SANDEE

Working Paper, No 61 - 11

The Welfare Impacts of Leasehold Forestry in Nepal

Bishnu Prasad Sharma

ECONOMICS & THE ENVIRONMENT

Published by the South Asian Network for Development and Environmental Economics (SANDEE)
PO Box 8975, EPC 1056, Kathmandu, Nepal.
Tel: 977-1-5003222 Fax: 977-1-5003299

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:

Bishnu Prasad Sharma
The Welfare Impacts of Leasehold Forestry in Nepal

(SANDEE Working Papers, ISSN 1893-1891; WP 61–11)

ISBN: 978-9937-8521-0-4

Key words:
Leasehold Forestry
Biomass Collection
Economic Welfare
Institutional Rules

SANDEE Working Paper No. 61–11

The Welfare Impacts of Leasehold Forestry in Nepal

Bishnu Prasad Sharma
Patan Multiple Campus
Tribhuvan University
Nepal

June 2011

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

SANDEE Working Paper No. 61–11

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. Please see www.sandeeonline.org for further information about SANDEE.

SANDEE is financially supported by the International Development Research Center (IDRC), The Swedish International Development Cooperation Agency (SIDA), the World Bank and the Norwegian Agency for Development Cooperation (NORAD). The opinions expressed in this paper are the author's and do not necessarily represent those of SANDEE's donors.

The Working Paper series is based on research funded by SANDEE and supported with technical assistance from network members, SANDEE staff and advisors.

Advisor
E. Somanathan

Technical Editor
Pranab Mukhopadhyay

English Editor
Carmen Wickramagamage

Comments should be sent to
Bishnu Prasad Sharma
Patan Multiple Campus
Tribhuvan University
Nepal
Email: bisunita@wlink.com.np

Contents

List of Tables

List of Figures

Abstract

The study analyzes the role of the leasehold forestry (LHF) program in improving household welfare in Nepal. We estimate both the time saved in biomass collection and the addition to income through increases in biomass availability from LHF. The findings reveal that a household participating in the LHF programs saves 33 workdays in biomass extraction while the contribution to household income from biomass from LHF plots is approximately 5 percent of household income. The study concludes that the restructuring of the LHF regime could increase efficiency and improve welfare. A change in policy, re-allocating LHF plots now held on a group basis as individual household parcels, would provide greater economic incentives for those involved in the LHF Program. Moreover, providing participating households with LHF plots at a shorter distance from the homestead and compensating for very poor quality soil by providing other inputs would further improve welfare gains from the LHF program.

Keywords: Leasehold forest; Biomass collection; Economic welfare; Institutional rules.

The Welfare Impacts of Leasehold Forestry in Nepal

1. Introduction

This study examines the contribution of leasehold forestry (LHF), an innovative forestry management program, to household welfare in Nepal. It focuses on two main aspects of the welfare contribution of the LHF program: (i) the time-saving by households with regard to the collection of forest products and (ii) the availability of increased biomass and its determinants. An important policy question we address is whether degraded forest land, a resource available to a greater or lesser extent in all low-income countries, can be managed for purposes of both environmental and socio-economic improvement.

Forest incomes constitute a significant portion of the incomes of poor households in all developing countries (Jodha, 1986; Vedeld et al., 2007). However, whether the state can effectively manage forests for the benefit of targeted poor households remains a contentious issue. LHF is a new kind of property rights regime introduced in 1993 by the Government of Nepal with the twin objectives of regenerating degraded forest land and alleviating rural poverty. Presently, around 4000 LHF groups with 36,000 household members function in 26 out of the 75 districts in Nepal (MOF/GON, 2009). The Government of Nepal considers LHF a high priority and LHF, according to studies conducted in Nepal, has succeeded in improving the forest cover in previously degraded land (IFAD, 2003; NPC/UNDP/PRSP, 2005).

Under a LHF regime, the Government hands over state-owned, virtually open access, degraded forest lands to a group of identified poor households, generally less than ten in number, with each household receiving around one hectare of land in the form of a lease contract. The duration of the lease is 40 years, with provision to extend it to another 40 years. This lease enables the recipient household to exercise legally all rights exercised by a private landowner although actual ownership of the land vests with the state, a scenario in which the land is de jure state-owned but de-facto privately-owned. The state requires the LHF households to protect their forest lands against degradation from open grazing, forest fires, soil erosion, etc., either for the purpose of enhancing the natural regeneration of trees, shrubs and grass or to cultivate economically beneficial perennial plants on LHF lands. Open grazing on the LHF land is to be replaced by stall feeding of livestock while LHF rules ban the cultivation of cereals on leasehold land. The basic idea is to enhance forest regeneration while also making it possible for LHF land to meet basic livelihood needs. The program expects LHF households to enhance their income in a sustainable manner from both livestock, due to improved fodder availability, and timber and non-timber forest products.

LHF is considered innovative for a number of reasons. First of all, it utilizes degraded forest or wasteland that has low productivity but is available in significant amounts in Nepal. Approximately 11 percent of the total land area of Nepal is appropriate for conversion into LHF land and can be handed over to the resource-poor population at no cost to the government for the twin purposes of addressing poverty and regenerating forests.

However, prior experience and knowledge in this particular type of resource management is almost non-existent among policy makers. Similarly, the livelihood and welfare impacts of the LHF Program are also not very well understood. There is, thus, a need to analyze the economic and welfare impacts of this program on the participating households. The findings of this research will therefore be of use not only to Nepal but to other countries with similar resource circumstances and constraints.

The rest of the paper is organized as follows. Section 2 deals with leasehold forestry management experiences. Section 3 describes the study area while Section 4 describes the methodology. Section 5 presents the findings and discusses the results. Section 6 concludes with a policy discussion.

2. Experiences from Leasehold Forestry Practices

The practice of leasing agricultural land to tenants has existed from time immemorial. The leasing of publicly-owned forest lands to private agents for forest-based enterprises along with performance bonds where the private enterprises are required to grow forests is quite common in countries such as Malaysia, Indonesia and the Philippines (Richards, 1999). The practice of leasing government land to individual households for the purpose of forest regeneration and poverty reduction is however relatively new.

India is one country that has experimented with a form of leasehold management regime under the Capacity 21 Project with the support of the United Nations Development Program (Parikh, 1998). Among the most successful of such experiments was that of an NGO, the National Tree-Growers' Cooperative Federation (NTGCF), which came to be replicated in more than 400 villages in six different states of India. The NTGCF set up a village-level tree-growers cooperative society (TGCS) with the active participation of the villagers and the stakeholders. All village households were eligible for membership in the society. There are 130 to 170 million hectares of degraded land in India. The state government therefore provided 30 to 40 hectares of degraded land or wasteland on a long-term lease to the TGCFs usually at no charge. The NTGCF provided grants to cover the costs of planting trees, fencing the area, protecting the plantation, and for watering it for a period of five years. The local society, the TGCS, managed the operations in a democratic manner. The usufruct right over the resulting forest were vested with the village level TGCS. The societies paid wages to the villagers who provided labor for the planting and watering activities which also created new employment opportunities for the poor in the village. But this kind of leasehold seemed to require both land leases and investment contributions from the government and was actually managed by the government rather than by the communities. Nepal's leasehold experience is different because the government assigns full responsibility for land management, including capital investment, if any, to the lease recipients.

In general, forest management regimes in developing countries aim at livelihood improvements rather than seeing forests as engines of economic growth. Livelihood improvements occur in a number of ways such as increased availability of biomass, reduced drudgery, savings in collection time, supplementary incomes, etc. But in non-monetized economies, these benefits are difficult to measure. Some of the literature on the LHF practice in Nepal have concluded, for instance, that households have been able to save a considerable amount of the time spent in collecting forest products for livelihood as a result of LHF in their communities (Bhattarai et al., 2007; IFAD, 2003; Thompson, 2000). The IFAD study used both primary and secondary data but the analysis was qualitative and did not focus on the economic impact of LHF. The study concluded that while LHF was successful in regenerating degraded land, its impact on reducing poverty was uneven. This was because it was dependent on three inter-connected factors: (i) the productive potential of the LHF sites themselves; (ii) access to and communication with the market; and (iii) the degree of dynamism and collaboration within the group.

Similarly, a study of LHF in Nepal by Thompson (2000) has examined its impact using both program and control households. The findings indicated that there was a slight increase in the value of large livestock and a reduction in the scarcity of livestock feed. The limitation of the study was that it did not focus on an economic valuation of the contributions of leasehold forestry but dealt with only livelihood aspects.

Based on a review of the available literature, it is evident that LHF is an innovative program for natural resource management. This study is however the first detailed economic evaluation of this program.

3. Study Area and Data

Although the LHF program is to be found by now in 26 districts in the mid-hills regions of Nepal (which has an elevation of 300-3000m above mean sea level), Makwanpur and Kavrepalanchok (Kavre, for short) were the first two districts to implement the program in 1993. We therefore purposively selected the districts for two reasons: (a) the two pioneering districts would represent mature LHF regimes and (b) due to their location in the lower and upper parts of the mid-hill belts, they would be representative of the topographical diversity in which LHF program has been targeted in Nepal (see Figure 1 for the location of study districts).

Kavre and Makwanpur are contiguous districts with slightly different topographic features although their development indicators are quite similar. The land areas for the two districts are 1396 and 2426 sq km respectively while the altitude ranges from 300 to 3000 meters above sea level. In terms of climate, the two districts have tropical, temperate and cool temperate climates in different parts of the district with wet summers and dry winters. The mean temperature ranges from 9-28 degrees Celsius and precipitation from 1300-2700 millimeters per year in the two districts depending on the location. Eighty percent of the rain falls within the four monsoon months of June to September. Maize and millet are the two main crops in the mountains while farmers grow paddy, wheat, potato and vegetables in the foot hills and river basins. Only limited parts of these districts are accessible by road and people rely on foot-trails to access the health services, market and schools.

Though the two districts are contiguous, their development indicators are not uniform with the two districts recording varying performances for different aspects (UNDP, 2004; see Table 4). In terms of ecology, we can classify the two districts under two major ecological regions-the mid mountains and the Shiwaliks. The mid-mountains boast a rocky topography and are quite stable while the Shiwaliks display fragile hill topography. The soil in the Shiwaliks is made up of sandy clay and boulders while desertification is rampant due to flash floods and landslides. Makwanpur has 60 percent of its area under Shiwalik hills and is, thus, more ecologically fragile in contrast with Kavre where the area under Shiwalik is just 3 percent. Due to human encroachments into the forest cover, hundreds of hectares of land convert to desert land every year. Thus, the Government of Nepal considers the need to address the ecological crisis in the mid-hills through appropriate forest management one of its urgent priorities (HMGN/MFSC, 2002).

In 2007, Makwanpur and Kavre had 288 and 243 LHF groups, respectively. Since the LHF program is based on the principle of the natural regeneration of forests, we set aside a five-year gestation period for forest products harvesting based on discussions with forestry professionals. Accordingly, we took 245 and 194 LHF groups in the two districts with a more than five-year tenure (which meant LHF groups established before 2003) as the appropriate population for our study.

We based our study on primary data collected through a questionnaire survey. We collected secondary information on the distribution of LHF groups by Village Development Committees (VDCs) from the Leasehold Forestry Division in Kathmandu and the relevant District Forest Offices. Our sample was based on a listing of all the eligible LHF groups in the two districts.

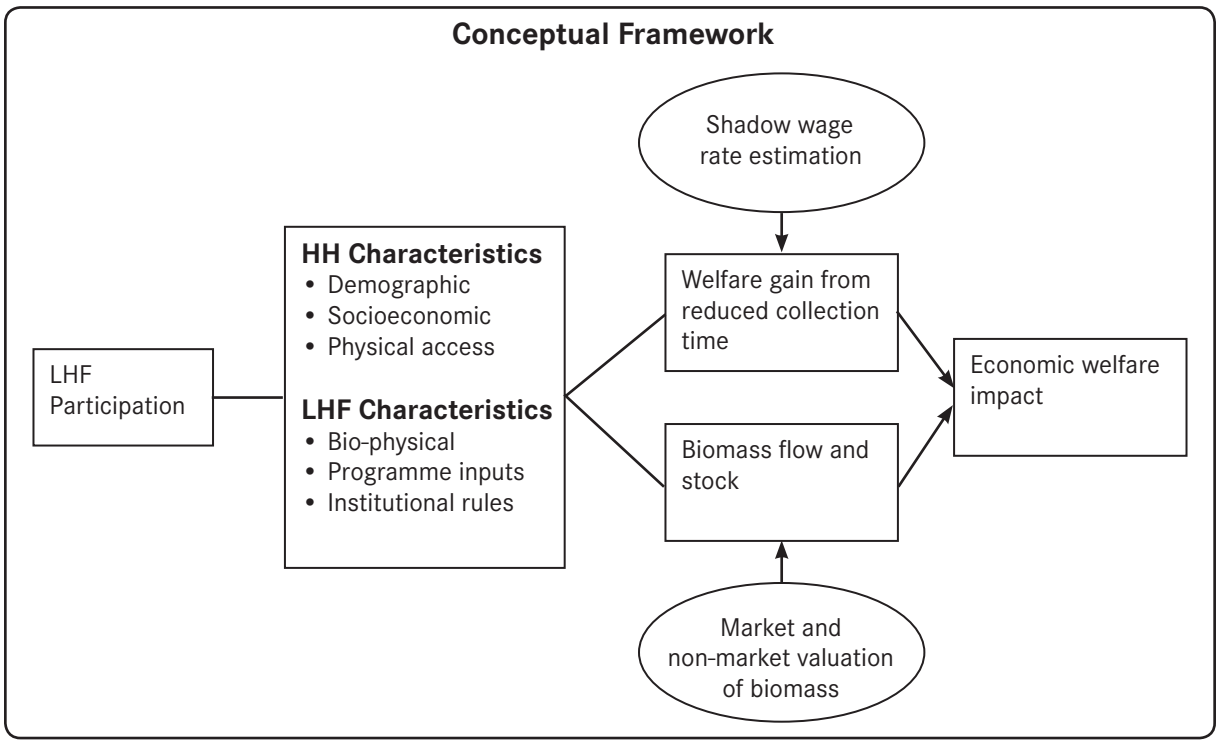
We used a structured questionnaire to collect information on household demographic and socio-economic factors while community-level information was collected through a separate schedule. We conducted the survey between January and May 2008 and collected household income data for the previous year by recall method to be treated as the reference period.

4. Methodology

4.1 Analytical Conceptual Framework

Under a LHF forestry regime, households with specific socio-economic, demographic and physical access characteristics participate in the management of degraded forest plots allotted to them by the Department of Forests (DOF). These LHF plots themselves have some bio-physical attributes along with program inputs from the government and institutional rules devised to manage the regime. The DOF provides assistance in preparing a five-year operational plan for forest management, training, formation of savings groups and other networks as well as incentives (such as free goats). The DOF also undertakes the monitoring and supervision of LHF group performance.

The participating LHF households, after completing a gestation period, are expected to experience improved welfare through at least two channels: firstly, with access to forest resources at relatively short distances which leads to a saving in time for households through reduced collection time. We can measure the value of this welfare gain through tools that measure the shadow wage rate of the LHF households, which reflects their opportunity cost in terms of time. Secondly, control over open grazing results in the increased availability and harvesting of forest



products through improved forest regeneration. We measure the money value of increased biomass flow and stock from LHF using market and non-market valuation techniques. These two measures of welfare expressed in the form of a monetary valuation provide a measure of the economic impact of LHF. The welfare gain in terms of biomass flow from LHF is in turn determined by institutional provisions such as group or individual management, gender of the LHF members, distance to the LHF plot, and household characteristics.

4.2 Sampling Design

We used a multi-stage sampling approach in order to select the households that form the unit of analysis. VDCs were the primary sampling units (PSUs). We used the method of probability proportional to size (PPS) sampling to select the VDCs. At the next stage, we selected LHF groups by using simple random sampling in the selected VDCs. We interviewed all households of the selected LHF group.

We selected approximately 50 percent of the VDCs in each district, which came to 12 VDCs out of 23 in Makwanpur and 10 out of 19 VDCs in Kavre. At the next stage, we randomly selected 5 LHF groups from the selected VDCs in Makwanur and 3.5 LHF groups in Kavre.[1] With a mode value of 5 households per LHF in Makwanpur and 7 households per LHF in Kavre, we had approximately 545 households (300 and 245 respectively) for the two districts. If a VDC selected through PPS had less than the required number of LHF groups, all LHF groups in that VDC would automatically come into the sample while the remainder would come from the nearest LHF VDC. In the case of the present study, however, all VDCs in the PPS had more than the required LHF groups.

In the course of the research, we had to replace four LHF groups, two from each district, with adjacent LHF groups due mainly to problems with access. Among the selected LHF groups, we replaced a LHF group if less than 50 percent of LHF households of a group were available for interview. In such instances, we chose the most proximate LHF group. Accordingly, in the course of the research, we visited an additional five LHF groups (4 from Makwanpur and 1 from Kavre) to supplement the LHF groups originally selected where only less than 50 percent households were available for interview (either due to the absence of the LHF member or the household head), thus making up a total of 100 LHF groups for the survey. We surveyed a total of 508 LHF households with 297 coming from the Makwanpur district and 211 from the Kavre district.

[1] We selected 4 LHF groups in 5 VDCs and 3 LHF groups in the other 5 VDCs, alternatively, in order to ensure that the resulting sampled LHF groups were in proportion to the LHF population in the two districts. This provided us with 95 LHF groups—60 in Makwanpur and 35 in Kavre.

4.3 Valuation of Household Time Savings

There are a number of approaches to valuing household time, the most common being the use of the market wage rate. However, since the labor market is very thin in the study area where labor is rarely hired on a cash basis, we had to come up with alternatives to the market wage rate. The other alternatives for the purpose of valuing labor time are the shadow wage rate estimation based on the household production function and the calorific value of energy consumed in labor activities. Selecting an appropriate value for labor time from among these three alternative measures was difficult.

The household production function under non-separability has been used for estimating the shadow wage rate in agriculture (Thapa, 2003; Skoufias, 1994), in firewood collection (Amacher et al., 1996), and to estimate the shadow prices of fuel, cut-grass and leaf fodder (Cooke, 1998). The main deductions of the household production function are as follows: at equilibrium, the marginal returns to labor are exactly equal across all activities while additional labor is utilized up to the point where their marginal product is equal to the shadow wage rate. Based on the analytical framework provided by the household production function, we planned initially to consider the marginal productivity of labor in farm production as a measure of the shadow wage rate in the study. Accordingly, we used maize production, an activity in which most members of the households participated. We found the average shadow wage rate of labor based on the marginal productivity of labor in maize production to be NRs 11.1 per hour (1 USD = 67.76 [NRB, 2009]). However, maize production is a seasonal activity in Nepal (only about four months during the monsoon season) and has a high yield. Thus, the marginal productivity of labor in maize production might over-state the value of labor time.

Some studies have made use of the calorific value of the energy consumed by labor in collection activity as a monetary measure of labor time (Hartter and Boston, 2008; Macdonald et al., 2001). This method assumes that when no alternative employment opportunities are available, labor stays idle. The energy consumed in terms of calories remains at some minimum level during rest whereas when a laborer performs any physical activity, s/he consumes additional energy through the food s/he consumes by way of compensation. The difference between the calories consumed during work and the calories consumed when staying idle per hour gives a measure of the minimum caloric consumption due to physical activity. The money value of energy consumed during the extra physical labor gives a measure of the minimum cost of human labor.

In the context under consideration, we found we could convert the number of hours saved in the collection of forest products from LHF into the money value of calories required for work. Hence, going by the available literature, we could broadly classify traveling to the site, collecting forest products and carrying them back as moderate physical activity requiring 150-350 calories per hour. We use the average requirement as 250 calories per hour. The calorie consumption for an average person staying idle is 84 calories per hour (McArdle, 1986; Williams, 1983). Thus, an average adult would need an additional 166 calories per hour to engage in collection activity rather than remain idle. It is possible to obtain the cost of the additional calorie requirement by estimating the amount of staple food grain that the worker must consume in order to extract the given calories of energy needed to perform the activity. The conversion factor in terms of maize which was the staple food for most of the households was 3.42 calories per gram (World Bank, 1998). We obtained the money value of the quantity of maize required using the locally prevailing market price for maize in the community.

After finding out what additional hours they would have to work if they collected from open access rather than from LHF plots, we could convert these hours of additional work into additional calorie requirements. This estimate would give a lower bound for the money value of time. It was possible therefore to estimate the average wage rate using the calorific nutrient requirement to be NRs 0.98 per hour.

As mentioned earlier, a third alternative is to use the locally prevailing daily wage rate. Generally, economic studies make use of the prevailing wage rates when they do not take into consideration the specific nature of the labor market under shallow market conditions. These are wage rates households pay during peak seasons or at normal times due to working members being away from home for foreign employment. Since work is not available throughout the year at the local wage rate that prevails during peak seasons and since a laborer cannot be hired below the equivalent subsistence calorific value, we constructed an adjusted wage rate reflective of the equilibrium of demand for and supply of labor. We could devise the most appropriate wage rate by averaging the lower bound

calorific wage rate and the prevailing rural market wage rate. This was because all practical wage settlement deals throughout the year were likely to take place through the interaction of these two market forces: the necessity to hire labor on the part of the employer (i.e., demand for labor) and the need to find work on the part of the laborer (i.e., supply of labor) with the lower bound calorific value and the upper bound prevailing wage rate functioning as references.

The prevailing average local wage rate was NRs 13.4 per hour. As discussed earlier, we devised an adjusted wage rate by averaging the calorific wage rate (NRs 0.98 per hour) and the average local wage rate. This adjusted wage rate came to NRs 7.2 per hour on average for male and female labor. We estimated the value of time saved based on the adjusted wage rate. Once we determined the price of labor time, we could convert the time saved per load of forest products extracted into a monetary value. We used the difference in time between what it would take to collect a load from open access and what it would take to collect from their LHF plots in order to estimate the value of the time saved.

4.4 Valuation of Additional Bio-mass from LHF

A number of techniques exist for the valuation of forest biomass. They comprise market prices, a near market or proxy market price, or a value based on the barter exchange method (Bann, 2003). However, we found that most of the forest products in the study area were extracted from private lands, community forests, LHF plots, government forests, or from open access areas. There was no local market for forest products such as firewood, fodder grass and leaf litter; nor were there firewood substitutes such as kerosene or marketed liquefied petroleum gas (LPG) cylinders except in a few exceptional cases. Since there was no market, we tried a field experiment where LHF households were asked to bid for a load of forest products in exchange for food grain. But since the local communities were not accustomed to such practices, they could not relate to this exchange. During one such session, some elders suggested the use of collection time as a basis for the valuation of forest products. According to them, whenever a household was unable to collect forest products, they would ask someone to do it for them and pay in quantities of food grain on the basis of collection time. Discussions in other sites showed that it was a customary practice well-established in the region. The people also cited a traditional practice of paying a Pathi (approximately 3.2 kg) of maize for arduous work during the peak season and ½ Pathi per day for other moderate jobs such as working in a maize field, collecting firewood, etc.

Since open access areas are available to all members of the community at any time, the LHF members suggested that we adopt the time taken to collect from open access areas as a measure of time for the purpose of valuing forest products in terms of the prevailing wage rate. This was also a methodology adopted by earlier studies (Bluffstone, 1995; Hartter and Boston, 2008; Kohlin and Amacher, 2005; and Macdonald et al., 2001).

We therefore estimated the value of the main forest products, firewood, fodder grass and leaf litter, using the time taken to collect them from open access sources. We considered these values as representative of the rural labor market demand and supply situation in terms of the adjusted wage rate as discussed earlier. Accordingly, we found the average price per load of firewood, fodder-grass and leaf-litter to be NRs 11.63, 13.06 and 7.69 respectively. We considered these to be the shadow prices.

4.5 Socio-economic, Forestry and Institutional Characteristics of LHF Households

LHF household characteristics provide vital background information for the purpose of better understanding the issues and dimensions of LHF activities. The average family size of the LHF households was 6.5. This was slightly higher than the average in the hills (5.3) (see CBS, 2004). The socially marginalized population (i.e., Dalits) constituted a very small portion (3 percent) of the LHF households despite a state policy giving priority to underprivileged groups in the allocation of LHF lands. One fourth of the LHF members were female. The majority of the LHF members were middle-aged (with a mean age of 45.7 years) with a huge variation in their ages ranging from 18 to 80 years. 37 percent were illiterate. Among the literate household heads were also those who had never been to school but were functionally literate through self-learning. Males were 85 percent of the household heads

among the LHF households with most of them citing agriculture as their main occupation. Roughly 12 percent of the households had a member or members away from home remitting money.

The average landholding size among LHF households was 0.6 hectares (with a std.dev. of 0.4) with most of the land un-irrigated and yielding a single crop or two crops per year during the monsoon. The average number of large and small ruminants in LHF households was 3 and 5.5 units respectively. Opportunities for linkages between LHF households and the market were low due to the remoteness of these areas

The per capita income of these households, including biomass income, was around NRs 14,000. The poverty line income for Kavre and Makwanpur districts, which are classified under the eastern hills, was NRs. 8069.6 at 2003-04 prices (CBS, 2005). Since the inflation adjusted poverty line income was NRs 9509 per capita at 2007 prices, 44 percent of the LHF households were found to be living in poverty.

The data revealed that 61, 62 and 56 percent of LHF households were extracting firewood, grass fodder and leaf litter respectively from the LHF plots in different quantities. According to the data, 74 percent households were therefore extracting some or all of these main forest products while the remaining 26 percent could not or did not extract any of these products. The LHF households used 112 back-loads (or Bharis) of firewood annually on average, while the amount ranged significantly from no firewood use to a maximum of 540 loads per year. Very high firewood consumption was associated with the problem of carrying milk to markets. A large number of households in both the districts dehydrated the milk by boiling it for long hours to make milk cakes which would then be carried on the backs of porters on a 12-15 hour journey to be used as a raw material in the preparation of sweets in Kathmandu. The lack of a market for fresh milk, thus, had serious implications in terms of firewood demand and deforestation. Of the total amount of firewood used by households, 28.2 percent came from private land while the remaining 71.8 percent came from public land (i.e., community forests, LHF, government-owned forests, or open access).

Households collected green grass and tree fodder, too, for livestock. There was a wide variation in the amounts collected as livestock feed, too, ranging from 0-2340 loads. Households collected a large share (62.1 percent) of the fodder grass from private land while the rest came from public land sources. Households also collected and used dry leaves, as well as green biomass, as bedding material for livestock, with the average annual collection at 273 back loads. This bedding material converted into animal compost manure becomes a major source of soil nutrients in the hills of Nepal. Households also collected dry leaves during the fall to be utilized on rainy days during the monsoon season while they engaged in green biomass collection for leaf-litter throughout the year. They collected about one third (or 31.2 percent) leaf litter from private land sources and the remaining two thirds (or 68.8 percent) from public land sources.

For LHF households, community forests (at 52.6 percent) are the largest provider among the public land sources of firewood, followed by LHF (at 21.8 percent), government-owned forests (at 15.5 percent) and open access (at 10.1 percent). With regard to fodder-grass, the largest share came from LHF (at 41.2 percent) followed by community forests (at 39.1 percent), government-owned forests (at 15.6 percent) and open access (at 4.1 percent). Community forests (at 52 percent) were the largest source of leaf-litter from public land sources followed by LHF (at 34.6 percent), government-owned forest (at 11.1 percent) and open access (at 2.2 percent). Thus, the contribution of LHF to firewood, fodder-grass and leaf-litter among the public sources ranged between 22 to 41 percent, which could be considered substantial.

With regard to membership in LHF programs, the normal procedure for LHF group formation requires a group to apply to the Forestry Department with an operational plan. The Department then provides the group with a certificate of ownership listing the names of each household member in the group. The government however permits the LHF plots to be managed in groups or individually. In fact, several LHF groups presently under group management expressed their desire to have their own individual plots. At present, however, only 28 percent households enjoy individual plot management although LHF rules require forestry officials to distribute LHF plots according to demand from LHF households. The average number of households in the LHF group was 6 with the minimum at 4 and the maximum at 10 households.

The number of years a household had remained with an LHF group varied between 6 to 13 years (with the mean at 10 years) as our study included in the sample only those LHF households with more than 5 years with a group due to the selection criteria employed. The mean area of LHF plots per household was 0.68 ha though the initial official target was to provide around one hectare per household.

The LHF households varied significantly in terms of distance to the LHF plots from their homestead. Although the mean distance was 17 minutes, it varied, for instance, from as short as one minute to as long as 1 ½ hours one way of travel time from the homestead. The long distances between LHF plots and homestead have serious implications when it comes to both forest management and exercising exclusive rights to a plot for the purpose of preventing intruders from grazing cattle and extracting forest products.

In addition, for the purpose of augmenting the income generation of poor LHF households, the program provided female goats to such households. Around 17 percent households had benefitted from this practice.

One important factor that determines the contribution of the LHF plots is the quality of land. For a more objective assessment of the quality of the LHF plots, we graded the LHF plots into three categories as good, moderate and poor in terms of soil quality, steepness and the presence of nuisance species. We considered the LHF plots that fell into the poor category in terms of all these three characteristics as very poor. 26 percent fell into the category of the very poor due to bio-physical characteristics.

Around 38 percent of households felt the difficulty in exercising exclusion (that is, the right to exclude outsiders) as the most serious problem in LHF management. A number of LHF groups had become defunct (about 7 percent) either due to disputes with the local community or due to natural factors such as floods or landslides that had washed away the LHF land. This study includes such defunct group households in order to avoid over-stating the benfits of the LHF program.

The other issues reported by the huseholds are: (a) lack of monitoring and supervision by the Forestry Department; (b) the poor quality of LHF land; (c) the LHF plots being managed in groups rather than under individual household management; (d) the lack of income-generating activities in LHF; (e) the long distance to the LHF plot; (f) the problem of access to credit; and, (g) access to market.

Some issues regarding the data collection for the study need to be stated here. Part of the data used in this study was based on recall – the recall period was one year. We also encountered some problems due to transmutations in families over time–with grown-up sons settling down as separate family units–which made calculations on household extractions somewhat difficult. A further issue had to do with the adjusted wage rate, which had been the basis of the valuation of time saved as well as the valuation of forest biomass. We treated the two aspects as separate. Therefore, though we have used the adjusted wage rate as a basis of valuation, it does not necessarily lead to a double counting of the LHF benefits. In order to avoid the benefit of a double count, we simply avoided aggregating these two benefits.

5. The Main Findings

5.1 Economic Impact of Time Saved on Household Welfare

One of the major contributions of LHF is the saving in time for households that collect forest products. We used the difference in time between what it would take to collect a load from the nearest possible all-season alternative, generally open access, and what it takes to collect from their LHF plots in order to estimate the time saved. Community forests provide a harvesting alternative to LHF for the purpose of collecting firewood, fodder grass and leaf-litter but these alternatives are only available for some fixed duration based on the decision of the community forest user group committee and mostly at some small token price (Adhikari et al., 2004; Khatri-Chhetri, 2008; MOFSC/GON, 2009)[2]. Moreover, the access of poor households to collection from community forestry resources remains restricted unless special pro-poor initiatives are adopted (Acharya et al., 2008; Mahanty et al., 2006).

[2] The Community Forestry Development Guidelines published by the Ministry of Forest and Soil Conservation of the Government of Nepal has stated that the quantities and the product prices per load would be fixed for the forest product to be provided by its user group members.

The average time saved per load of firewood, fodder-grass and leaf-litter for households collecting these products from their LHF plots was 0.78, 0.90 and 0.49 hours respectively. Therefore, based on the loads of these three products, the annual time saved was 23 hours, 145 hours and 579 hours respectively. We observed a significant variation in the time saved among households indicating the great diversity in collection time and amounts. As mentioned earlier, the distance from home to the LHF plot varied from a minute to 150 minutes. When we converted the total time saved in the collection of the above three products based on the average number of working hours for the area under consideration, it yielded an average time saving of 39 workdays per year.

We used the shadow wage rate discussed earlier to estimate the money value of time saved. The average annual value of time saved was the highest in fodder-grass collection (at NRs 1140) followed by leaf-litter (at NRs 438) and firewood (at NRs 176). The money value of time saved in collection was thus on average NRs 1755.

The households were also engaged in forestry management activities such as cleaning the forest floor for nuisance species, pruning, thinning, etc. The households on average devoted 5.3 workdays, which was equivalent to NRs 165, to forestry activities. In addition, the LHF households assembled periodically in their groups to discuss LHF issues and to collect their monthly savings. Sometimes they would also visit the District Forest Office (DFO) for consultations. They spent on average 4.7 hours on these meetings, which came to 6.1 workdays as transaction days. This figure is very low for a de-facto private property management scenario like LHF. Moreover, a study of community forest members, who have the right to harvest only on communally determined days, revealed that they spent 13.5 days on average on forest activities (Adhikari, 2008). The average annual value of the transaction cost of LHF caretaking, LHF meetings, DFO visits and travel cost was NRs 253. Thus, the net value of time saved by the households was NRs 1337. In relative terms, this comes to around 33 workdays saved or 1.5 percent of the annual household income.

5.2 Economic Value of Biomass from LHF Plots

The study also estimated the value of main forest biomass collected from all sources including LHF. It valued timber for construction at the price paid to the Community Forest Committee during extraction. It used local market prices to value thatching grass, grass seeds, broom grass, wild fruits and vegetables. Households valued standing timber in the LHF plots as per tree species, their years of maturity and market access. We annualized this value to obtain a yearly average value. We have had to exclude the annualized value of standing timber in private lands due to measurement problems.

Biomass incomes were computed as: (a) biomass from all sources; (b) biomass from non-private sources (community forest, LHF, government forest and open access) only; and (c) biomass from LHF sources only (see Table 1). The LHF contributed annually about 18 percent of the total biomass value while the communities extracted 37 percent of the biomass requirement from non-private sources. Other income from LHF, typically in cash, was only around 5 percent of the total value of biomass. If we were to account for both the flow and annualized value of standing stocks, the share of LHF comes to 30 percent of all sources and 53 percent of non-private sources.

5.3 Household Income from Non-environmental and Environmental Sources

Agriculture was the major occupation of 78 percent of the households while crop income constituted the largest share at 26.1 percent followed by a similar share of salary and business income (25.9 percent). The net income from livestock products and sale of live animals was 7.9 percent. Remittance income (at 12 percent) exceeded the local wage income (which was only 10.9 percent). Total transfer income (at -0.03 percent) was slightly negative as there was a strong tradition of sending gifts to relatives on occasions of death or other events. About 61 percent households were in debt with an average debt of NRs 22632. The loans were mostly from informal markets where the average interest rate, at around 30 percent per annum, is more than twice the interest rate in the formal sector.

The income from sources such as agricuture, livestock, wages, remittances, etc., was at 84 percent while the income from biomass extracted from different sources stood at around 16 percent. Fifty-six percent of the biomass income came from non-private land sources while 44 percent came from private land sources. The share of LHF biomass (or the flow and annualized return from timber) was around 5 percent of the household income.

5.4 Determinants of LHF Contributions

This section aims at analyzing the various factors, including policy choices for land allocation and management, which impact on LHF contributions to livelihood support since their primary objective is the optimization of biomass value from LHF (i.e., the value of the annual flow of the forest products plus the annualized value of timber in the LHF plot). The policy relevant variables under consideration refer to those variables that influence the allocation, management and outcomes of LHF programs. In addition, we factor in LHF household characteristics that also influence the flow of forest produce.

The distance to the source of biomass is one of the most important determinants of extraction (Bluffstone, 1995; Kohlin and Amacher, 2005). Distance (here measured in minutes) from the homestead is expected to negatively correlate with extraction. However, it is also expected to have a non-linear relation as the decline is expected to be higher at smaller distances from the homestead but is likely to remain constant as distances increase beyond some practical magnitude. We expect the squared term of distance therefore to have a negative impact on LHF collections too.

Since some species of vegetation mature with each additional year, we expect the value of biomass flow to increase with additional years of tenure of a LHF. As discussed earlier, LHF plots are either group or individually managed. We assume LHF plots under individual management to have a higher yield than under group management due to incentive compatibility and lack of significant externalities.

Other factors that are likely to affect LHF extractions and incomes are: (a) Exclusion rights: If LHF households were experiencing problems in exercising exclusive rights, this would adversely affect LHF extractions; (b) Forest and soil quality: The bio-physical quality of the forest is an important determinant (Bluffstone, 1995). Respondents ranked their plots between zero (good) and 3 (worst); (c) Women's participation: Studies indicate that community-level programs are more effective when women are given leadership and management roles (Adhikari, 2008). We expect male membership in LHF therefore to have a negative impact on LHF flows.

Apart from these, household socio-economic and resource characteristics such as family size, private land holding, the literacy status of household head, and non-biomass income of the household are also likely to affect LHF biomass flows. A larger family size in the case of LHF households may enable a greater quantity of biomass collection. On the other hand, we expected the aggregate private landholding size to have a negative impact on LHF collection from community sources. We expect the literacy status of the household head to raise LHF biomass income as it enhances the capacity of the household to use LHF land more productively. However, it may also negatively impact on forest income because of the alternative livelihood choices available to the more literate (Babulo et al., 2008). Similarly, we expect non-biomass income to reduce LHF biomass income due to higher specialization in non-biomass related occupation. The conceptual model given below factors in these considerations:

Biomass income from LHF = f (institutional variables, household and resource characteristics)

The institutionally-determined variables are (i) the travel time to the LHF plot from the household; (ii) individual or group management of LHF plots; (iii) the number of households in the group; (iv) the gender of the LHF members; (v) the physical characteristics of the LHF plots; and (vi) provisions for monitoring and supervision to ensure exclusion rights. The Forestry Department, for instance, can devise rules for optimum distance and the number of households in the group, etc., when allocating LHF plots.

We use the ordinary least squares (OLS) regression in order to test for five alternative specifications. To allow for correlation within LHF groups, standard errors were clustered by their respective LHF groups. The results indicate that institutional variables are significant, which in turn suggests that policy intervention may have important outcomes. The alternative model specifications test the robustness of these target policy variables.

As expected, the time taken to reach the LHF plots has an important bearing on LHF extractions. The marginal loss in biomass income for an increase in each minute of walking distance was around NRs 52 for all models. The elasticity coefficient indicated a 0.21 percent decline in LHF biomass yield for each percentage increase in travel

distance (that is, time in minutes). The squared value of the distance to the LHF plot and the number of years of LHF participation were, however, not statistically significant.

The co-efficient of plot ownership type (individual or group) suggests that individual owners had a higher LHF biomass income of approximately six thousand Nepalese rupees over group-owners. This variable was statistically significant at 1 percent level of error for all five model specifications indicating the strong influence of private management on biomass income in the case of LHF plots.

The quality of the LHF plot had a statistically significant impact on biomass income from LHF plots with poor quality plots resulting in significant reductions in LHF biomass income in three of the five model specifications. Therefore, the government needs to review its policy of giving extremely degraded land for purposes of LHF. The welfare impact would moreover be higher if, along with degraded land, allottees were provided with saplings of plant species that survive in such harsh conditions. Likewise the size of private landholding had a significant negative impact in 3 out of the 5 model specifications indicating that those with larger private holdings had less incentive to utilize LHF plots productively.

On the other hand, the following variables did not show any significant impact: (a) the years of tenure in LHF; (b) the number of households in the LHF group; (c) the gender of the LHF member; (d) the literacy status of the household head; and (e) the income from other sources (i.e., non-biomass). The adjusted R squared was around 0.46 for all models.

6. Conclusions and Policy Recommendations

States often resort to the devolution of common property resources or state land either to reduce their fiscal burden or under pressure by the communities themselves for collective or individual self-management of such resources (Shyamsundar, 2008). In the case of Nepal, the experiment with LHF started around one and a half decades ago with groups of poor households being given the responsibility of improving the ecological status of degraded forest lands in the mid-hills of Nepal. The objective of this program was to improve the livelihood of households through enhanced biomass, livestock and other cash income benefits.

The results of the study show that LHF has contributed to improving household welfare through a saving of around 33 workdays of collection time and by supplementing household biomass requirements and consequently biomass income (which is around 5 percent of household income). Our study shows that the benefits (including biomass from LHF plots and expected income from future timber harvest) outweigh household costs. The institutional issues that negatively impact benefits that became evident from our study are: a) distance to LHF plots; b) lack of exclusive rights for the management of LHF plots as individual household parcels; and c) the quality of the LHF plots. These factors have probably led to the following sub-optimal utilization of LHF lands: (i) LHF plot owners spend very little time (that is, around 5 work days per year) managing their plots; (ii) 26% of households do not extract anything from LHF plots; and (iii) less than 5 % LHF products contribute to the cash income. Thus, our study indicates that it is necessary to restructure the LHF program so that it would enhance LHF land utilization and reduce costs of LHF management while increasing the benefits to low-income LHF participants.

Acknowledgements

The study received generous financial support from the South Asian Network for Development and Environmental Economics (SANDEE) and valuable logistical support from the SANDEE Secretariat. My thanks are due to the LHF households for providing invaluable help, warm hospitality and patience during the survey. Sumanta Neupane, Indu Raj Joshi, Sunil Kharel and Dinesh Pokharel conducted the field surveys in difficult and remote locations. Ghana Prasad Neupane assisted with the data entry programming.

I am grateful to E. Somanathan and Priya Shyamsundar for their advice and to Pranab Mukhopadhyay and Carmen Wickramagamage for suggestions on earlier drafts of the paper.

References

Acharya, KP; Adhikari, J; Khanal, DR (2008) 'Forest tenure regimes and their impact on livelihoods in Nepal, *Journal of Forest and Livelihood 7*(1): 7-18

Adhikari, B (2008) 'Is Cooperation Costly with Diverse Economic Agents?' in Ghate, R; Jodha, NS; Mukhopadhyay, P (ed), *Promise, Trust and Evolution: Managing the Commons of South Asia*, New York: Oxford University Press, 238-259

Adhikari, B; Di Falco, S; Lovett, JC (2004) 'Household characteristics and forest dependency: evidence from common property forest management in Nepal', *Ecological Economics* 48: 245-257

Amacher, GS; Hyde, WF; Kanel, KR (1996) 'Household fuel-wood demand and supply in Nepal's Terai and mid-hills: choice between cash outlays and labor opportunity', *World Development* 24 (11): 1725–1736

Babulo, B; Muys, B; Nega, F; Tollens, E; Nyssen, J; Deckers, J; Mathijs, E (2008) 'Household livelihood strategies and forest dependence in the highlands of Tigran, North Ethiopia', *Agricultural Systems* (98): 147-155

Bann, C (2003) 'An economic analysis of tropical forest land use options, Ratnakiri province, Cambodia', Research Reports 5/15/03 Available at http://203.116.43.77/publications/research1/ACF4B.html [Accessed on June 28, 2007]

Bhattarai, B; Dhungana, SP; Kafley, GP (2007) 'Poor-Focused Common Forest Management: Lessons from Leasehold Forestry in Nepal', *Journal of Forest and Livelihood* 6(2): 20-29

Bluffstone, RA (1995) 'The effect of labor market performance on deforestation in developing countries under open access: an example from rural Nepal', *Journal of Environmental Economics and Management* 29: 42-63

CBS (2006) *District Profiles.* Central Bureau of Statistics. National Planning Commission Secretariat, Kathmandu, Nepal.

CBS (2005) *Poverty Trends in Nepal*. Central Bureau of Statistics, National Planning Commission Secretariat, Kathmandu, Nepal

CBS (2004) *Nepal Living Standard Survey 2003/04 Statistical Report Vol. 2*. Central Bureau of Statistics, National Planning Commission Secretariat, Kathmandu, Nepal

Cooke, PA (1998) 'Intra-household labor allocation responses to environmental good scarcity: a case study from the hills of Nepal', *Economic Development and Cultural Change* 46 (4): 807-830

Hartter, J; Boston, K (2008) 'Consuming fuel and fuelling consumption: modeling human caloric demands and fuelwood use', *Small-Scale Forestry* 7 (1): 1-15

HMGN/MFSC (2002) *Nepal Biodiversity Strategy*. Ministry of Forest and Soil Conservation, Government of Nepal, Supported by the Global Environment Facility and UNDP, Kathmandu, Nepal

IFAD (2003) *Kingdom of Nepal Hills Leasehold Forestry and Forage Development Project* (Loan Nº 250-NP), Interim Evaluation, International Fund for Agricultural Development, Available at http://www.ifad.org/evaluation/public_html/eksyst/doc/prj/region/pi/nepal/nepal.pdf [Accessed on 1 September, 2006]

Jodha, NS (1986) 'Common property resources and rural poor in dry regions of India', *Economic and Political Weekly* 21(27): 1169-81

Khatri-Chhetri, A (2008) 'Who pays for conservation: evidence from forestry in Nepal,' in Ghate, R; Jodha, NS; Mukhopadhyay, P (ed), *Promise, Trust and Evolution: Managing the Commons of South Asia*, New York: Oxford University Press, 260-282

Kohlin, G; Amacher, GS (2005) 'Welfare implications of community forest plantations in developing countries: the Orissa social forestry project', *American Journal of Agriculture Economics* 87(4): 855–869

MacDonald, DH; Adamowicz, WL; Luckert, MK (2001) 'Fuelwood collection in northeastern Zimbabwe: valuation and caloric expenditures', *Journal of Forest Economics* 7(1): 29-51

Mahanty, S; Gronow, J; Nurse, M; Malla, Y (2006) 'Reducing poverty through community based forest management in Asia,' *Journal of Forest and Livelihood* 5(1): 78-89

McArdle, WD; Katch, FI; Katch, VL (1986) *Exercise Physiology: Energy, Nutrition and Human Performance (2nd Ed)*, Philadelphia: Lea and Febiger, Available at: http://www.fitness.gov/exerciseweight.pdf [Accessed on February 7, 2009]

MOF/GON (2009) *Economic Survey*. Ministry of Finance, Government of Nepal, Kathmandu, Nepal

MOFSC/GON (2009) 'Community forestry development program guidelines', Ministry of Forest and Soil Conservation, Government of Nepal, Kathmandu, Nepal

NPC/UNDP/PRSP (2005) 'Final report on impact evaluation of hills leasehold forestry and forage development project (HLFFDP) (GCP/NEP/049 NET)', National Planning Commission/United Nations Development Program/Poverty Reduction Strategic Program, Project Evaluation Report, Kathmandu, Nepal

NRB (2009) *Exchange Rate for US Dollar*. Quarterly Economic Bulletin 44(3): 96

Parikh, RF (1998) 'Poverty and environment: turning the poor into agents of environmental regeneration', Working Paper Series WP 1, Social Development and Poverty Elimination Division, UNDP, Kathmandu, Nepal

Richards, M. (1999) 'Internalizing the externalities of tropical forestry: a review of innovative financing and incentive mechanisms', European Union Tropical Forestry, Paper 1, Overseas Development Institute, London

Shyamsundar, P. (2008) 'Decentralization, Devolution and Collective Actions - A Review of International Experiences,' in Ghate, R; Jodha, NS; Mukhopadhyay, P (ed), *Promise, Trust and Evolution: Managing the Commons of South Asia*, New York: Oxford University Press, 70-98

Skoufias, E (1994) 'Using shadow wages to estimate labor supply of agricultural households', *American Journal of Agricultural Economics* 76(2): 215-227

Thapa, PJ (2003) *Modeling the Efficiency of Family and Hired Labor: Illustrations from Nepalese Agriculture*. Hampshire: Ashgate Publishing Limited

Thompson, RH (2000) 'Assessment of the impact of HLFFDP on participating households from the household survey data 1994-99', Internal Document of FAO - TA/HLFFDP, FAO, Kathmandu

UNDP (2004) *Nepal Human Development Report 2004*. United Nations Development Program, UNDP Nepal, Kathmandu

Vedelde, P; Angelsen, A; Bojö, J; Sjaastad, E; Berg, GK (2007) 'Forest environmental incomes and the rural poor', *Forest Policy and Economics* 9(7): 869-879

World Bank (1998) 'Poverty in Nepal at the turn of the twenty-first century', Report No. 18639-NEP, Poverty Reduction and Economic Management Unit, South Asia Region, Available at http://siteresources.worldbank.org/INTPAME/Resources/Country-studies/nepal_pim.pdf [Accessed on May 27, 2009]

Tables

Table 1: Average Value of Forest Products by Kind of Biomass Sources (in NRs)

Biomass Sources	Main Forest Products	Other Forest Products	Annualized Value of Standing Timber	Total Value
All Biomass Sources (Public and Private)	11,269.5 (81.5)	596.1 (4.3)	1,970.6 (14.2)	13,836.2 (100.0)
Non-Private Forest Sources Only	5,361.9 (69.7)	363.4 (4.7)	1,970.6 (25.6)	7,695.9 (100.0)
LHF Sources Only	1,928.1 (47.0)	205.4 (5.0)	1,970.6 (48.0)	4,104.1 (100.0)

Note: Figures in parantheses are row percentages.
Source: Field Survey

Table 2: Descriptive Statistics of Variables

Variables	Descriptions	Mean	Std. Dev.	Min	Max
TIMETAKEN	Time taken to reach LHF plot in minutes	16.83	19.27	1	150
TIME_SQUARED	Square of time taken to reach LHF plot	653.83	1959.55	1	22,500
YEARSLHF_TENURE	Years of involvement in LHF	9.65	1.96	6	13
LHFPLOT_INDIVMGMT	LHF plot is managed by individual =1, by group=0	0.26	0.44	0	1
LHF_GROUPSIZE	Number of households in LHF group	6.38	1.37	4	10
GENDER_LHFMEMBER	Sex of LHF member is male=1, female=0	0.75	0.43	0	1
POORLHF_LANDQUALITY	Quality of LHF plot in scales of poorness ranging from 0-3.	0.33	0.60	0	3
EXCLU_PROBLEM_EXIST	Problem of exclusion exist=1, else=0	0.94	0.23	0	1
FAMILY_SIZE	Total family members in the household	6.52	2.62	1	18
PRIV_LAND	Total private landholding (agri and wasteland) in hectares	0.65	0.48	0	3.41
HHHEAD_LITERATE	Literacy status of household head (literate=1)	0.63	0.48	0	1
NONBIOMASS_INCOME	Total non-biomass income of household (NRs)	73,533.18	81,128.23	-20,465	842,140

Table 3: Determinants of LHF Biomass Income

	(1)	(2)	(3)	(4)	(5)
VARIABLES	**LHF_YIELD**	**LHF_YIELD**	**LHF_YIELD**	**LHF_YIELD**	**LHF_YIELD**
TIMETAKEN	-52.83***	-52.56***	-51.79***	-51.78**	-50.54**
	(19.87)	(19.94)	(19.68)	(19.76)	(19.57)
TIME_SQUARED	0.190	0.193	0.179	0.179	0.162
	(0.176)	(0.177)	(0.178)	(0.178)	(0.176)
YEARSLHF_TENURE	18.02	18.17	15.50	15.27	8.959
	(154.5)	(154.7)	(154.9)	(154.5)	(153.2)
LHFPLOT_INDIVMGMT	6,189***	6,194***	6,120***	6,121***	5,976***
	(911.6)	(911.9)	(895.9)	(894.7)	(902.6)
LHF_GROUPSIZE	119.8	124.9	128.3	128.2	119.1
	(152.6)	(155.0)	(153.2)	(153.4)	(152.1)
GENDER_LHFMEMBER	-929.7	-946.4	-918.1	-917.5	-863.5
	(617.6)	(625.1)	(611.9)	(613.9)	(615.6)
POORLHF_LANDQUALITY	-589.7**	-582.6**	-629.7**	-630.1**	-610.7**
	(262.2)	(264.8)	(266.5)	(268.0)	(268.0)
EXCLU_PROBLEM_EXIST	-1,187	-1,186	-1,209	-1,209	-1,209
	(839.1)	(838.0)	(834.3)	(835.8)	(833.0)
FAMILY_SIZE		25.43	60.34	60.47	32.25
		(53.55)	(58.57)	(58.86)	(61.22)
PRIV_LAND			-608.9*	-608.2*	-722.0**
			(316.7)	(315.7)	(324.3)
HHHEAD_LITERATE				-10.49	-87.74
				(253.6)	(253.6)
NONBIOMASS_INCOME					0.00335
					(0.00279)
Constant	4,346**	4,148**	4,349**	4,356**	4,516**
	(1,847)	(1,965)	(1,978)	(1,957)	(1,952)
Observations	508	508	508	508	508
R-squared	0.458	0.458	0.462	0.462	0.465

Table 4: Socio-economic and Forestry Indicators of the Study Districts

Indicators	**Nepal**	**Makwanpur**	**Kavre**
Life expectancy at birth	60.98	55.75	69.33
Adult literacy	48.6	58.0	56.1
Female adult literacy	39.4	32.2	41.7
Mean years of schooling	2.75	2.33	2.60
GDP per capita in PPP	1,310	1,836	1,572
Human Development Index (HDI)	0.471	0.479	0.543
Human Poverty Index	39.6	35.3	33.5
Land under forest cover	29	59.1	32.1
Shrub land (degraded forest)	10.6	2.0	20.4

Source: Nepal Human Development Report, 2004 (UNDP, 2004), CBS, 2006

Figure

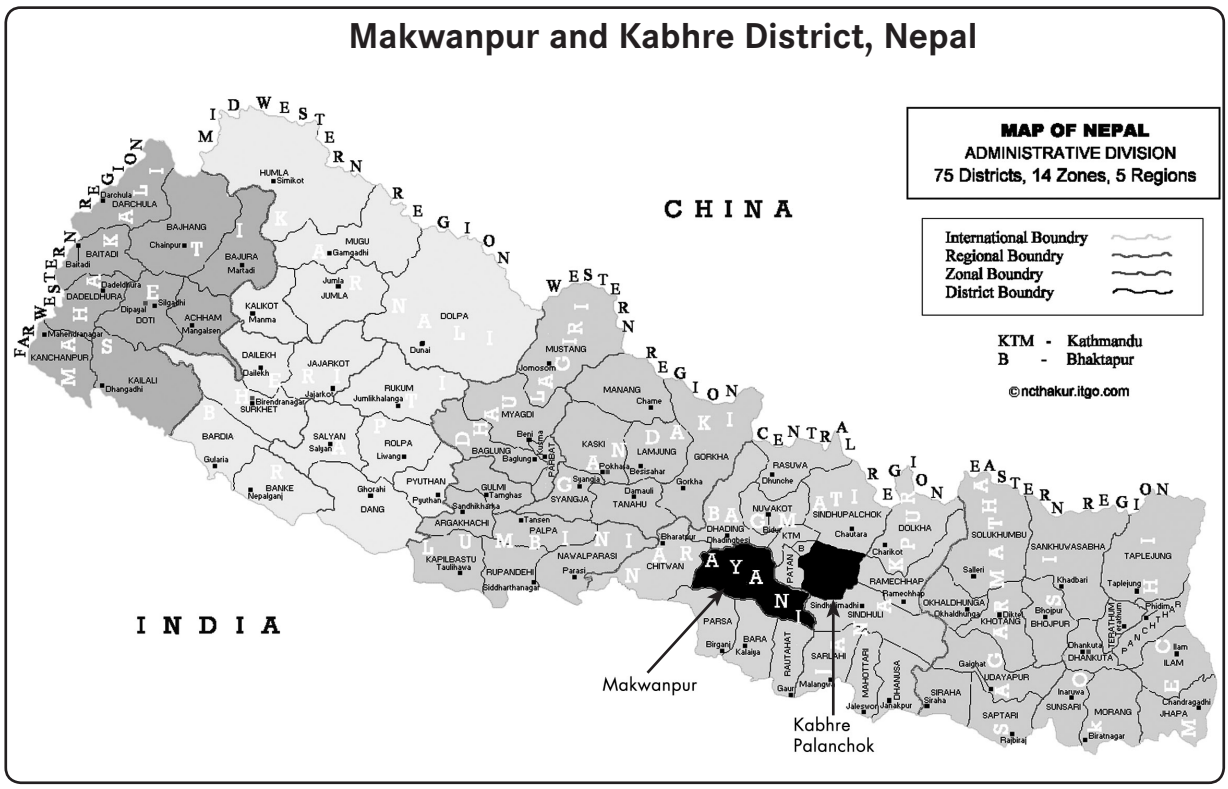
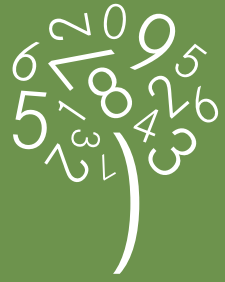


Figure 1: Map of Study Districts



SANDEE

P.O. Box 8975, E.P.C 1056, Lalitpur, Nepal

Street address: c/o ICIMOD, Khumaltar, Lalitpur, Nepal

Tel: 977 1 5003222**, Fax:** 977 1 5003299**, Email:** info@sandeeonline.org **Web:** www.sandeeonline.org

SANDEE Sponsors

ICIMOD IDRC CRDI Norad Sida

This work is licensed under a
Creative Commons
Attribution – NonCommercial - NoDerivs 3.0 License.

To view a copy of the license please see:
http://creativecommons.org/licenses/by-nc-nd/3.0/

This is a download from the BLDS Digital Library on OpenDocs
http://opendocs.ids.ac.uk/opendocs/

Institute of Development Studies