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Significant Contribution of Community Forests to Users' Household Income in Far-West Mid-Hill of Nepal

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Abstract: The study was carried out in three Community Forest User Groups (CFUGs) in Achham district of Nepal. This paper examines the benefits and costs incurred by three income class households (HHs) from Community Forest (CF) over a period of 10 years using semi-structured interviews with 212 randomly selected HHs and 3 sub-group discussions. The findings of the research reveal that the rich HHs derived the highest mean annual gross benefit (35.23%) followed by middle (32.47%) and poor (32.30%) income class HHs respectively. Likewise, rich HHs incurred the highest mean annual gross cost (49.82%) followed by middle (30.47%) and poor (19.71%) income class HHs respectively. Overall, benefits gained by the HHs was 17 times the cost incurred. While benefits from forest products constituted the highest share (97.26%) of benefits, conversely, forest product collection costs constituted the highest share (53.33%) of costs . The results of the research also suggest that rich HHs received the highest Net Present Value (US$ 2537.80) followed by poor (US$ 2504.11) and middle (US$ 2463.89) income class HHs over 10 years at 10% discount rate. The Benefit Cost Ratio for poor, middle and rich income class HHs was found to be 25.52, 16.32 and 11.14 respectively. Household level income from CF is significantly influenced by many bio-physical, economic and demographic variables. The analytical results suggested that education of HH head, distance to CF boundary from user's home, age of HH head, and HH economic status were statistically significant and showed the negative linear relationship wth HH income from CF. On other hand, livestock unit and HH labor force were statistically significant as expected *a priori* and showed linear relationship with HH income from CF. Based on these findings, appropriate cost-benefit sharing mechanism were suggested with regular silvicultural operations to empower poor households in CF activities.

Keywords: Community Forest, Benefit, Cost, Benefit-Cost Ratio, Household Level, Wealth class, CF management, Mid-hill, Determinant of CF income

1 INTRODUCTION

Community forestry, recognized as the most successful participatory approach and a new development initiative of Nepal's forestry sector in rehabilitant forest condition and improving regeneration (Branney & Yadav, 2009, 2009; Gautam, Webb, Shivakoti, & Zoebisch, 2003; Mahapatra, 2000; Springate-Baginski, Soussan, Dev, Yadav, & Kiff, 1999), is defined as a process of delivering the authority of protecting and managing local forests to the local communities for fulfilling their subsistence needs of forest products in sustainable basis (Kanel, 2004). It is also a means of social mobilization and livelihoods of rural people (Pokharel & Nurse, 2004). (Gilmour & Fisher, 1991) defined as community forestry was perceived as a control and management of forest resources by the rural people who use them from the past especially for domestic purposes and as an integral part of farming systems of the agrarian community.

Community-Based forest management (CBFM) initiated with the evolution of National Forestry Plan (1976), was further prioritized by formulating CBFM policy framework- 'Panchayat forest and Panchayat Protected Forest rules and regulation 1978, Master Plan for the Forestry Sector 1986, Forest Act 1993, Forest Regulation 1995 (Don Gilmour, 2003). As

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mentioned in (MPFS, 1989), it identified the six primary and six supporting programs, which formalized the concept of community forestry that has been initiated in the local level since the late 1970s and later on Forest Act, 1993 and Forest Regulation, 1995 legitimated the community forestry then extensively waved and spread the program across the middle-hills (Don Gilmour, 2003).

As reported by DFRS/FRA (2015), the Forest area covers the 5.96 million ha (40.36%) and the other wooded land (OWL) 0.65 million ha (4.38%) in Nepal, where 3.56 million hectares forests has been taken as potential area for community forest (MPFS, 1989). By the end of Fiscal Year (FY) 2015/016, the 1.81 million ha (about 29% of the total forest area) of national forests have been handed over to 19361 Community Forestry User Groups (CFUGs) benefited 2461549 households (DOF, 2017). Similarly, by the end of fiscal year 2016/017, 41245.10 ha of national forests have been handed over to 396 CFUGS, which is about 38% of the total forest land area of the district, benefited 62757 households (some repeated HHs) (DOF, 2017).

As reported by (Bhattarai, 2012; Gilmour, O'Brien, & Nurse, 2005; Kanel & Niraula, 2004), (Graner, 1999) , in the hills of Nepal, forests are the vital component of Nepalese farming system and play a significant role in livelihood of rural households. Timber, poles, fuelwood, fodder, ground grass, leaf-litter, various types of Non-timber forest products (NTFPs) are the direct tangible benefits and employment opportunity, income generation activities, land allocation to pro-poor households, material support etc. are tangible indirect benefits derived from their community forest (CF) and the forest products use pattern from community forests reflects the heterogeneous make-up of CFUGs (Malla *et al.,* 2002). whereas, rural households also contribute (costs) to community forests in many ways such that contributing voluntary labor in CF management activities, vigilance of forests, transaction costs, time spent in protection from fire and so on.

Graner, (1999) described that the following three main patterns of CF benefits derived by different income class households in the Middle hills: (i) for most households, agriculture is the primary activity, based on the ownership of small terraces of irrigated and/or un-irrigated farmland; middle-class households commonly have land-holdings and cattle, but only modest private tree resources and grazing land and they tend to be heavily dependent on inputs to their farming systems from common forest land. (ii) Poor and landless households depend on non-land based activities such as laboring, artisanal work and NTFP collection. To pursue these they have specific needs from the forest distinct from the other wealth-rank groups; such as charcoal for blacksmithing, and fuel wood and medicinal plants for use and sale. (iii) Rich households may supplement farming with incomes from local businesses or service employment and often have land outside the village and may spend only part of the year in the hills. They commonly have more irrigated land as well as un-irrigated land holdings; extensive on-farm tree resources, grazing land; private forest and a substantial number of livestock.

There are two schools of thoughts about community forestry regarding who benefiting more from CF and role of CF in poverty alleviation. Several studies have mentioned that the poor are deprived of getting benefits from community forestry (Banjade *et al.*, 2006; Pokharel & Nurse, 2004; Upreti, 2000). In practical base, after handed over the national forest as CF, it has the limited access to the poor and marginalized segments through change in property rights structures, so CF so far has not able to contribute significantly in improving to the livelihood of poor and marginalized fraction due to strict control (Adhikari, 2002). Similarly, Malla (2001); Neupane (2003); Timsina (2002) also argued that the decision-making forum dominated by elites, CF has dominance of elites and has not been able to provide equitable sharing of benefits among the marginalized segments of the society. Their presence is simply physical without meaningful voicing and expectations. There is growing concern about whether forest resources are acting as safety nets or poverty trap (Ghimire, 2007). Graner (1999) also noted in similar way that Community forestry has been criticized as a 'poor policy for poor people'. Whereas some other studies have argued that the CF play a positive contribution on life support system of the rural poor resulting play a crucial role in poverty reduction (Bartlett & Malla, 1992; Chhetri & Pandey, 1994; D. R. Dahal, 1994).

The poverty in the developing and underdeveloped countries of the world is endemic and Nepal can't stay beyond it. About 28.6% population is below the poverty line in Nepal whose intensity basically is more in remote and rural areas (NPC, 2018). The access of poor in fertile and productive land, natural resource, employment opportunities is minimal (NPC, 2017). Approximately 65.6 % of the total population of Nepal depends on subsistence farming and agriculture, livestock husbandry and forestry are the integral components of the Nepalese farming system (Deshar, 2013). As explained by (Dhungana, Pokharel, Bhattarai, & Ojha, 2007), although all the community based forest management modalities (such as community forest management, collaborative forest management, buffer zone community forest management, conservation area management, participatory watershed conservation, etc.) have resulted in a positive impact at the landscape level and social capital formation at the group level, but critics have pointed out that the contributions have been captured by local elites and have not dropped down to extremely pro-poor, consequently realization to recognize the need to modify the management approach from group approach to household approach.

In Nepal, limited studies have been quantified the economic value of benefits derived from community forests and the household level inputs, labor and time allocation as costs attributed to forestry activities, in addition, none of such studies are commenced in the study area yet. There is a lack of studied regarding disaggregated analysis of the benefits receiving by individual household, especially community-based management (Maharjan *et.* al 2009). Richards *et.* al. (1999) stated that a quantitative assessment of product flows and values to different households is an important aid in designing effective project and policy interventions. Thus, the main objectives of this paper are (i) to value the direct benefits derived from CF and inputs/costs associated to CF management contributed by users' households in monetary terms and (ii) to analyze the Benefit-Cost Ratio (BCR) of CF management over a ten years' time horizon cash flow incurred by CFUG households. Being the community of the study area is agrarian society, they rely on forest resource since their existence. Later on, they are managing community forest as a component of livelihood linking with subsistence economy. But, no any economic valuation regarding benefits derived from CF as well as contribution of them to CF yet. In this context, the paper focused on valuation of direct benefits and costs incurred by users' households, assessment of determinants of CF income (benefits) and analysis of BCR of CF management, whether it is economically viable or not to users' household level for long term.

Therefore, to evaluate the economic viability of CF management to household level, some particular measures of cost-benefit analysis, also known as benefit-cost analysis, were adopted. Cost-benefit analysis (CBA) is a way of assessing the consequences of public projects and reforms, in which the estimated benefits (income) are weighed against the costs (inputs). For this purpose, all consequences must be measured in the same unit, and the traditional choice of unit is money (Buncle *et al.*, 2013; Nyborg, 1996). Drèze & Stern (1987) provided a standard reference for the theory of CBA. As they pointed out the two basic ingredients of CBA are the ability to predict consequences (a model) and the willingness to evaluate them (an objective function). CBA may be used at a number of points during the life of a project, or the 'project cycle' (Lal & Holland, 2010). CBA uses willingness to pay to measure benefits and opportunity cost to measure costs. The opportunity cost of resources is their value in the alternative use to which they would have been put (Harrison, 2010).

2 METHODS AND MATERIALS

2.1 The Study Area

The study was commenced in the three CFs (*Timilsen, Listigadh and Ghogeran* CF) of Achham District in Far-Western region of Nepal and selected based on time of tenure rights of CFUG, existence of socio-economic heterogeneity in CFUG, matching the geographical cluster of the district and activeness in Community Forest Operational Plan (CFOP) implementation through rigorous consultation with DFO staffs as presented in Figure 1, where the Community forestry program has been practiced since the Fiscal Year 1992/093 as priority program. Out of the total area of the district, forest land covers 57.95%, other wooded land (tree cover of 5-10%: 5.59% & shrubs: 0.43%) occupies 6.02% and other lands occupies 36.04% (DFRS/FRA, 2015). Almost all national forests nearby settlement have been handed over as CFs and managed by CFUGs continuously since more than two decades. By the end of the Fiscal Year of 2016/017, the 396 community forests having the total area 41245.10 ha have been handed over to CFUGs (DFO, 2017).

As mentioned in Timilsen Community Forest Operational Plan (CFOP, 2015) and (DFO, 2017), Timilsen CF is situated at an altitudinal range of 500-2200masl. It lies in ward number 4 of *Bannigadhi Jayagadh* Rural Municipality in Achham district, far-west Nepal. It has an area of 199.57 ha, handed-over as a CF to CFUG in 1993 benefited 304 HHs. The major castes in CFUG are Brahmin, Kshetri and Dalit. The major tree species found in CF are *Pinus roxburghii*, hill Sal (*Shorea robusta*), *Madhuca indica* and *Alnus nepalensis*, dominated by *Pinus roxburghii*, the sub-tropical coniferous forest type. The major NTFP found in CF is Timur (*Zanthozylum armatum*) and pine resin.

Listigadh CF is situated at an altitudinal range of 700-1800masl. It lies in ward number 1 of *Mangalsen* Municipality in Achham district, far-west Nepal. It has an area of 184.32 ha, handed over as a CF to CFUG in 2005 benefiting 79 HHs. The major castes in CFUG are Kshetri, Janajati and Dalit. The major dominated tree species found in CF is *Pinus roxburghii,* and other sub-species are hill Sal (*Shorea robusta*), *Alnus nepalensis*, Quercus spp., dominated by *Pinus roxburghii*, the sub-tropical coniferous forest type. The major NTFP found in CF is Timur (*Zanthozylum armatum*), small bamboo (*Arundinaria strictus*) and *Cinamomum tamala* (CFOP, 2011, (DFO, 2017).

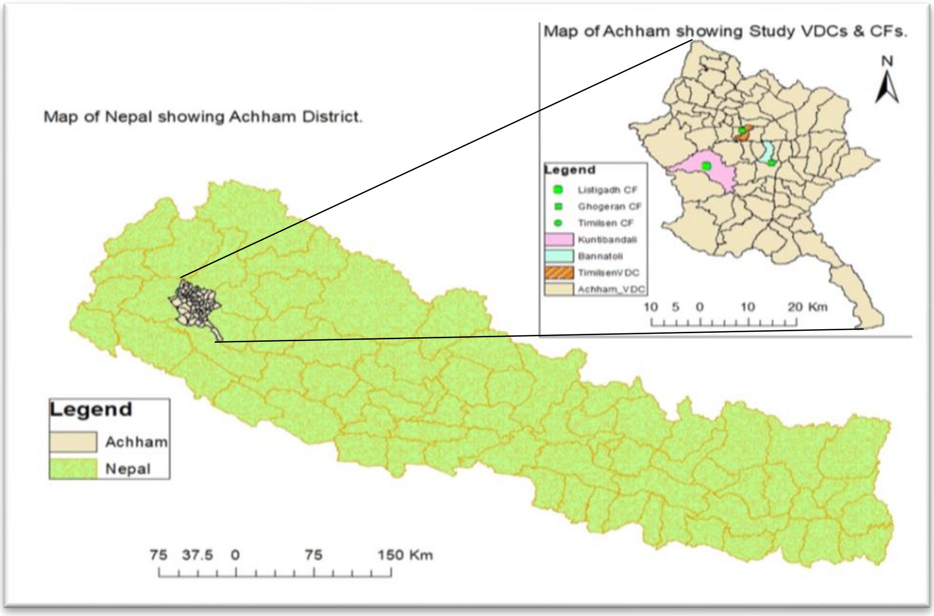


Figure 1: Location Map of Study Area and CFs.

Similarly, Ghogeran CF is situated at an altitudinal range of 1400-2200masl. It lies in ward number 12 of *Mangalsen* Municipality in Achham district, far-west Nepal. It has an area of 125.31 ha, handed over as a CF to CFUG in 1997 benefiting 141 HHs. The major castes in CFUG are Kshetri, Thakuri and Dalit. The major tree species found in CF are *Quercus* spp. *Alnus nepalensis*, *Rhododendron arboreum* and associated species in some blocks is *Pinus roxburghii*. It bears the lower temperate forest type. The major NTFP found in CF are Timur (*Zanthozylum armatum*), Sugandhawal (*Valeriana wallichii*), Nepali dalchini (*Cinamomum tamala*) and *Asparagus* spp. (CFOP, 2014, (DFO, 2017).

2.2 Methodology

Households of CFUG were taken as a research unit, where total 212 households from 3 CFs were taken as a sampled households following the Cochran's (correction) sample size formula with 95% confidence level, ±5% precision and maximum possible proportion 0.5 (Cochran, 1977), which represents the 40% of the total population size (N= 524).

Participatory wealth-ranking exercise, which is a useful tool for the grouping of households according to their relative wealth status (Chambers, 1994), was done in each CFUG and the all CFUGs households were stratified into three wealth-ranked classes (strata), i.e. poor, middle and rich, basically based on multidimensional local criteria like food sufficiency, land-holding size, livestock unit and employment/job status of households as a major criterions (Dev, Yadav, Springate-Baginski, & Soussan, 2003; Richards *et al.*, 1999).

Among these strata, samples were randomly chosen with proportionate manner (Table 1)for households' survey to gather the *economic data* (gross income, production, land, livestock); *demographic information* (education, caste, sex, HH size, labor force of HH, age of household head) and *bio-physical information,* (i.e. direct benefits- Consumptive uses, derived from CF and contribution to CF management, i.e. inputs/costs, by user households for 10 years' time horizon, time taken to reach forest boundary, distance to local market, price of products of time series, labor wage of time series). In the absence of recorded information with CFUG, '*Memory Recall method*' (Richards, Maharjan, & Kanel, 2003) was adopted to gather time series data of subsistence forest products. Likewise, the key-informants' interview and key-informants' sub-group discussion was held with CFUGC members and different income class, especially key women of poor income class to determine/evaluate the price of agriculture products and barter value of non-marketed forest products in their locality respectively. Some households were migrated abroad, so were missed during sampling.

Table 1: Population size and proportion of stratified sampled HHs.

SN.	Name of CF	Population size (N)			Proportionate of sampled HHs in each wealth-ranked classes		
		Rich	Middle	Poor	Rich	Middle	Poor
1.	Timilsen CF	52	191	61	25 (**48**)	66 (**35**)	30 (**49**)
2.	Listigadh CF	8	26	45	4 (**50**)	10 (**38.5**)	18 (**40**)
3.	Ghogeran CF	13	51	77	5 (**38.5**)	23 (**45.1**)	31 (**40.3**)
	Total:	**73**	**268**	**183**	**34 (46.57)**	**99 (36.94)**	**79 (43.17)**

Note*: Value in parenthesis represents the percentage of HHs.*

In addition to primary data, some other necessary complementary data belonging to forest products used/sold/distributed have been compiled from CFOP, minute and other written documents of each CFUGs, DFO and District Agriculture Development Office (DADO).

2.3 Analytical Framework

2.3.1 Identification of direct benefits and costs of CF management

2.3.1.1 Components of household benefits

The benefits derived from forest for individual households are multiple in nature. The goods and services supplied by the forest ecosystem vary from direct use value, indirect use values (Costanza *et al.*, 1997) to non-use values (Hjortsø, Helles, Jacobsen, Kamelarczyk, & Moraes, 2006). But this study was focused on the direct use values (consumptive uses: marketed goods such as timbers, fuelwood and non-timber products, medicinal herbs and non-marketed goods such as ground grass, fodder, leaf-litters, dry pine needle, etc. for subsistence uses) that the users derived from the CF. Community forest users manage their forests basically for forest products which assist to improve their livelihood by using and selling them. Due to methodological complexity and time constraint, the research is not concentrate in indirect services. Thus, here in, basically four categories of direct benefits received by community forest users' households during CF management were taken into account as given below:

a) ***Benefits from forest management***: it includes the benefits (wage) primarily cash received by user's households participating in the CF management activities such as silviculture/tending operations, forest protection activities, forest development activities, grass planting activities and so forth.
b) ***Benefits from forest products***: it includes the values (monetary value) of used/collected/distributed forest products that are marketed goods such as timbers, poles, fuelwood, NTFPs mainly medicinal herbs, agriculture tools and non-marketed goods such as ground grass, fodder, dry leaf-litter, green leaf-litter, dry pine needle.
c) ***The CFUG support***: it comprises the amount of cash as well as material support received by users' households from CFUG fund for income generation activities (IGAs), educational support, sanitation support as well as forest products supplied free of charge by CFUG for any ritual functions (Rai, Neupane, & Dhakal, 2016).
d) ***Benefits from other activities***: it comprises the allowances received from the CFUG for participating in the meetings, trainings, workshops, general assembly, representation, patrolling and such transactions.

2.3.1.2 Components of household costs

Five different types of costs to CF were taken into consideration. The first was the *forest management costs* voluntarily contributed by households as a labor to CF which includes the costs of participating in silvicultural/tending operations like thinning, pruning, cleaning, weeding and the forest protection costs, fire line construction/maintenance, firefighting and plantation activities. The second was *forest products collection costs* which was paid to the CFUG to get access to collect the products like timber, poles, firewood, grass, fodder, leaf-litters, agriculture tools and other NTFPs as well as product processing costs. The third one was the *transaction costs* which include the cost of CFOP preparation, forest monitoring/patrolling, monthly meeting, general assembly and representation. These costs arise during the course of development and implementation of the CFOP and CFUG constitution when forest users exercise their exclusive rights over common property resources (Adhikari & Lovett, 2006) . The fourth category was the *annual membership* costs paid to the CFUG to become a new member or renewed as a member by household. The fifth was *cost of materials (tools)* that households use for forest management and development activities. It comprises the purchasing, transportation and maintenance costs of tools.

2.3.2 Valuing the household direct benefits and costs from CF

2.3.2.1 Calculation of households' direct benefits (income) from CF

To estimate the gross economic value (gross income) of different forest products, the market price of successive years and barter-value method adopted by (Bhim Adhikari, 2003; Godoy, Lubowski, & Markandya, 1993; Richards, Kanel, Maharjan, & Davies, 1999) were used in the study.

Marketed products: timbers (m^3) firewood (*bhari*), agriculture tools (No.), charcoal and other NTFPs, basically medicinal herbs (Kg), the benefit (monetary value) of used/harvested/distributed forest products derived by households annually was calculated by through local market price. In case of non-marketed products, known as subsistence products such as ground grass, fodder, dry leaf-litter, green leaf litter, dry pine needle, small bamboo (*Nigalo*) (*Arundinaria strictus*), was calculated adopting the barter-value approach. In order to perform the barter game method, a sub-group of key-informants drawn from rich and poor wealth class households especially women (Richards *et al.*, 2003) were divided into two sub-groups, i.e., buyers and sellers, for discussion as a buyers and sellers for exchanging grass, fodder, leaf-litters, dry pine litter and small bamboo with a local commodity, that is maize, which has a well-known market value (Richards *et al.*, 1999). In this exercise, buyers were given a bag of maize and the sellers were given a fixed unit back load (*bhari)* of grass, fodder, leaf-litters, dry pine litter and a bundle (*bhari*- 80-100 pieces) of small bamboo. The participants were asked to discuss within their sub-group to fix the quantity of maize they deserved in exchange for these forest products in different season, i.e. dry and wet season. The barter game is a participatory contingent valuation method which has been used in a study of NTFP extraction in Bolivia (Vallejos, Cuèllar, Ayala, & Ramos, 1996). Then averaging the all estimates, a single barter value of non-marketed forest products was estimated for each time period. For this purpose, average price of maize of different time period was used.

To get the gross total monetary value of forest products of sampled households for each income class, all the items of gross economic value from different forest products were added in each case. The gross total value (benefit) obtained by households were quantified and averaged to represent the gross economic value or benefit per household for each wealth class households of each time period.

2.3.2.2 Calculation of households' direct costs (contributions) to CF

As stated by (Rai *et al.*, 2016), the costs of households' contributions to CF are estimated either in monetary terms, if they are paid in cash (for example, annual membership fees) or in time value when the voluntarily contribution is in terms of labor, i.e. participation in forest management activities like thinning, pruning, cleaning, firefighting, plantation and monthly meetings, CFUG constitution and CFOP preparation/revision, general assembly, representation and so on. Both travel (time to reach the program venue from participants' houses) and actual time spent (during of participation in the particular activities) were included in the estimation. In this situation the time value of costs was calculated adopting the opportunity cost of time spent by those households voluntarily in forest management (silvicultural/tending operations), forest protection (firefighting, illegal felling) and forest development (plantation, fireline construction/maintenance) activities as well as transaction activities (CFUG constitution and CFOP preparation/revision, monthly meeting, general assembly, monitoring, representation, forest patrolling etc.) activities. Although the opportunity cost of time may vary across individuals in the society, in the analysis, the opportunity cost of time for silvicultural/tending operations was assumed to be 47% of the local market wage rate based on the estimation proposed by (Rai & Scarborough, 2013, 2015),. Similarly, the cost of contribution by households to CF for forest protection, forest development and transactions activities was determined by using average local wage rate per man-day of study area for different time horizon (Adhikari, 2003; Dahal, 2009). According to the local condition averagely 8 hours is reported as a one day working hour.

In case of households' contribution directly paid in terms of cash and/or materials (grains in two seasons), the costs were determined as per actual paid amount by the users' households to CFUG in each time period to get access for forest products collection such as paying for timbers, poles, fuelwood, agriculture tools, other NTFPs as well as hired labor for conversion or collection, wage of forest watcher and membership fee.

To get the gross total costs of sampled households for each income class, all the items of gross cost structures were added in each case. The gross total costs incurred by households were quantified and averaged to represent the gross costs per household for each income class households of each time period. The self-labor of users' households to collect forest products was not considered as a cost in this study.

2.3.3 Benefit-Cost Analysis

Cost-benefit analysis (CBA), also called Benefit-Cost Analysis (BCA), is a systematic process for identifying, valuing, and comparing costs and benefits of a project (Buncle *et al.*, 2013), (Buncle *et al.*, 2013; CASA, 2007), i.e. CF management in our case. It is an economic decision tool to organize the information about project costs and benefits, and to determine the cost efficiency of investment for enhancing private and public welfare. To evaluate the efficiency (net gain and/or loss) of CF management in terms of economic valuation, the household level benefit-costs analysis (BCA) was regarded as an analytical tool assuming that the CF management as a long term project. CF management is a long-term process with risk and uncertainty resulting both cash inflow (all benefits and potential benefits items treated as inflows) and outflow (all expenditures and potential expenditure items, time spent as labor force treated as outflows) throughout the management period. Therefore, it was needed to have a fixed timeframe for the BCA. For this study, the latest 10 years' time horizon (i.e. 2008 to 2017) data were taken for analysis, which was gathered from CFUGs records and household questionnaire survey through '*memory recall method*' (Richards *et al.,* 2003). The cash flow for the given period was compounded to reflect present values (PVs) of benefits and costs using the 10% discount rates considering 2017 as a base year. As stated by Harrison, the choice of an appropriate discount rate is also an important step in the NPV analysis (Harrison, 2010). Similarly, as defined by Asian Development Bank (ADB), there are significant variations in public discount rate policies practiced by countries around the world, with developing countries, in general, applying higher social discount rate (SDR) (8% to15%) than developed countries (3% to 7%), whether the current practice of applying a uniform SDR of 10% to 12% to all development projects in all countries is still appropriate in a changing world (ADB, 2013). On the other hand, the three Asian developing countries surveyed (India, Pakistan, and Philippines) follow the social opportunity cost of capital (SOC) approach and apply a much higher rate, in the range of 12 to 15%, and the People's Republic of China uses 8% (ADB, 2013). (Harrison, 2010) also reported that in the absence of further information, 8% is a reasonable default discount rate. Thus, more consideration should be given to the choice of an appropriate rate- such as the risk characteristics of the project (i.e. how costs and benefits vary with the state of the economy). Project flows that are more sensitive to market returns and other factors should have a higher discount rate, while projects that are less sensitive should have a lower one.

In this way, the present value (PV) of direct benefits and costs of CF management was calculated through compounding with above mentioned discount rate. The PV of benefit and costs with discounting/compounding was valued by using following the formulae as proposed by (CASA, 2007) for each socio-economic class.

$$\text{Present Value of Benefits (PVB)} = \sum_{n=0}^{N} B_n\,(1+r)^n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (1)$$

$$\text{Present Value of Benefits (PVC)} = \sum_{n=0}^{N} C_n\,(1+r)^n \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (2)$$

Where,
B = Total benefit in year "n" expressed in constant dollars;
n = Year of cash flow
N = Evaluation period in Years (10 years);
C = Total cost in year "n" expressed in constant dollars;
r = Discount rate;

As stated in (CASA, 2007), there are a number of alternative criteria for the assessment of the economic value (net economic worth to society) of projects. Whilst there are number of criteria available, it is recommended that Net Present Value (NPV) be viewed as a preferred decision criteria for BCA. NPV is perhaps the most straight-forward BCA measure. It was estimated as follows:

$$NPV = PV_{Benefits} - PV_{Costs} \ldots\ldots \ (3)$$

Using NPV as a decision rule, a project is potentially worthwhile/viable, if the NPV is greater than 0; i.e. the total discounted value of benefits is greater than the total discounted costs (CASA, 2007).
Again, as stated in(CASA, 2007), another decision criteria for BCA is the benefit-cost ratio (BCR). The BCR is the ratio of the present value of benefits to the present value of costs, which was determined to evaluate the efficiency of CF management using the following formula:

$$BCR = \frac{PV_{Benefits}}{PV_{Costs}} \ldots\ldots\ldots\ldots(4)$$

A project is potentially worthwhile if the BC ratio is greater than 1. This means that the PV of benefits exceed the PV of cost(CASA, 2007).

2.3.4 Determinants of Community Forest Income: multiple linear regression model specification

Forests play a significant role to household income which effects on livelihood of households. The community forest income depends upon the various bio-physical, socio-economic and demographic components which may effect on total income from CF. An econometric model was developed to understand the predictive power of the independent variables on the dependent variable, i.e. community forest income. Therefore the following statistical model was proposed to determine the relation between community forest income (Explained variable) and others explanatory variables.

CF income (CF_INC) = ∫[Off-farm income(OFINC), Education of Household Head (EDUC), Walking Distance from home to forest boundary (DIST), Size of community forest (SCF), Land Holding Size (LAND), Livestock Size/unit (LSU), Labor Force in Household (LFHH), Age of Household Head (AGE), Socio-Economic Status of Household (SES), Community Forest User Group Economic status (CFUG_ES)].

Symbolically,

$$Y_i\ (CF\_INC) = \alpha_0 + \alpha_1 OFINC + \beta_1 EDUC + \alpha_2\, DIST + \alpha_3\, SCF + \alpha_4 LAND + \alpha_5 LSU + \alpha_6 LFHH + \alpha_7 AGE + \gamma_1 SES_1 + \gamma_2 SES_2 + \delta_1 CFUG\_ES_1 + \delta_2 CFUG\_ES_2 + \mu_i \ldots\ldots\ldots\ldots (5)$$

Where,

Y_i (CF_INC.)	= Percent of gross forest income; i.e. Explained variable.
α_0	= intercept parameter or constant coefficient/value.
$\alpha_1, \alpha_2, \alpha_3, \ldots \alpha_7$	= are the regression coefficients of the respective variables which significance will be tested, such as X_1, X_2, X_3,….., X_7 respectively.
β_1	= regression coefficients of the education of HH head (0, < high school; otherwise 1; dummy);
γ_1 & γ_2	= regression coefficients of the socio-economic status of HHs. (Rich, Middle, Poor; dummy)
δ_1 & δ_2	= regression coefficients of the community Forest User Group economic status (Rich, Middle & Poor community; dummy).
μ_i	= error term, (i.e. factors other than X that affect Y).

3 RESULTS AND DISCUSSION

3.1 Biophysical, demographic and socio-economic characteristics of Households

The following Table 2 shows the bio-physical and demographical attributes of the studied CF.

Table 2: Biophysical and demographic characteristics of studied CFs

Name of CF	Area (ha)	CF Handed-over date	No. of HHs	Forest area HH^{-1} (ha)
Timilsen CF	199.57	1993	304	0.65
Listigadh CF	184.32	2005	79	2.33
Ghogeran CF	125.31	1997	141	0.89

Source: DFO, Achham, 2016 & CFOPs.

As presented in (Table 2), Listigadh has more average spatial area per HH (2.33 ha HH^{-1}) followed by Ghogeran and Timilsen CF. But Ghogeran CF has the highest growing stock per ha (145.39 m^3) followed by Listigadh CF (136.31m^3) and Timilsen CF (73m^3) (CFOP, 2014, CFOP 2011 & CFOP 2015) respectively. As presented in (Figure 2), 84% of the respondents rely on agriculture as their major occupation followed by employees, teachers and others, however all HHs ultimately rely on agriculture, nevertheless agriculture alone could not sustain the annual food demand of households, therefore people rely on other economic activities. It depicts that the community of the study area belongs to agrarian society. The agrarian society heavily depends on forests, i.e. community forest in case of study area.(CBS, 2012) reported that about 99% HHs of the study area are dependent on fire-wood as a usual source of fuel for cooking, whereas the district average is 98%.

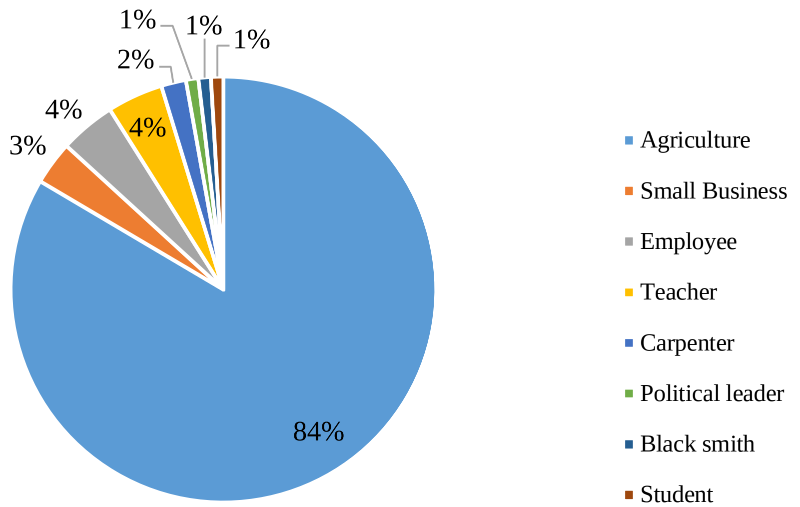


Figure 2: Occupation of Respondents (n = 212)

3.2 Users' Households and Forest Products Collection Trend from CF

The following (Table 3) and (Figure 3) show the major forest products collection/harvesting pattern from CF by different wealth class HHs. Although the amount of firewood does not vary greatly with respect to wealth class, the rich households collect higher amount of dry leaf-litters and dry pine needle, because they have more agriculture land and livestock, thus needed more compost manure and bedding materials, whereas poor households have less. The richer households collect more timber/pole as compared to poor households to construct houses, livestock shed house and so on.

Table 3: Mean annual quantity of major forest products collected per HH by different wealth-ranked category over a 10 years' time period.

Forest Products	Unit	Wealth-ranked category of HHs		
		Rich (n=34)	Middle (n=99)	Poor (n=79)
Timber & poles	Cu.ft.	4.00 (**6.78**)	1.61 (**3.61**)	1.02 (**2.30**)
Fire-wood	*Bhari**	75.09 (**33.11**)	74.27 (**28.27**)	73.56 (**25.60**)
Ground grass	*bhari*	55.24 (**79.24**)	59.28 (**76.79**)	66.72 (**89.40**)
Tree fodder	*bhari*	5.57 (**15.33**)	4.44 (**11.49**)	7.69 (**16.62**)
Dry leaf-litter	*bhari*	52.52 (**59.09**)	50.54 (**43.98**)	38.64 (**38.10**)
Green leaf-litter	*bhari*	0.44 (**2.57**)	5.26 (**19.39**)	3.89 (**15.04**)
Dry pine needle	*bhari*	21.11 (**24.15**)	17.05 (**23.18**)	10.87 (**18.21**)
Agriculture tools	No.	0.44 (**0.84**)	0.50 (**0.85**)	0.58 (**0.88**)
Nigalo (small bamboo)	Bundle**	0.04 (**0.18**)	0.05 (**0.19**)	0.25 (**1.26**)
Timur (*Zanthozylum* spp)	Kg.	0.62 (**2.51**)	0.13 (**0.41**)	0.20 (**0.45**)
Charcoal	*Doko****	0.0 (**0.0**)	0.05 (**0.05**)	1.22 (**6.25**)

** - represents a back-load with average weight of 30-35 Kg.* *Source: Field survey (2017)*
*** - represents a bundle on average of 80-100 pieces of small bamboo.*
**** - represents a back load on average weight of 10-15 Kg in bamboo basket.*
(..) - *Figures in parenthesis represent the standard deviation.*

As shown in the above (Table 3), rich households collected 3.92 times more and middle households collected 58% more timber and poles as compared to poor households. Rich households depended less on fodder and green leaf-litter because they partially managed those products from their private land as well as they owned less and productive livestock, but rich households collect more dry pine needle (21.11 *bhari*) for animal bedding, making compost and mulching as well as firing before cropping, especially uplands as compared to poor HHs (10.87 *bhari*). In contrast, poor households depended more on CF to collect ground grass, tree fodder and green leaf-litter because of their little or no private land parcels. Therefore, poor households collected more ground grass, tree fodder and green leaf-litters. Collection of tree fodder is not allowed for whole year, open only 1-2 months and/or during implementing silvicultural operations. Adhikari, Di Falco, & Lovett (2004) reported the similar result to their study and argued that better-off households collect higher amount of livestock related products. Similarly, the quantity of agriculture tools collected by HHs was nearly similar to all wealth class HHs year^{-1}, but the poorer households collected small bamboo (*Nigalo*) in higher quantity because they (some occupational households) make *dokos* (baskets) from *Nigalo* and sell those outside their group vicinity to earn money for their livelihood, nonetheless *Nigalo* found only only one CF, i.e. Listigadh CF. almost househodls collect timur as spice for their own use, but sometimes sell to village level trader for business purpose. Charcoal is collected by goldsmith and ironsmith for energy source to make agriculture tools and basically they belongs to poor wealth class HHs. The findings from this study on quantity of various forest products extracted and consumed by households concurs with study by (Bhattarai, 2012).

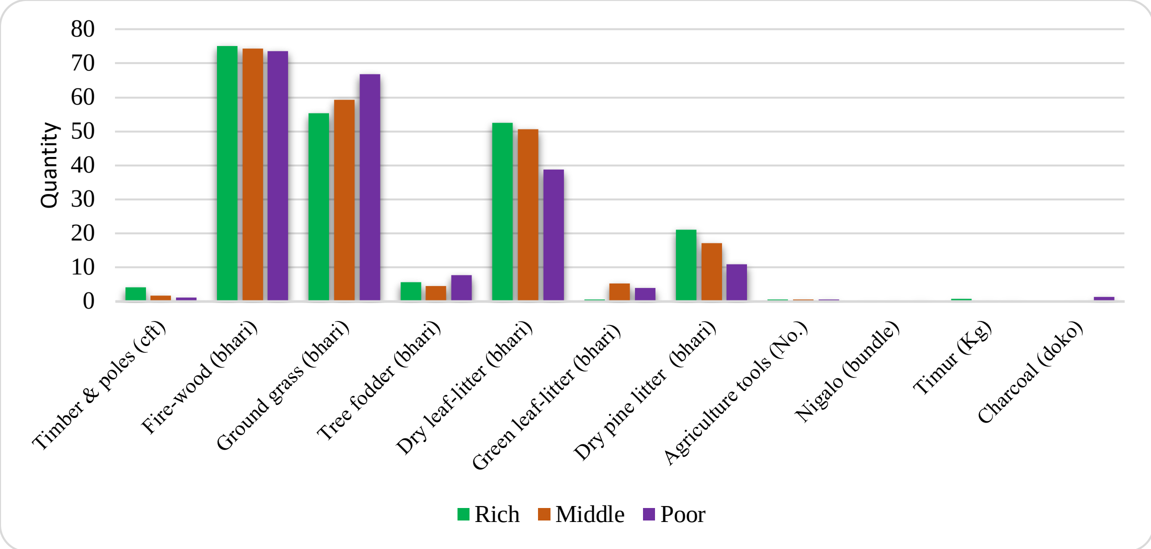


Figure 3: Mean Annual quantity of forest products collected by HHs over the 10 years from CF

Households' basic forest products requirements of firewood, ground grass, tree fodder, leaf-litters, dry pine needle, others NTFPs, charcoal, timber and poles are met as per defined in CFOP as well as decided by CFUG general assembly. Harvesting forest products, principally timber, is associated with silvicultural operations. Timber is harvested once in a year as per their need by removing dead, dying, and diseased and deform (4D) trees not exceeding the quantity prescribed in CFOP. Cutting of green wood is not allowed, only dry wood (dead branches, fallen twigs) from dead and fallen trees/poles is collected round the year in free of charge, especially for subsistence use but some poor households sold firewood in the local market for their livelihood.

Tree fodder collection primarily from *Quercus* species occurred at the end of dry season at which green grass/forage is not available for livestock and open only for 1 or 2 months. However, in Timilsen CF, it is restricted to collect tree fodder to improve forest condition. Grass is collected (both green and dry grass for forage) throughout the year in free of cost. Collection of dry leaf-litter (*Suko Syaula*), dry pine needle (*Salli kusum*) and green leaf-litter for animal bedding, mulching and making compost manure is an essential part of subsistence farming system. (Maharjan, 1998) stated that forest resources remain an integral part of farming system in the Mid-hills of Nepal and concerns on the sustainability of forests and farm systems are inseparable. Certain occupational castes such as Blacksmith and Goldsmith made charcoal in a certain season from dry and dead wood by paying certain charge, but making charcoal from green and standing trees is not allowed in all CFs (CFOP 2011, CFOP 2014 & CFOP 2015). Some studies reported that some occupational castes and poor households faced hardship who need a large quantity of firewood and charcoal to run their business (Springate-Baginski *et al.*, 1999). Almost households collected *Zanthozylum armatum* (*Timur*) from the CF averagely 0.16 kg year^{-1} HH^{-1} for subsistence use (spice) and few households for commercial purpose.

3.3 Direct benefits and costs incurred by users' household from CF

Forest products play a significant contribution to the total CF benefits of households. Amongst them ground grass, fuelwood and leaf-litter (both dry and green litter) share the higher proportion while timber/pole deserves the 4th position (1.3 -10%) in each year as shown in (Table 4), where pine is the major timber species. The similar argument was reported by (KC, Koirala, & Adhikari, 2015) in their study that firewood and fodder shared about 43% of each of the total forest products benefits. In contrast,(Rai *et al.*, 2016) stated that timber collected by users' households contributed by 43% of the total benefits from forest products, but the higher share seemed due to wood value, i.e. the major timber species is *Shorea robusta*, which is more valued than pine and others constructional timber.

Table 4: Annual Benefits HH^{-1} derived from forest products over 10 years (n = 212) (in US$)

Forest products	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
Timber/pole	4.50	10.33	4.38	2.05	11.69	8.60	12.51	19.86	8.86	9.61
Fuel wood*	29.78	28.45	33.01	48.24	38.31	48.46	60.30	66.07	78.17	104.96
Ground Grass	52.14	55.49	62.19	59.16	59.89	54.57	55.43	55.44	56.38	62.37
Tree Fodder	4.62	5.20	6.06	6.14	5.88	5.46	5.53	5.71	5.94	6.88
Leaf Litter (both)	28.82	32.74	37.12	35.57	37.24	34.24	36.14	35.55	36.53	41.98
Dry pine needle	4.09	5.20	4.11	6.19	6.59	6.38	6.88	7.36	7.79	8.71
Agriculture tools	1.17	1.31	1.52	1.63	1.60	1.95	2.24	1.92	2.45	2.05
Nigalo	0.06	0.07	0.09	0.08	0.21	0.21	0.21	0.24	0.09	0.09
Timur	0.09	0.10	0.08	0.09	0.08	0.08	0.07	0.19	0.69	0.64
Total:	**125.26**	**138.89**	**148.57**	**159.13**	**161.48**	**159.94**	**179.31**	**192.35**	**196.88**	**237.29**

Figures in parenthesis represents the percentage share of benefits from forest products. *Source: Field data, 2017*

**- Fuel wood represents the firewood plus charcoal.*

User's households derived direct benefits associated with Community Forest Management (CFM) from variety of sources as presented in (Table 5, 6 & 7). All CFUGs distributed forest products to their users, which contributed higher share to HHs of the total CF benefits. (Table 5, 6 & 7) show the share of benefits and costs incurred by households from different sources with respect to wealth class, where rich HH derived 97.78%, middle HH derived 97.76% and poor HH derived 96.39% share of total benefits from forest products followed by cash and material support by CFUG (1.93%, 1.65% and 2.65% respectively). But benefit from CF management activities deserve the 3rd position for rich and middle HH (0.28%, & 0.38%) followed by other benefit (0.01% & 0.21%), whereas other benefits deserves the 3rd position (0.69%) for poor HH followed by benefits from CF management (0.27%) over 10 years' time period. In aggregate, the share of forest products constitute 97.26% followed by cash and materials (2.07%), other benefits (0.35%) and benefits from CF management (0.32%) (Table 8). (KC, Joshi, & Aryal, 2014 & Rai *et al.*, 2016) have also found forest products as major benefits in their study which is in line with our findings. The poor HH derived the least benefit from CF management activities (0.27%) (Table 7), because, according to the response of some poor respondents, they were less or no informed by executive committee members in CF management activities, consequently less or no opportunity to participate in forest management activities. On the other hand, poor households benefited more from cash and material supports provided by CFUG (2.65%) as compared to rich (1.93%) and middle HHs (1.65%), because cash and material supports activities were focused to poor and marginalized groups and Community Forestry Development Program Guideline 2014 has mandatory provision to allocate at least 35% of the CFUG income in favor of poor and marginalized group (DOF/CFD, 2014). Regular expense done by CFUGs in such source is the verification of this claim shown in (Table 5, 6 & 7).

Table 5: Mean annual Benefits and costs of CFM HH^{-1} over 10 years by **rich** HH (n = 34) (in US$)

Description	**Components of Benefits/Costs**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total benefit**
Benefits	Benefits from Forest Products	130.79	128.03	145.38	165.47	180.09	154.03	176.52	262.21	205.72	283.85	**1832.08 (97.78)**
Associated	Benefit from CF management activities.	0.00	0.00	0.00	0.00	0.81	0.00	0.99	1.37	1.73	0.29	**5.18 (0.28)**
With	Cash & material support from CFUG	0.00	0.00	0.00	0.00	0.00	0.00	7.35	25.70	0.27	2.86	**36.18 (1.93)**
CFM	Other benefits	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.08	0.00	**0.23 (0.01)**
	Total:	**130.79**	**128.03**	**145.38**	**165.47**	**180.90**	**154.03**	**184.91**	**289.37**	**207.80**	**286.99**	**1873.67 (100)**
Costs	CF management cost	2.51	2.81	2.87	2.59	2.65	2.44	4.60	4.74	3.29	2.61	**31.12 (18.43)**
Associated	Forest products collection costs	12.61	1.96	3.75	0.17	27.44	1.57	4.27	22.34	20.19	15.29	**109.58 (64.88)**
With	Transaction cost	2.01	2.15	2.85	2.39	2.53	2.44	3.01	2.97	2.84	2.91	**26.10 (15.45)**
CFM	Annual membership fee	0.24	0.25	0.26	0.22	0.21	0.19	0.19	0.18	0.17	0.18	**2.09 (1.24)**
	Material cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.00 (0.0)**
	Total:	**17.37**	**7.17**	**9.72**	**5.38**	**32.84**	**6.63**	**12.07**	**30.23**	**26.49**	**21.00**	**168.89 (100)**

** - Figures in parenthesis represents the percentage share of benefits and costs of each source.*

Similarly, (Table 5, 6 & *7*) show the mean annual costs HH^{-1} for CF management incurred by users' household over a 10 years and share by source to the total costs within wealth class HHs. On average, *forest products collection cost* constitutes the highest proportion (rich: 64.88%, middle: 52.37% & poor: 42.65%) of the total costs contributed to CF by different HHs and it was due to the high conversion cost of timber (labor cost), that was US$ 0.34-0.38 ft^{-1}.

Table 6: *Mean annual Benefits and costs of CFM HH^{-1} over 10 years by* ***middle*** *wealth class HH* (n = 99) (in US$).

Description	**Components of Benefits/Costs**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total benefit**
Benefits	Benefits from Forest Products	120.84	148.36	145.90	162.40	156.77	160.29	195.26	174.20	192.38	231.43	**1687.83 (97.76)**
Associated	Benefit from CF management activities	0.00	0.08	0.00	0.00	0.00	0.57	0.98	2.13	1.81	0.94	**6.52 (0.38)**
With	Cash & material support from CFUG	0.00	1.37	0.00	0.00	0.00	3.67	3.99	13.53	5.82	0.17	**28.55 (1.65)**
CFM	Other benefits	0.00	0.00	0.00	0.00	0.00	0.00	0.36	2.94	0.35	0.00	**3.65 (0.21)**
	Total:	**120.84**	**149.80**	**145.90**	**162.40**	**156.77**	**164.53**	**200.60**	**192.80**	**200.36**	**232.54**	**1726.56 (100)**
Costs	CF management cost	2.39	2.63	2.71	2.52	2.36	2.49	3.74	3.90	3.42	2.65	**28.81 (27.90)**
Associated	Forest product collection costs	1.77	6.77	1.21	9.82	9.62	4.11	9.04	2.03	7.93	1.77	**54.07 (52.37)**
With	Transaction cost	1.37	1.42	1.76	1.52	1.82	1.80	2.09	2.08	2.14	2.39	**18.38 (17.80)**
CFM	Annual	0.23	0.24	0.25	0.21	0.20	0.18	0.18	0.17	0.16	0.17	**2.00**

	membership fee											**(1.93)**
	Material cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0 (0.0)**
	Total:	**5.75**	**11.06**	**5.94**	**14.07**	**14.00**	**8.57**	**15.04**	**8.18**	**13.65**	**6.99**	**103.25 (100)**

** - Figures in parenthesis represents the percentage share of benefits and costs of each source.*

The CF management costs constitute the 2nd position (18.43%, 27.90% & 34.02%) followed by transaction costs (15.45%, 17.80% & 20.65%) and annual membership fee (1.24%, 1.93% & 2.68%) within the rich, middle and poor household respectively. The overall CFM costs seem to be less in this study as compared to other similar studies, because most of the CF management activities were done with paid labor, not voluntarily, therefore, were not considered as costs contributed by HHs. In this context,(KC *et al.*, 2015) reported in the similar study, the CF management cost constitute the 86.84% of the total costs. In this study, in aggregate, as shown in (Table 8), the share of forest products collection costs constitute 53.33% following by CF management costs (26.86%), transaction costs (17.89%) and annual membership fee (1.93%). In the similar study, (Rai *et al.*, 2016) stated that the share of forest products collection costs was 91% of the total cost in average. Likewise, the share of costs of CF Operational Plan preparation was 3.82% and transaction costs was 2% of the total costs. The transaction costs in this study is seems to be little more, because the CF Operational Plan preparation cost also belongs to transaction costs.

Table 7: Mean annual Benefits and costs of CFM HH^{-1} over 10 years by **poor** wealth class HH (n = 79) (in US$).

Description	**Components of Benefits/Costs**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total benefit**
Benefits	Benefits from Forest Products	128.45	131.70	153.27	152.31	159.36	162.05	160.53	185.06	198.73	224.53	**1655.99 (96.39)**
Associated	Benefit from CF management activities	0.04	0.00	0.00	0.00	0.20	0.19	0.61	0.45	2.02	1.06	**4.57 (0.27)**
With	Cash & material support from CFUG	0.00	0.00	4.46	0.00	3.93	1.41	7.38	11.26	10.71	6.42	**45.56 (2.65)**
CFM	Other benefits	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.92	1.44	1.47	**11.84 (0.69)**
	Total:	**128.49**	**131.70**	**157.73**	**152.31**	**163.49**	**163.65**	**168.52**	**205.69**	**212.90**	**233.48**	**1717.95 (100)**
Costs	CF management cost	2.13	2.27	2.42	2.34	2.28	1.87	2.47	2.37	2.37	2.22	**22.74 (34.02)**
Associated	Forest product collection costs	1.28	1.31	1.77	0.77	7.24	2.21	1.56	8.27	3.21	0.88	**28.51 (42.65)**
With	Transaction cost	0.92	1.19	1.36	1.21	1.40	1.22	1.34	1.45	1.67	2.04	**13.80 (20.65)**
CFM	Annual membership fee	0.21	0.22	0.22	0.19	0.18	0.16	0.16	0.15	0.15	0.15	**1.79 (2.68)**
	Material cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.00 (0.0)**
	Total:	**4.53**	**4.98**	**5.78**	**4.52**	**11.11**	**5.46**	**5.53**	**12.25**	**7.40**	**5.29**	**66.84 (100)**

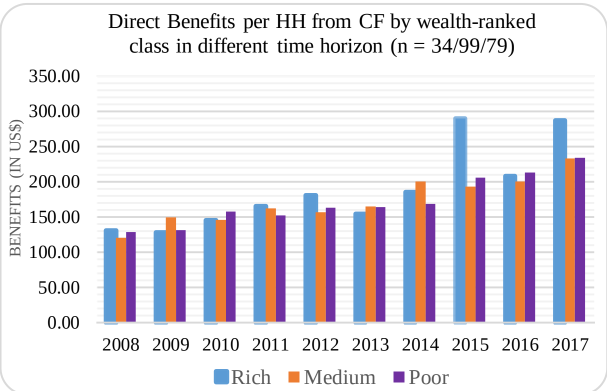
Figures in parenthesis represents the percentage share of benefits and costs of each source.

Table 8 and (Figure 4) show the trend of mean gross benefits derived from CF (Figure 4a) and mean gross costs contributed to CF HH^{-1} (Figure 4b) during 2008 to 2017's time period. The result depicts that amongst the wealth class, rich household derived the highest proportion of direct gross benefits (35.23%) and poor household received the lowest (32.30%). (Parajuli, Lamichhane, & Joshi, 2015) stated the similar result that rich households obtained the highest proportion of direct benefits (36.80%) and poor households received the lowest (29.70%). (Adhikari, 2003) also highlighted on average 85% of the common pool resource related income accruing to rich HHs, whereas poor HHs only 63% from livestock related forest products. The results also reveal that the economic benefits of households is much more in that year when they harvested more timber/pole from the CF (Figure 4a) and the cost is much more in that year when they engaged in silvicultural operations and fire protection activities (Figure 4b).

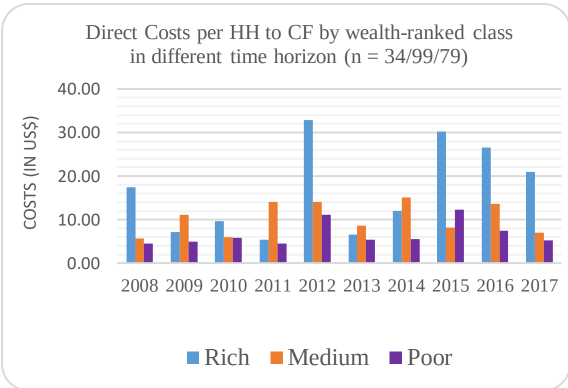
Table 8: Mean annual Benefits, costs and Net Benefit (NB) of CFM HH^{-1} $year^{-1}$ over 10 years' time period by wealth class (in US$).

Components of benefits/costs	Aggregate result (n =212)	Wealth-ranked category of HHs		
		Rich (n = 34)	**Middle (n = 99)**	**Poor (n = 79)**
Direct benefits				
Benefits from Forest Products	169.91 (97.26)	183.21 (35.40)	168.78 (32.61)	165.60 (31.99)
Benefit from CF management activities	0.56 (0.32)	0.52 (31.90)	0.65 (39.88)	0.46 (28.22)
Cash & material support from CFUG	3.61 (2.07)	3.62 (32.79)	2.86 (25.91)	4.56 (41.30)
Other benefits	0.62 (0.35)	0.02 (1.27)	0.37 (23.57)	1.18 (75.16)
Total:	**174.70 (100)**	**187.37 (35.23)**	**172.66 (32.47)**	**171.80 (32.30)**
Direct costs				
CF management cost	2.69 (26.86)	3.11 (**37.65**)	2.88 (34.87)	2.27 (27.48)
Forest product collection costs	5.34 (53.33)	10.96 (**57.02**)	5.41 (28.15)	2.85 (14.83)
Transaction cost	1.79 (17.89)	2.61 (44.77)	1.84 (31.56)	1.38 (23.67)
Annual membership fee	0.19 (1.93)	0.21 (35.59)	0.20 (33.90)	0.18 (30.51)
Material cost	0.0 (0.0)	0.0	0.0	0.0
Total:	**10.02 (100)**	**16.89 (49.82)**	**10.33 (30.47)**	**6.68 (19.71)**
Net Benefit (NB)	**164.68**	**170.48 (34.24)**	**162.33(32.58)**	**165.12(33.16)**

Source: *Field survey 2017 & derived from Table 5, 6, 7.*
Figures in parenthesis represents the percentage share of benefits and Costs by HH.



(a)



(b)

Figure 4: Trend of Benefits (a) and Costs (b) incurred from CF HH^{-1} over 10 years

Likewise, the results also show that rich households contributed the highest proportion of costs (50%) of the total cost as compared to poor HHs (20%). (Yam B Malla, Neupane, & Branney, 2003; Pokharel & Nurse, 2004) argued that poor member in the CFUG bear disproportionate cost of their involvement in CF which is a major issue for community forestry. Poor households contributed less in voluntarily labor because they move in searching the wage paid labor opportunities to join hand and mouth and for their livelihood. In contrast, (Parajuli *et al.*, 2015) reported middle category households contributed the highest direct costs (36.64%) following the rich category households (32.65%) and poor category households (30.71%). But the findings of this study are in line with (Adhikari, 2003; Dahal, 2009; Richards *et al.*, 1999) and mentioned that rich households derived the highest proportion of direct benefits and poor households received the lowest. This may be in this research because rich households harvested more timber/poles, leaf-litters, dry pine needle and *timur* as compared to poor households. But, in this study, rich households received the highest net benefit (34.24%) followed by poor (33.16%) and middle (32.58%).

3.4 Present Value (PV), Net Present Value (NPV) and Benefit: Cost Ratio (BCR) of direct benefits and costs incurred by users' household from CF

The (Table 9) summarizes the present value of total gross benefits (income), present value of total gross costs (inputs), net present value and BCR over the 10 years' time horizon (2008 to 2017) at 10% discount rate considering the 2017 as a base year. The findings report that, in aggregate, the PVB received by HH is US$ 2643.99. Categorically, the rich HHs derived more direct benefits (PVB US$ 2787.96) from CF followed by middle (PVB US$ 2624.68) and poor (PVB US$ 2606.23). Likewise, the benefit derived from CF by HHs was much higher than the cost associated with CF management. The result presented in (Table 9) shows that the rich HH contributed the highest total gross costs (PVC US$ 250.16) and the poor HH contributed the least (PVC US$ 102.12) to CF. This comparable data of direct benefits and costs incurred by different wealth class indicate that rich HHs had more involvement in the overall CFM activities and in contrary, poor HHs had least, primarily in voluntarily labor activities, consequently they incurred less gross costs.

Table 9: Present value of Benefits, costs, Net present value and BCR of CFM HH^{-1} by aggregate & wealth class at 10% discount rate over a 10 years' time period (in US$).

Description	Aggregate result (n = 212)	Wealth-ranked category of HHs		
		Rich (n = 34)	Middle (n = 99)	Poor (n = 79)
Present Value of Total Benefits (PVB)	2643.99	2787.96	2624.68	2606.23
Present Value of Total Costs (PVC)	153.29	250.16	160.79	102.12
Net Present Value (NPV)	2490.70	2537.80	2463.89	2504.11
Benefit-Cost Ratio (BCR)	**17.25**	**11.14**	**16.32**	**25.52**

Similarly, rich HHs gained the highest net benefits (NPV US$ 2537.80) followed by poor (NPV US$ 2504.11) and middle (NPV US$ 2463.89). It depicts that comparing the NPV, poor HHs are more benefited than middle from CF, but in reality, it may be due to less contribution (costs) incurred by poor HHs. Based on above (Table 9), the net present benefits HH^{-1} $year^{-1}$ in this study is greater than calculated by (KC *et al.*, 2015) (US$ 25.41) and (Karky, 2008) (US$ 46). (Parajuli *et al.*, 2015) calculated the net present benefit in their study as US$ 815.36, 494.23 & 287.12 of rich, medium & poor households respectively at 8% discount rate over 50 year time period. In contrary, poor income class households had negative (-4%) net present benefit (M.Dahal, 2009).

However, it was intended to find out the total benefits (income) and net benefits derived from CF by different wealth-ranked households are statistically differ or not and which pair of mean is not equal, one-way ANOVA and Bonferroni test was run in STATA 13 assuming the null hypothesis (H_0) of there is no significance difference in mean of total benefits and net benefits as well as pairs of mean is equal. The result presented in the (Table 10 & 11) depicts that the probable F (p-value) of total benefit and net benefit is greater than alpha level of significance (α)= 0.05 (prob. F=0.7564 & Prob. F = 0.9192 > 0.05 respectively), i.e. the null hypothesis in accepted. This suggests that there is no significant difference between mean of total benefits and net benefits derived from CF by different wealth class HHs. This means all HHs benefited equally statistically. Similarly, Benferroni test was run to find out the pair-wise comparison of mean amongst wealth-ranked category and as presented in (Table 12), p-value of all pair of mean is equal to 1.00 [p-value = 1.000 > α (.05, .01 or .1)], i.e. the null hypothesis is accepted. This suggests that all pairs of mean are equal, i.e. no one pair of mean is not different.

Table 10: Description of Analysis of variance (one-way ANOVA) of total benefits derived from CF by category (n = 212).

Source	Analysis of variance			F	Prob.>F
	SS	df	MS		
Between groups	$6.8836e^{09}$	2	$3.4418e^{09}$	0.28	0.7564
Within groups	$2.5733e^{12}$	209	$1.2312e^{10}$		
Total	$\mathbf{2.5802e^{12}}$	**211**	$\mathbf{1.2228e^{10}}$		

Table 11: Description of Analysis of variance (one-way ANOVA) of Net Benefits derived from CF by category (n = 212).

Source	Analysis of variance			F	Prob.>F
	SS	df	MS		
Between groups	$1.9677e^{09}$	2	983833075	0.08	0.9192
Within groups	$2.4394e^{12}$	209	$1.1672e^{10}$		
Total	$\mathbf{2.4414e^{12}}$	**211**	$\mathbf{1.1570e^{10}}$		

Table 12: Comparison of total benefits and Net benefit of households by category (Bonferroni test)

	Comparison of CF income by Category		Comparison of Net income by Category	
Row Mean Col Mean	**Middle**	**Poor**	**Middle**	**Poor**
Poor	-680.379 1.000	-	2611.78 1.000	-
Rich	15203.5 1.000	15883.9 1.000	8802.96 1.000	6191.18 1.000

As presented in the (Table 9), the aggregate BCR of CFM in this study is 17.25. Categorically, the BCR is 11.14, 16.32 and 25.52 of rich, medium and poor respectively. Our calculated BCR is higher with compare to study of (Dahal, 2009) (1.09, 1 & 0.81for rich, medium and poor respectively) conducted in 16 CFs of Bhojpur and Dhankuta district in Eastern Nepal,(KC *et al.*, 2015) (3.06) conducted in a CF of Nuwakot district in central Nepal at 12% discount rate,(K. C. *et al.*, 2014) (3.91) done in a CF of Syangja district in Western Nepal at 12% discount rate, (Rai *et al.*, 2016) (about 1 to 3.5 in aggregate and 8 to 14.5 with different scenario) (showing in histogram) carried out in 8 CFs of Chitwan district in Central Nepal at 10% discount rate.

3.5 Determinants of Household Income from Community Forest

This section analyses the bio-physical, demographic and socio-economic determinants of household income accrued from community forest and their effects on it. First of all, bivariate correlations between independent variables and Variance Inflation Factor (VIF) of independent variables was run in STATA 13 to examined whether there is multi-collinearity among the independent variables (If correlation value of coefficient is > than 0.8, there is a chance of multi-collinearity, similarly, if the VIF value of individual coefficient is > than 10, there is a chance of multi-collinearity- "rule of thumb") (Williams, 2015). The result showed no multi-collinearity among the independent variables (almost correlation coefficients are <0.3 and mean VIF is 1.72), but showed the collinearity to size of community forest (SCF) with CFUG_ES1 during regression analysis, therefore, the variable SCF was omitted from the model. Likewise, residuals versus fitted plot (rvfplot) (fig. 4) command, Breusch-Pagan test and White's test was used to detect the heteroscedasticity in the sampled data and "*Robust*" command was run to estimate the *robust standard errors* with regression analysis for dealing with heteroscedasticity. As reported by (Williams, 2015), heteroscedasticity causes standard errors to be biased. Ordinary least square (OLS) assumes that errors are both independent and identically distributed; robust standard errors relax either or both of those assumptions. Hence, when heteroscedasticity is present, robust standard errors tend to be more trustworthy. As Allison (n.d.) cited in (Williams, 2015) pointed out, the use of robust standard errors does not change coefficient estimates, but (because the standard errors are changed) the test statistics will give reasonably accurate p values; so, robust standard errors seem to be a more common and popular method for dealing with issues of heteroscedasticity. In this study, when running regression, an outlier belonging to education of household head (EDUC) was dropped to improve the precision of predicted value of independent variables and the value of R-square.

The analytical results for determinants of household income (benefit) from CF are presented in Table 13 below. The R-squared (R^2), known as coefficient of multiple determination, is 40.98% (i.e. 40.98% of the variation in the CF income is explained by predictors in the model) and

Table 13: Determinants of household income from CF and their analytical description.

Variables: CF_INC	Coefficient (coef.)	Robust Std. Error.	t-Value	p> |t| (p-value)	[95% conf.	Interval]
OFINC	.0090098	.0055267	1.63	0.105	-.0018887	.0199083
EDUC	-6311.156	2858.101	-2.21	0.028**	-11947.21	-675.1053
DIST	-5464.769	2189.607	-2.50	0.013**	-9782.579	-1146.96
LAND	-160.9862	110.6215	-1.46	0.147	-379.127	57.15466
LSU	2568.846	517.8044	4.96	0.000***	1547.758	3589.934
LFHH	872.5785	398.9908	2.19	0.030**	85.78599	1659.371
AGE	-111.0201	68.20096	-1.63	0.105	-245.5094	23.46922
SES1	1461.595	2280.023	0.64	0.522	-3034.511	5957.701
SES2	2779.414	3382.081	0.82	0.412	-3889.902	9448.731
CFUG_ES1	-6902.676	3346.844	-2.06	0.040**	-13502.51	-302.8451
CFUG_ES2	-14196.96	3357.538	-4.23	0.000***	-20817.88	-7576.043
Constant (_cons)	28264.61	6109.558	4.63	0.000***	16216.83	40312.4

**** Significant at 0.01 level.*
*** Significant at 0.05 level.*

adjusted R^2 for the estimation is 37.72%. The F-statistics for overall goodness-of-fit of the regression model is 11.71, which is highly significant at alpha (α) = 0.01, 0.05 & 0.1 significance level having the probable value (Prob.> F) = 0.0000. It is evident that the most of the variables are statistically significant in the regression model with expected sign. As presented in Table 13, firstly, education level of household head (EDUC), a binary variable (0 if education level is less than high school, otherwise 1), is negatively (coef. -6311.156) associated to the CF income (CF_INC). For EDUC, the p-value is quite low (0.028**) and shows the evidence to reject null hypothesis (H_0) of non-linear relationship between EDUC and CF_INC at 5% significance level. So, we have some evidence to suggest that there is a negative linear relationship between EDUC and CF_INC controlling the other predictors. Numerically, the household head having the education level equal or greater than high school derived the low income (benefit) from CF than that having the education level less than high school by 6311.26 NRs.(Gunatilake,1998) stated the similar fact that education level of the family is inversely related to forest dependency due to high opportunity cost of time to other sector. Secondly, distance from home to CF boundary (DIST) is also negatively (coef.-5464.769) associated to the CF_INC. For DIST the p-value is quite low (0.013**), which is statistically significant at 5% level of significance. It depicts that there is a negative linear relationship between DIST and CF_INC holding the all other variables constant. This means, an increase in the DIST from home to the boundary of CF by unit Kilometer there is on average decrease in the amount of CF_INC by 5464.77 NRs. The finding of this research with respective to distance from home to forest agrees with the study carried out by (Adhikari, 2003 & Gunatilake, 1998) as families living close to the forest have advantage of requiring less time to reach forest for particular forest resources, resulting distance from home to the forest is inversely related on forest resource dependency of households. Thirdly, average number of Livestock Unit (LSU) owned by household is positively (coef. 2568.846) associated to the CF_INC derived by household. For LSU the p-value is extremely low (0.000***), which is statistically significant at 1% level. That means an increase in LSU of household by one unit there is on average an increase in the amount of CF_INC of household by NRs. 2568.85. the finding concurs with the study of (Adhikari, 2003b; Varughese, 1999), which stated households with large herds of livestock spent the more time to collect fodder, litters and grass and more agriculture compost. It shows that households harvested/used much more forest products from CF as their LSU increase. Forth, average number of household labor force (LFHH) has also positive linear (coef. 872.5785) relation to the households' income derived from CF. P-value corresponding to LFHH is less (0.030**), which is statistically significant at 5% level of significance.

Numerically, a unit increase in labor force in household, there is on average an increase in CF_INC of household by 872.58 NRs. (Gunatilake,1998) mentioned that forest activities due to labor intensive activities, families having the more labor force can mobilize part of their in forest dependent activities and lead to extra extraction of forest resources, so labor force is directly related with forest-based activities. Fifth, Community Forest User Groups' economic status ($CFUG\_ES_1$), which is binary variable (1= poor CFUG, otherwise 0), has negative linear relationship (coef. -6902.676) to CF income. P-value corresponding to $CFUG\_ES_1$ is low (0.040**), means it is statistically significant at 5% level. Numerically, it indicates that the households of CFUG having the poor economic status derived less income from CF than the CFUG having the rich economic status by by 6902.68 NRs. Similarly, sixth, Community Forest User Groups' of rich economic status ($CFUG\_ES_2$), which is binary variable (1= rich, otherwise 0) also negative linear relationship (coef. -14196.96) on CF_INC. P-value associated to CFUG_ES2 is extremely low (0.000***), means it is statistically significant at 1% level of significance. It indicates that on an average the value of variable for CFUG of rich economic status is lower than the CFUG of poor economic status by NRs. 14,196.96[1].

CONCLUSIONS AND POLICY IMPLICATIONS

The community in the study area belonged to agrarian society. 84% of the respondents were farmers and the rest were other professionals, however all ultimately relied on agriculture. 100% of the HHs in the study area depended on firewood as usual source of fuel for cooking.

This empirical study shows that forest products were collected for subsistence needs from CF by HHs, especially, as firewood, ground grass, dry leaf-litter and dry pine needle are the most important forest products and harvested in higher quantity. Although the quantity of firewood collected by all three wealth class HHs was nearly same, it was, because of lacking of the other alternative sources of fuel for them. The findings showed that rich HHs harvested the highest quantity of timber/pole, firewood, dry leaf-litter, and dry pine needle, whereas poor HHs harvested the highest quantity of groud grass and tree fodder from CF. Rich HHs harvested timber/poles about 4 times more in quantity (cu.ft.) compared to poor HHs and 2.5 times compared to middle income HHs. Nontheless, poor HHs collected some occupational forest products like agriculture tools and small bamboo (*Arundinaria strictus*) in higher quantity to make finished goods and sell them to earn money for their better livelihood.

Among the sources of benefits (income) derived from CF, *benefits from forest products* constituted the highest share (97.26%). Similarly, components amongst costs (inputs), *forest product collection costs* constitute the highest share (53%) followed by *cost of CF management activities* (27%). Comparing the benefits and costs incurred in CFM by household level, costs bears about 17 times less than benefits. Based on gross benefits, rich HHs gained the highest benefit followed by middle and poor, concuring results by Adhikari (2005). But based on NPV, rich HHs received the highest NPV followed by poor and middle income HHs due to less cost incurred by poor HHs in overall CFM. However, total benefits and Net benefits were not statistically significant for all three wealth class. An interesting finding was that the BCR of CFM was higher compared to silimar other studies (Dahal, 2009; K. C. *et al.*, 2014; KC *et al.*, 2015; Rai *et al.*, 2016) as well as categorically, the BCR was higher by poor HHs followed by middle and rich. It depicts that based on BCR, poor HHs benefits more from CF followed by rich and middle income HHs. In this context, to balance the costs among three wealth-ranked HHs, appropriate benefit-cost sharing mechanism shoud be provisioned in the CFOP to foster equitable distribution mechanism such that anyone is able to obtain what they need in different points in time as well as participate in the CF management activities (Nightingale, 2002). Besides, silvicultural operations should be implemented at regular basis with mandatory representation of all user HHs.

Household level income from CF was significantly influenced by many bio-physical, socio-economic and demographic variables such as education of household head, distance from home to fourest boundary, age of household head, community forest economic status 1 and 2, livestock unit and household labor force. The analytical results for determinants of HH income from CF suggest that education of household head, distance from home to fourest boundary, age of household head, community forest economic status 1 and 2 were statistically significant and showed negative linear relationship with HH income from CF. On other hand, livestock unit and household labor force were also statistically significant as expected *a priori* and demonstrated linear relationship with HH income from CF. In this context, the government should focus on education to reduce the forest dependency, improve forest condition and increase better earning alternative livelihood opportunities for HHs outside the CF.

[1] 104 NRS ≈ 1 US$ in March 2018

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REFERENCES

1. ADB. (2013). *Cost-benefit analysis for development: A practical guide. Mandaluyong City, Philippines.* Asin Development Bank (ADB). Publication Stock No. TIM125320-2. Retrieved from https://www.adb.org
2. Adhikari, B. (2002). Household characteristics and common property forest use: complementarities and contradictions. *Journal of Forestry and Livelihoods*, *2*(1), 3–14.
3. Adhikari, B. (2003a). *Property rights and natural resources: Socio-economic heterogeneity and distributional implications of common property resource management*. SANDEE, Kathmandu, NP.
4. Adhikari, B. (2003b). What Determines Household Dependency on Community Forests? Empirical Evidence from Nepal. In *Proceedings of XII World Forestry Congress. Quebec, Canada.*
5. Adhikari, B. (2005). Poverty, property rights and collective action: understanding the distributive aspects of common property resource management. *Environment and Development Economics*, *10*(1), 7–31.
6. Adhikari, B., Di Falco, S., & Lovett, J. C. (2004). Household characteristics and forest dependency: evidence from common property forest management in Nepal. *Ecological Economics*, *48*(2), 245–257.
7. Adhikari, B., & Lovett, J. C. (2006). Transaction costs and community-based natural resource management in Nepal. *Journal of Environmental Management*, *78*(1), 5–15.
8. Banjade, M. R., Timsina, N. P., Neupane, H. R., Bhandari, K., Bhattarai, T., & Rana, S. K. (2006). Transforming agency and structure for facilitating pro-poor governance in community forestry. *Journal of Forest and Livelihood*, *5*(1), 22–33.
9. Bartlett, A. G., & Malla, Y. B. (1992). Local forest management and forest policy in Nepal., *6*, 99–116.
10. Bhattarai, R. C. (2012). Economic impact of community forestry in Nepal: a case of mid-hill districts of Nepal. *Economic Journal of Development Issues*, *13*, 75–96.
11. Branney, P., & Yadav, K. P. (2009). *Change in Community Forestry Condition and Management 1994-98. Analysis of information for the forest resource assessment study and socio-economic stydy of the Koshi hills.* NUKCEP, Kathmandu, Nepal.
12. Buncle, A., Daigneault, A., Holland, P., Fink, A., Hook, S., & Manley, M. (2013). Cost-benefit analysis for natural resource management in the Pacific. *Suva, Fiji: Secretariat of the Pacific Community. Available at Www. Undp-Alm. Org/Sites/Default/Files/Downloads/Cost-Benefit_analysis_for_natural_resource_management_in_the_pacific-A_guide. Pdf (Accessed August 2015)*.
13. CASA. (2007). *CASA. (2007). Cost-Benefit Analysis Methodology.* Civil Aviation Safety Authority (CASA),Canberra, Australia.
14. CBS, N. (2012). National population and housing census 2011. *National Report*.
15. Chambers, R. (1994). The origins and practice of participatory rural appraisal. *World Development*, *22*(7), 953–969.
16. Chhetri, R. B., & Pandey, T. R. (1994). *User Group Forestry in the Far western Region of Nepal: A case study from Baitadi and Achham.* ICIMOD, Kathmandu, Nepal.
17. Cochran, W. G. (1977). *Sampling Techniques.* New York., USA: John Willey & Sons Inc.
18. Costanza, R., d'Arge, R., De Groot, R., Farber, S., Grasso, M., Hannon, B., … Paruelo, J. (1997). The value of the world's ecosystem services and natural capital. *Nature*, *387*(6630), 253.
19. Dahal, D. R. (1994). *A review of FUG: case study from Western Nepal.* ICIMOD, Kathmandu, Nepal.
20. Dahal, M. R. (2009). Externality Analysis of Community Forest Management. *The Third Pole: Journal of Geography Education*, *5*(7), 62–69.
21. Deshar, B. D. (2013). An overview of agricultural degradation in Nepal and its impact on economy and environment. *Glob J Econ Social Develop*, *3*(1), 1–20.
22. DevDFID, O. P., Yadav, N. P., Springate-Baginski, O., & Soussan, J. (2003). Impacts of community forestry on livelihoods in the middle hills of Nepal. *Journal of Forest and Livelihood*, *1*(3), 64–77.
23. DFO. (2017). *Annual Monitoring Report of Community Forestry Development Program,.* District Forest Office (DFO) Achham, Nepal.
24. DFRS/FRA. (2015). *State of Nepal's Forest.* Government of Nepal, Department of Forest Research and Survey.
25. Dhungana, S. P., Pokharel, B. K., Bhattarai, B., & Ojha, H. (2007). Discourses on poverty reduction from forestry in Nepal: A shift from community to household approach (pp. 4–7). Presented at the international Conference on Poverty Reduction and Forests: Tenure, Market and Policy Reforms, Bangkok.
26. DOF. (2017). *Community Forestry Bulletin.* (Vol. 17). Department of Forests (DOF), CFD, Babarmahal, Kathmandu, Nepal.
27. DOF/CFD. (2014). *Community Forestry Development Program Guideline*. Community Forestry Division (CFD), Department of Forests (DoF), Babarmahal Kathmandu, Sigma Upset Press Lalitpur, Nepal. Retrieved from http://www.dof.gov.np
28. Drèze, J., & Stern, N. (1987). The theory of cost-benefit analysis. In *Handbook of public economics* (Vol. 2, pp. 909–989). Elsevier.
29. Gautam, A. P., Webb, E. L., Shivakoti, G. P., & Zoebisch, M. A. (2003). Land use dynamics and landscape change pattern in a mountain watershed in Nepal. *Agriculture, Ecosystems & Environment*, *99*(1–3), 83–96.
30. Ghimire, G. P. (2007). *Contribution of Community Forestry in Community Development and Household Income: A case Study from Kavrepalanchowk District, Nepal. Master thesis,.* Tribhuvan University, Institute of Forestry, Nepal.
31. Gilmour, D., & Fisher, R. J. (1991). Villagers, forests, and foresters: The philosophy, process, and practice of community forestry in Nepal.
32. Gilmour, Don. (2003). Retrospective and prospective view of community forestry in Nepal. *Journal of Forest and Livelihood*, *2*(2), 5–7.
33. Godoy, R., Lubowski, R., & Markandya, A. (1993). A method for the economic valuation of non-timber tropical forest products. *Economic Botany*, *47*(3), 220–233.
34. Graner, E. (1999). Forest Policies and Access to forests in Nepal: Winners and Losers. In *Anthropology and Sociology of Nepal- Culture, Societies, Ecology and Development.* SASON, Kathmandu, Nepal.
35. Gunatilake, H. (1998). The role of rural development in protecting tropical rainforests: evidence from Sri Lanka. *Journal of Environmental Management*, *53*(3), 273–292.
36. Harrison, M. (2010). Valuing the Future: the social discount rate in cost-benefit analysis.
37. Hjortsø, C., Helles, F., Jacobsen, J. B., Kamelarczyk, K. B. F., & Moraes, R. (2006). A review of forest economics research in Bolivia. *And No. Forest & Landscape Working Papers*, (18–2006).
38. K. C., A., Joshi, G. R., & Aryal, S. (2014). Opportunity cost, willingness to pay and cost benefit analysis of a community

forest of Nepal. *International Journal of Environment*, *3*(2), 108–124.

39. Kanel, K., & Niraula, D. (2004). Can livelihood be improved from community forestry: preliminary evidences from Nepal. *Banko Janakari*, *14*(1), 19–24.
40. Kanel, K. R. (2004). Twenty-five years of Community Forestry: Contribution to Millennium Development Goals '. Presented at the Twenty-five Years of Community Forestry. Proceedings of the Fourth National Workshop on Community Forestry.
41. Karky, B. S. (2008). The economics of reducing emissions from community managed forests in Nepal Himalaya.
42. KC, A., Koirala, I., & Adhikari, N. (2015). Cost-benefit analysis of a community forest in Nepal. *Journal of Sustainable Forestry*, *34*(3), 199–213.
43. Lal, P., & Holland, P. (2010). *Economics of Resource and Environmental Project Management in the Pacific*. IUCN and SOPAC, Gland, Switzerland and Suva Fiji.
44. Mahapatra, R. (2000). Community forest management: the Nepalese experience., 30–47.
45. Maharjan, M., Dhakal, T., Thapa, S. K., Schreckenberg, K., & Luttrell, C. (2009). Improving the benefits to the poor from community forestry in the Churia region of Nepal. *International Forestry Review*, *11*(2), 254–267.
46. Maharjan, M. R. (1998). The flow and distribution of costs and benefits in the Chuliban Community Forest, Dhankuta District, Nepal. *Rural Development Forestry Network*, *23*, 1–12.
47. Malla, Y. B. (2001). Changing policies and the persistence of patron-client relations in Nepal: Stakeholders' responses to changes in forest policies. *Environmental History*, 287–307.
48. Malla, Y., Barnes, R., Paudel, K., Lawrence, A., Ojha, H., & Green, K. (2002). Common property forest resource management in Nepal: Developing monitoring systems for use at the local level.
49. Malla, Yam B, Neupane, H. R., & Branney, P. J. (2003). Why aren't poor people benefiting more from community forestry. *Journal of Forest and Livelihood*, *3*(1), 78–92.
50. MPFS. (1989). *Master Plan for the Forestry Sector (MPFS), main Report and Executive Summary*. His Mejesty's Government of Nepal, Ministry of Forests and Soil Conservation,Kathmandu.
51. Neupane, H. (2003). Contested impact of community forestry on equity: Some evidence from Nepal. *Journal of Forest and Livelihood*, *2*(2), 55–61.
52. Nightingale, A. J. (2002). Participating or just sitting in? The dynamics of gender and caste in community forestry. *Journal of Forest and Livelihood Vol*, *2*(1).
53. NPC. (2017). *14th Three Year's Interim Plan*. Government of Nepal, National Planning Commission (NPC), Kathmandu, Nepal.
54. NPC. (2018). *Nepal's Multidimensional Poverty Index: Analysis Towards Action*. Government of Nepal, National Planning coomission (NPC), Kathmndu, Nepal.
55. Nyborg, K. (1996). *Environmental Valuation, Cost-Benefit Analysis and Policy Making: A Survey. Statistics*. Norway Research Department.
56. Parajuli, R., Lamichhane, D., & Joshi, O. (2015). Does Nepal's community forestry program improve the rural household economy? A cost–benefit analysis of community forestry user groups in Kaski and Syangja districts of Nepal. *Journal of Forest Research*, *20*(6), 475–483.
57. Pokharel, B. K., & Nurse, M. (2004). Forests and people's livelihood: Benefiting the poor from community forestry. *Journal of Forest and Livelihood*, *4*(1), 19–29.
58. Rai, R. K., Neupane, P., & Dhakal, A. (2016). Is the contribution of community forest users financially efficient? A household level benefit-cost analysis of community forest management in Nepal. *International Journal of the Commons*, *10*(1).
59. Rai, R. K., & Scarborough, H. (2013). Economic value of mitigation of plant invaders in a subsistence economy: incorporating labour as a mode of payment. *Environment and Development Economics*, *18*(2), 225–244. https://doi.org/10.1017/S1355770X1200037X
60. Rai, R. K., & Scarborough, H. (2015). Nonmarket valuation in developing countries: incorporating labour contributions in environmental benefits estimates. *Australian Journal of Agricultural and Resource Economics*, *59*(4), 479–498. https://doi.org/10.1111/1467-8489.12071
61. Richards, M., Kanel, K., Maharjan, M., & Davies, J. (1999a). *Towards participatory economic analysis by forest user groups in Nepal*. ODI.
62. Richards, M., Kanel, K., Maharjan, M., & Davies, J. (1999b). *Towards participatory economic analysis by forest user groups in Nepal*. ODI.
63. Richards, M., Maharjan, M. R., & Kanel, K. (2003). Economics, poverty and transparency: measuring equity in forest user groups. *Journal of Forest and Livelihood*, *3*(1), 91–106.
64. Springate-Baginski, O., Soussan, J., Dev, O., Yadav, N., & Kiff, E. (1999). Community forestry in Nepal: Impacts on common property resource management.
65. Timsina, N. (2002). Empowerment or marginalization: A debate in community forestry in Nepal. *Journal of Forest and Livelihood Vol*, *2*, 1.
66. Upreti, B. (2000). Contributions of Community Forestry in Rural Social Transformation: Some Observations From Nepa., 31–33.
67. Vallejos, C., Cuèllar, R., Ayala, J., & Ramos, C. (1996). Estudio de valuación del bosque de Lomerío: memoria del taller realizado con representantes de las comunidades Las Trancas y Puesto Nuevo. *BOLFOR, Santa Cruz, Bolivia*.
68. Varughese, G. (1999). Villagers, bureaucrats, and forests in Nepal: Designing governance for a complex resource.
69. Williams, R. (2015). Multicollinearity. University of Notre Dame.(Indiana, USA).