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OPPORTUNITY COST, WILLINGNESS TO PAY AND COST BENEFIT ANALYSIS OF A COMMUNITY FOREST OF NEPAL

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Abstract

One of the major policies in response to global climate change is reduction of green house gases emission. Community forests of Nepal are acting as major sources and sink of green house gases, in spite of providing socio-economic benefits to the user groups. There is a lack of information on whether community forests address the socio-economic disparity of user groups, and how it affects opportunity cost and willingness to pay to the forest users groups. Focusing on how the socio-economic conditions of forest users affect forest management, opportunity cost and willingness to pay; and effect of carbon trading mechanism and discounting on the cost benefit ratio, this study was carried out in one CF in western Nepal. The data collection methods included carbon stock measurement, household survey, focus group discussion and key informant interview. Study has shown that most of the forest users are in medium and poor economic classes and female involvement in forest conservation and management was remarkable. Poor people had high dependency on forest product and are most likely affected in terms of opportunity cost. Rich people were willing to pay more to sustain forest ecosystem services. Benefit cost ratio measured directly with and without discounting was 3.91 and 2.97, respectively. The findings of the present study indicate that the community forests users groups are benefitted from the current state of management.

Keywords: Community Forest management; Opportunity cost; Willingness to pay; Cost benefit analysis; Nepal

Introduction

Global climate has always been changing naturally (CEH, 2007; Dhakal, 2010), but the changes in the last 50 years are dramatic, and scientists attribute the changes to human induced factors (IPCC, 2001, 2007). On an average, the global temperature has been increased by 0.75 ^{0}C over the last hundred years (1906-2005), and 0.44 ^{0}C in the last 25 years (IPCC, 2007). Deforestation contributes to about 20% of the total greenhouse gas emissions (IPCC, 2007; Dhital, 2009). Forests play an important role in regulating the global climate (Banskota et al., 2007; Rana 2008; REDD, 2010), and act as sinks and sources of carbon dioxide (IPCC, 2001; GW, 2010; Aryal et al., 2013), and still support the livelihoods of more than 1.6 billion people (CBD, 2011).

Nepal is one of the pioneering countries in implementing community-based forest management scheme (Paudyal et al., 2006; Pandit et al., 2009; Aryal et al., 2013). Within the last four decades, community forest has been promoted as an important step in common property resource management (Rana, 2008; Agrawal and Angelsen, 2010). Local users develop their own operation plans, set harvesting rules, rates and prices for forest products (UNCSD, 2012). A total of 1,665,419 hectare of forest land is handed over to 17,810 CFUGs (DoF, 2013). Nepal's community forest had been acknowledged in Rio+20 conference in 2012 (UNCSD, 2012), to encourage the active participation of local people in managing production and distribution of forest produce (Muthoo, 2002). Furthermore, community forest also helps in reducing poverty, addressing social exclusion and creating rural employment (Kanel et al.,2009; CIFOR, 2012; Patel et al., 2003), as well as carbon sequestration (Gautam and Watanabe, 2009).

Community forest of Nepal has been found to provide monetary and non-monetary benefits (Katoomba, 2007; K C, 2012), in relation to socio-economic status of the users groups (UNREDD, 2010). Revenues from carbon payments, wood products and non-wood forest products provide direct monetary benefit to the local people (Verweij, 2002). Ecosystem services such as watershed regulation, biodiversity, nutrient cycling, soil conservation, improved water quality, climate change mitigation, recreational and cultural values provide indirect benefits (Acharya et al., 2009; Martino, 2009; Parrotta et al 2012). Payments for ecological service from forest is rising, but there is a doubt whether poor people get benefit or not (Angelsen and Seven, 2003). So, REDD-Plus is being developed as a form of payment for an ecosystem service (Oli and Shrestha, 2009; Christophersen and Stahl, 2011).

Deforestation, for all its negative impacts, also bring benefits (Luttrell et al., 2007). Timber can be used for construction and cleared land for crops and pastures (Pagiola and Bosquet, 2009). Selective logging, forest degradation, fuel wood collection and grazing of animals bring benefits, and avoid the degradation (GPI, 2011). Estimating these opportunity cost is thus the central problem in estimating the costs of reduced emission from deforestation and forest degradation (REDD) (Pagiola and Bosquet, 2009; Nabanoga et al., 2010).

Studies of community forest from Nepal are unable to express all the costs and benefits associated with the present community forest management (Allison et al., 2009; Ghazoul et al., 2010). The effects of community forest on rural livelihoods and equity have also been subject for research (K C et al., 2012). The present study aims to explore the feasibility analysis of community forest management to relate socio-economic status of the user groups, opportunity cost and willingness to pay considering a community forest user group from western mid-hill. The major goals covers i) how socio-economic conditions of the community forest users affect forest conservation and management, ii) how wealth-being groups affect opportunity cost and willingness to pay for ecosystem services, And iii) what is the effect of implementation of carbon trading mechanism and discounting on benefit cost ratio of community forest.

Methodology

The study was conducted in Gwangkhola Sapaude Babiyabhir Community Forest. It lies in ward number eight of Putalibazar Municipality in Syangja district, western Nepal, representing mid- hills (Figure-1). It has an area of 92 hectares, handed over to Community Forest Users Group in 2000 (CFOP, 2006; K C et al., 2013b). The rationale for selecting this community forest was the availability of growing stock biomass data of 2006 which was used for calculating the incremental carbon stock (K C, 2012).

Characteristics of Gwangkhola Sapaude Babiyabhir Community Forest

Handover year (renewed year):	2000 (2006)
Total household involved:	195 (Dalit-6; Janajati-70 and Higher caste-119)
Total Population:	1025
Executive committee members:	13 (Male-9, Female-4; Dalit-1, Janajati-2, Other-10)
Major caste in group:	Brahmin, Chettri, Newar; similar as Pokharel, (2012)
Altitude (mean average sea level):	930-1325 m
Vegetation Type:	Temperate deciduous forest
Major tree species:	*Castanopsis indica*, *Schima wallichi, Diasporous Montana, Pinus wallichiana*

Source: (CFOP, 2006; KC et al., 2013a)

A pilot inventory was framed for the present study following the standard manual (Subedi et al., 2010) in October (2010). For this, a meeting was held with executive members of the Gwangkhola Sapaude Babiyabhir Community Forest to know the basic characteristics of the study area. Community forest operation plan prepared in 2006 was reviewed to examine the possibility of getting growing stock data. The boundary of forest was tracked and block division of the forest was done for forest survey using GPS (Garmin Etrex 10) (Skutsch et al., 2009).

The field work was conducted in April –May, 2011 for measurement of biomass. The forest carbon measurement guidelines of Ministry of Forest and Soil Conservation (MoFSC, 2011) and forest carbon stock measurement guidelines for measuring carbon stocks in community-managed forests prepared by Subedi et al., (2010) was used for forest survey and biomass measurement (KC et al., 2013a).

For the household survey, the list of household was obtained from the operation plan of Gwangkhola Sapaude Babiyabhir Community Forest.

All the household were classified into three wealth being groups; rich, medium and poor based on the focus group discussion (FGD) conducted with forest users (Adhikari and Lovett, 2005).

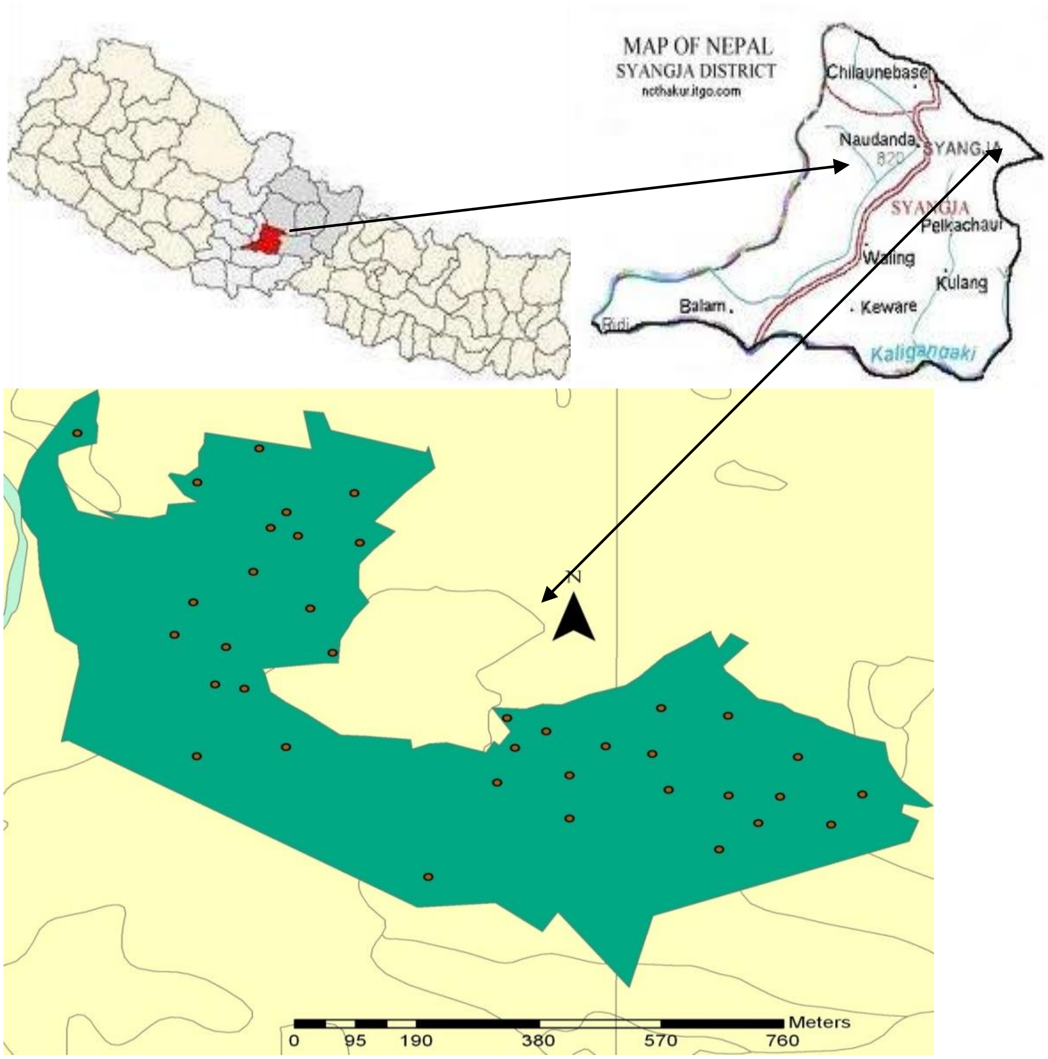


Figure 1: Map of Study Site (K C et al., 2013b)

Table 1: Economic stratification of CFUG

Economic class	Total Number of HH	Percentage	Sample Taken
Rich	43	22.05	22
Medium	102	52.31	52
Poor	50	25.64	26
Total	195	100.00	100

If the gross yearly income of the family (collectively from service, agricultural output, business and others) was more than 3.5 lakhs, they were considered as rich. If it was less than 3.5 lakhs but were easily sustaining their life without much trouble, they were considered as medium. If the family had to depend on daily wage from their work for their survival and had owned very less agricultural field, they were considered as poor. Households belonging to the poor income group are mostly from lower castes whereas higher income groups represent upper castes (Adhikari and Lovett, 2005).

By applying stratified random sampling, more than 50% (100 out of 195) sample was taken for household survey (table-1). Semi- structured questionnaire survey was done with the selected household to collect data on socio economic status, household contribution to forest management, willingness to pay for ecosystem services provided by forest and opportunity cost. Information on forest product collection was taken from past 5 years from 2006 -2010.

The local market price of forest products, wages of labor and verification of household information was done during focus group discussion and key informant survey. The secondary information of administration and management cost from 2006-2010 and other community forest related information was taken from CFOP, (2006)

The economic valuation of the community forest was made on the basis of benefit cost ratio (Campbell et al., 2003). The benefit cost ratio was analyzed at different rate of carbon credit including and excluding willingness to pay.

Benefit cost ratio (BCR) without discounting was calculated as the direct ratio of total benefit (B) and total cost (C) as BCR = B/C.

Discounting reflects the balance between present and future wellbeing (Philbert, 1999) and the opportunity cost of capital (Groom and Palmer, 2012). The present value is calculated using the method of compound interest using discount rate (CASA, 2007). Present value estimates of income are based on market and discount rates (Groom and Palmer, 2012). Benefit cost ratio with discounting was calculated by following CASA, (2007) as follows:

$$\text{Benefit Cost Ratio(BCR)} = \frac{\text{Present Value Benefits}}{\text{Present Value Costs}}$$

Calculation of benefit and cost from 2006-2010 for people involvement cost, opportunity cost, willingness to pay and animal rearing was done by using following equations.

$$\text{Present Value Benefits} = \sum_{n=0}^{N} \frac{\text{Bn}}{(1+\text{r})\text{n}}$$

$$\text{Present Value Costs} = \sum_{n=0}^{N} \frac{\text{Cn}}{(1+\text{r})\text{n}}$$

Calculation for all types of benefit and cost from 2010-2014 was done by using following equation.

$$\text{Present Value Benefits} = \sum_{n=0}^{N} \text{Bn}(1+\text{r})\text{n}$$

$$\text{Present Value Costs} = \sum_{n=0}^{N} \text{Cn}(1+\text{r})\text{n}$$

Where, B = Total Benefit in year 'n' expressed in constant dollars; n = Evaluation period in years; C = Total Cost in year 'n' expressed in constant dollars; N = Total number of years, 10 years; r = Real discount rate (12 %) as taken by Rana, (2008)

The total benefit includes benefit of forest products, benefit from animal rearing, willingness to pay for ecosystem services provided by forest and benefit from carbon credit. The benefit of forest products and benefit of animal rearing was estimated by direct market pricing method (Delphi Method) (Karpagam, 2007). The direct market pricing method was applied as the local market price of the forest goods. The user group were also rearing animal in some part of the forest and getting benefit. The amount of fodder saved in home in term of bhari (bundle) due to animal rearing in the forest was converted into monetary value. The entire forest product was easily sellable in the local market and the price was obtained by means of FGD and KIS as follows.

1 cubic feet timber costs US $ 10.67 (N Rs. 800)

1 Bhari (load carried at back) Firewood (45 kg) costs US $ 1.33 (N Rs. 100)

1 Bhari Fooder (30 kg) costs US $ 0.33 (N Rs. 25)

1 Bhari leaf litter (15 kg) costs US $ 0.067 (N Rs. 5)

Willingness to pay for Ecological services provided by forest was calculated following the methodology of King & Mazzotta, (2003). Services provided by forest to be valued were identified before the field visit. Ecological services include provisioning (food and water), regulating (ability of ecosystems to regulate floods, diseases and land degradation), supporting (soil formation and nutrient cycling), and cultural (recreational and religious) services (Chaudhary, 2009). Willingness to pay for the better conservation, management and continuity of current benefits of the community forest was taken from household survey. Payment for ecological services can help to enhance biodiversity, conserve forests and woodland, strengthen the provision of non-wood forest products, improve the provision of water quality and mitigate climate change by storing and sequestering carbon (FAO, 2011).

Carbon stock for 2006 was calculated from the growing stock data of the forest as given in the community forest operation plan by using methodology of IPCC, (2006). The carbon stock for 2011 inventory was calculated from above ground tree biomass, sapling biomass, leaf litter herb and grass biomass and soil organic carbon (KC et al., 2013a).

Yearly incremental carbon stock was calculated as follows:

Yearly incremental carbon stock = (Carbon stock in present inventory in 2011 – Carbon stock in 2006 inventory)/5.

The incremental carbon stock was converted to tons of CO_2 equivalent by multiplying it by 44/12, or 3.67 (Pearson et al., 2007).

Benefits from carbon credit were calculated by multiplying annual incremental CO_2 stock with market value US$ 8 per ton CO_2. World Bank recommended market price per ton CO_2 ranges from 1-15 US $ as suggested by Neff et al., (2007) (Rana, 2008). So, carbon benefit at different rate (US $ 6, 8, 10, 12, 14) was calculated to analyse the benefit cost ratio.

The total cost includes forest management cost and opportunity cost. Management cost include the money spend by user group committee members in managing and monitoring forest. It includes salary of guard, office management cost, forest management cost and cost of building physical infrastructure, plantation, thinning of trees, training, education and others.

The best alternative of community forest management was, use of forest product such as litter and fodder. People had opportunity to rear animals in the forest in the past but not now. Due to the handover of forest to community forest user group, people were deprived of taking litter and fodder from the forest and had to destroy the privately owned land and forest to get these needs. Hence, opportunity cost was determined by converting this total fodder obtained in the household survey into monetary value.

Results

The socio-economic attributes of the user group are presented in table 2. The total population of the community forest user group was 1031. Majority of people were in active age groups in between 11 to 49 years. Out of 195 user groups, 43 families were rich, 102 families were medium and 50 families were of poor economic category (table-2). The average landholding size was 11.61 ropani. The average amount of shrubland owned by each community forest user group was 4.03 ropani. Similarly, average unirrigated agricultural land, irrigated agricultural land and the private forest was 3.73, 3.50 and 0.35 ropani per household respectively. Very less private forest was owned by the user groups in the given village. The major livestock domesticated by the user groups were buffalo, cow, ox and goat. The average livestock owned was 5.62. Most of the families had kept buffalo (0.94/ HH) for milk and milk products.

Table 2: Socioeconomic status of studied community forest user group in 2011

Population			Landholding/HH			Livestock no /HH		
Category	No.	%	Category	Amount of land (in Ropani)	Average/ HH	Category	No.	Average/ HH
Male	480	46.56	Shrubland	785	4.03	Buffalo	183	0.94
Female	551	53.44	Unirrigated land	727	3.73	Cow	89	0.46
Total	1031	100	Irrigated land	683	3.50	Ox	113	0.58
Below 10 yr	205	19.88	Private forest	69	0.35	Goat	710	3.64
Between 11- 49 Years	570	55.29	Total	2264	11.61	Total	1095	5.62
Above 50 yr	256	24.83						

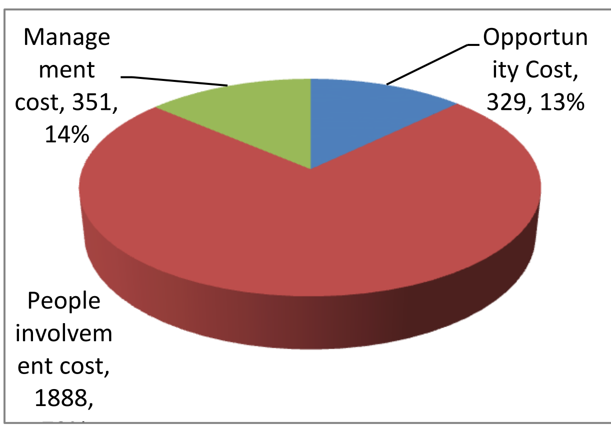
Many families kept ox (0.58/ HH) for tilling the agricultural field and goat (3.64/ HH) for meat.

The total willingness to pay was US $ 1401 and the total opportunity cost (OC) of the forest was US $ 329 as shown in table-3. Poor and medium standard household were affected by opportunity cost as it contribute 31.02 % and 51.58 %, respectively of total opportunity cost. Rich, medium and poor household were willing to pay 25.97 %, 51.95 %, 22.08 % of total willingness to pay, respectively for the ecosystem services provided by the forest as shown in table-3. Rich people had more willingness to pay (WTP) in comparison to poor and medium economic standard people.

Table 3: Opportunity Cost and Willingness to Pay for different economic class

Economic class	No. of houses	% of Total houses	No. of sample taken	Total WTP for ES (US $)	WTP %	Opportunity Cost (US $)	OC %
Rich	44	22.56	22	364	25.97	57.23	17.40
Medium	99	50.77	52	728	51.95	169.65	51.58
Poor	52	26.67	26	309	22.08	102.05	31.02
Total	195	100	100	1401	100	328.93	100

Cost associated with the community forest was peoples' involvement cost, management and administrative cost and opportunity cost as shown in figure-2. About 73% of annual total cost for community forest management (US $ 1888) was only to pay people who involve in the management.



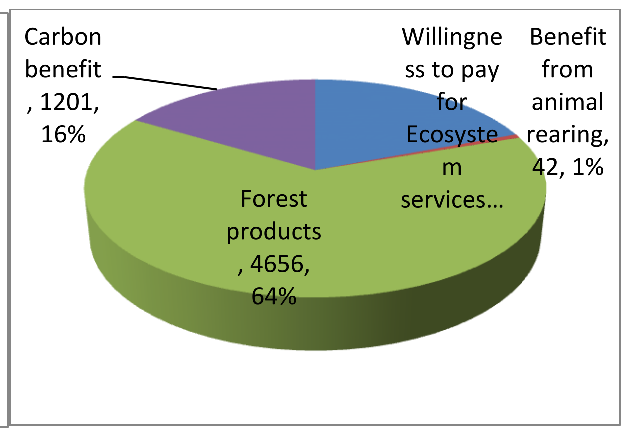


Figure 2: Cost and benefit associated with community forest user group

The annual benefit from forest product in given community forest was 64 % of total benefit (US $ 4656). The least benefit was from animal rearing which amount to 1% of total benefit (US $ 42). The yearly incremental CO_2 equivalent was 151 ton. The annual benefit from carbon credit through REDD scheme in this study was US $ 1201 at the rate of US $ 8 per ton of CO_2.

Real benefit cost ratio (BCR) was 1.91 with direct benefit and cost provided by community forest to the user group. Benefit cost ratio with willingness to pay and carbon credit at the rate of US $ 8 was 2.97 as shown in table-4. Benefit cost ratio will be 3.34 if the rate of per ton of CO_2 increases to US $ 14.

Table 4: Total Benefit, Total Cost and BCR in different benefit criteria in 2011

In US $	Real	With WTP	With CC at US $8	With WTP and CC at US $ 6	With WTP and CC at US $ 8	With WTP and CC at US $ 10	With WTP and CC at US $ 12	With WTP and CC at US $ 14
Total Benefit	4698	6099	5899	7000	7300	7601	7901	8201
Total Cost	2456	2456	2456	2456	2456	2456	2456	2456
BCR	1.91	2.48	2.40	2.85	2.97	3.09	3.22	3.34

Table 5: Benefit, Cost and BCR of CFM using NPV at discounted rate of 12%

Annual Cost /Benefit	Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	NPV
Cost Associated with CFM	Management Cost	201	196	210	240	223	250	280	313	351	393	2657
	Opportunity Cost	209	234	262	294	329	368	413	462	518	580	3669
	People Involvement Cost	1200	1344	1505	1686	1888	2115	2368	2653	2971	3327	21056
	Total Cost	1610	1774	1977	2220	2440	2733	3061	3428	3839	4300	27382
Benefit Associated with CFM	Benefit from Forest Products	5052	5329	5571	6398	6817	7635	8551	9577	10727	12014	77671
	Willingness To Pay	890	997	1117	1251	1401	1569	1757	1968	2205	2469	15624
	Benefit from Animal rearing	27	30	33	38	42	47	53	59	66	74	469
	Carbon Credit	1201	1201	1201	1201	1201	1345	1507	1687	1890	2117	13394
	Total Benefit	6732	7211	7678	8759	9461	10596	11868	13292	14887	16674	107158
BCR												3.91

The net present value including discounting of 12% of management cost, opportunity cost and people involvement cost were US $ 2733, 3782 and 21703 respectively (table-5). The net present value including discounting of 12% for benefit from forest products, willingness to pay, benefit from animal rearing and carbon credit was US $ 80005, 16104, 483 and 13805, respectively. The benefit cost ratio of community forest was 3.91 using net present value (NPV) with discounted rate of 12%.

Discussion

Most of the household in the user group were either in medium or in poor wealth being classes. This indicates high dependency of local people on forest products (Angelsen and Seven, 2003). Involvement of female in forest conservation and management in user group was found high. Most of the adult males were out of their village in search of education and employment opportunities in larger cities of Nepal which was similar to the status of whole country (CBS, 2012). Furthermore, youth migration to overseas in search of work is increasing to an extent that Nepal is one of the five countries where the contribution of remittance to the total gross domestic product of the country is the highest, currently contributing over 23% (MOLE, 2012). Active population of 11-49 years in the user group was found similar to the national average (CBS, 2011). The family sizes, proportion of the active population, economic status of the users groups affect both the forest products utilization and forest management. Households of small size from 5–8 people have the lowest forest product collection rate (Adhikari et al., 2007). Higher active population in the users groups indicates higher potentiality to contribute for sustainable management, conservation and enhancement of community forest (Ghazoul et al., 2010). Economic status of the household affects resource use patterns (Mahanty et al., 2012). Forests play a much more important role as sources of cash for poor than rich and medium households in relative term (Blomley and Iddi, 2009). Richer households involved more in decision making, crafting institutions for resource use and conflict resolution (Adhikari and Lovett, 2005).

The agricultural production is only sufficient for few months so people depend on market goods for survival. Average livestock per household in this study was higher than reported by Rana, (2008) in Dhading district of central Nepal. Most of the members manage their daily requirement of fodder, firewood, litter and timber from their shrub land and private forest. But for some families, who have very less shrubland and private forest, they depend on community forest for their sustenance of firewood and timber. Fodder from community forest was harvested during monsoon season in the month of July and September for livestock. The shrub land in community forest (about 20 hectares) was used permanently for rearing livestock. The grazing area was not sufficient for the user group so that livestock numbers were reduced after the formation of community forest. Similar cases were reported from other user groups as well (Adhikari et al., 2007).

Among the three economic classes, poor people were affected most in terms of opportunity cost. These people had high dependency in forest for animal rearing and litter collection. Due to strict rules, people were unable to rear animal and take litter from the forest.

Community forest had controlled over-grazing, illegal extractions, fires and had created functional common property management systems to replace open access use (Skutsch et al., 2009). According to the view of members, second best alternative of community forest management was making forest free from strict rules and regulation. Harvesting of timber and other forest products were managed in community forest. Opportunity cost in this study was lower than that calculated by Olsen et al.,(2009) in Brazil and Stich, (2009) in Bolivia.

Forest had lots of indirect and external benefit to the people. Forests play a key role in carbon sequestration, protecting water quality and clean air and in helping to regulate climate, floodwaters, disease, waste, and water quality (Mills et al 2002; Agustino et al, 2011; FAO, 2011). Rich people were willing to pay money for improving their health by the supply of fresh air and water supply (Chaudhary, 2009). Medium and low standard people were willing to pay money to protect their agricultural land from landslide and soil erosion. Willingness to pay value in this forest was much less than calculated by Subedi and Kathuria, (2006) and Chand, (2010) in far western Nepal. Hence willingness to pay measurement was important part of the study as it addresses the indirect and external benefit including REDD (Ghazoul et al., 2010).

The benefit associated with community forest was much higher than the cost involved in conservation and management. Forest management and administration cost is significantly and positively correlated with the cost on public services and infrastructure. The annual total forest management cost in this study was more than that calculated by Baral et.al 2008 but less than that calculated by Gryze and Durschinger, (2009) in Dolakha district of central Nepal. Economically and socially privileged sector of society contributes the most to commons management. Most of the costs are effort and time spent in lengthy discussions at the meetings and assemblies as supported by study of Adhikari and Lovett, (2005). The results indicate that the management and monitoring cost will increase after REDD implementation in the forest (Ghazoul et al., 2010).

Net gain per HH in the current study was much less than that calculated by Karky, (2008) in Ilam district of Central Nepal. The forest was absorbing 150.1 ton CO_2 yearly as non-monetary benefit against climate change by mitigating CO_2 emission. The annual benefit from carbon credit through REDD plus scheme in this study was less than that calculated by Karky, (2008) and Thagunna, (2009) in far western Nepal but more than that calculated by (Dahal, 2007) in central Nepal. The total benefit from forest products and carbon credit is supposed to be increased in the future as the newly grown trees will increase in size increasing the carbon stock (Gautam, 2002; Bhatta, 2004; Aryal, 2010; Bhusal, 2010; Mishra, 2010).

The benefit cost ratio without using discounting was 2.97, which was higher than that calculated by Dangi, (2006) in Makwanpur district and Rana, (2008) in Dhading district in central Nepal. But benefit cost ratio using discounting was lower than that calculated by Rana, (2008). Benefit cost ratio will be 3.34 if the rate of per ton of CO_2 increases to US $ 14.and is supposed to increase as costs are immediate and benefits occur at some point in the future (Groom and Palmer, 2012).

Conclusion

More users in medium and poor wealth being classes indicate high dependency in forest resources. Women's involvement was high in conservation and management of forest. Poor people were affected most by opportunity cost due to their higher sustenance in forest for animal rearing and litter collection. Rich people were willing to pay more money for forest ecosystem services. Benefit cost ratio measured directly without discounting and with discounting was 2.97 and 3.91 respectively.

The results showed that the user group has been benefitted in the current state. The findings of the study provides policy appraisal for implementation of REDD in community involved forest management system and its effects for users in different wealth being classes.

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