		
5		

Q. 10f. What is your perception regarding equity issue in community forestry?

Equity Issues	Y/N	How?
Are you relatively satisfied with existing institutional arrangements?		
Have you even been disadvantaged by institutional arrangements?		
Is allocation of membership rights in organization fair?		
Has distribution of resources and wealth change?		
Are costs and benefits of resource management based on individual's ability to pay?		
Others (please specify)		

G. Natural Resource Quality and Management

Q. 1g According to your idea, what is changing trend of the following indicators in the last 10 years?

Indicators	Trend			Remarks
	Increasing	Constant	Decreasing	
Crop production				
Area under forest				
Area under pasture				
Tree species				
Number of water spring				
Time to collect fuel, fodder and leaf litter				
Tree on private land				
Flooding/landslides				
CF related employment opportunity				
Time to fetch water				

Q. 2g. In your opinion, what were the likely effects of institutional change i.e. from state management to community-based management in local livelihoods?

Impacts	Strongly Agree	Agree	Disagree	Strongly Disagree
Increase equal access to resource base				
Threat alternative livelihood				
Unnecessary restriction				
Excessive collection charge				
Help reduce poverty				
Able to meet the household demand				
Decrease access to CF				

H. Miscellaneous

Q. 1h Are you or your family members are associated/participated in any village level development organization? ( ) Yes ( ) No

Q. 2h If yes, please provide following information?

S. No	Name of Organization	Type*	Nature of work**	Number involved		Position held	Remarks
				Female	Male		
1							
2							
3							
4							

* Local informal = 1 Local formal = 2 Government= 3 NGO=4 INGO=5
** Saving and credit=1 Conservation=2 Agriculture/livestock production=3
Women's organization=4, Village cooperative=5 Others=6 (specify)

Q. 3h Do you need credit for your livelihood activities? ( ) Yes ( ) No

Q. 4h If yes, where do you go for credit?

( ) Bank ( ) Land lord ( ) Neighbour ( ) Relatives ( ) Co-operatives

( ) others (please specify)

Q 5h How does FUG investing the surplus fund for various community development activities?

S. No	Investment	Are you benefited from this investment		If no, give the reason
		Yes	No	
1	Drinking water			
2	Rural road			
3	Irrigation scheme			
4	Temple			
5	School			
6	Health post			
7	Community House			
8	Others			

Q. 6h. What is the trend in employment opportunities in the past 10 years in your area?

S.No	Nature of Employment	Increasing	Decreasing
1	Forest-based opportunities		
2	Agriculture-based opportunities		
3	Cottage industry based opportunities		
4	Government		
5	Non-government		
6	Private sector		
7	Others		

Q 7h. Do you have any suggestions regarding the improvement of existing situation especially equity aspects of community forestry? How community forestry will be more profitable and sustainable?

APPENDIX B

Questionnaire for FUG Executive Committee Members

Name of Community Forest: Number of User household:
Date of FUG Formation: Date of Handover:
Area:

1. What are the income generating (IG) activities in community forest?

S.N.	IG Activities	Area	Beneficiary Households

2. What are the income sources for Forest User Group?

S.N.	Income Source	Remarks

3. What commodities are being extracted for commercial purpose so far?

S.N.	Commodity	Unit	Quantity	Total income (Rs.)

Q 3i How does FUG investing the surplus fund for various community development activities?

S. No	Investment	No. of Beneficiary Households	Remarks
1	Drinking water		
2	Irrigation scheme		
3	School		
4	Temple		
5	Health post		
6	Rural Access Road (Foot Path)		
7	Community House		
8	Others		

4. When FUG members gather for meeting?

( ) Once a month ( ) Once a two months ( ) As and when required

5. When the meeting of executive committee held?

( ) Once a month ( ) Twice a month ( ) As and when required

6. What is the percentage of user household who attend last 4 meetings?

7. What is the parentage of user committee members who attended last 4 meetings?

8. How do you evaluate the institutional performance of Forest User Group? (1= Least satisfactory and 5= Highly satisfactory)

S.N.	Name of Committee members	Rating				
		1	2	3	4	5

9. Does income generating and other activities undertaken by your group has been emulated in neighbouring areas?

( ) Yes ( ) No

10. What is the composition of Forest User Group Executive Committee in terms of gender?

( ) Number of female ( ) Number of male

11. How user groups were formed?

( ) Initiative from Forest Department ( ) Community's own initiative

12. How decision of executive committee is made?

( ) Consensus ( ) Majority

13. What is your suggestion regarding institutional development and distribution system of community forestry program?

SANDEE Sponsors

BEIJER
The Beijer International Institute of Ecological Economics – The Royal Swedish Academy of Sciences

IUCN
The World Conservation Union

DFID Department for International Development

FORD FOUNDATION

MACARTHUR
The John D. and Catherine T. MacArthur Foundation

Sida
Swedish International Development Cooperation Agency

the abdus salam international centre for theoretical physics

WORLD BANK INSTITUTE
Promoting knowledge and learning for a better world

SANDEE

South Asian Network for Development and Environmental Economics

SANDEE
P.O. Box 8975 EPC – 1056
Kathmandu, Nepal

Tel: 977-1-552 8761
Fax: 977-1-553 6789
E-mail: info@sandeeonline.org
Website: www.sandeeonline.org