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Full Length Research Paper

Assessing contribution of local community in biodiversity conservation at Laharepauwa of Rasuwa, Nepal

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The Tamang community is one of the poor groups living in Middle Mountain of Nepal. It pre-dominantly resides in Buffer Zone of Langtang National Park, located in north-central Nepal. The Buffer zones is areas of settlements and agriculture surrounding the core area set aside for wildlife habitats and rare flora. Access on buffer zone programs depends greatly on their representation on local institutions. There are three tiers of local institutions viz. Syaubari Buffer Zone Community Forest User's Group (SBZCFUG), Laharepauwa Buffer Zone User's Committee (LBZUC) and Buffer Zone Cooperative (BZC). 13.8% households represented in SBZCFUG. Likewise, 5.2 and 2.1% households represented in LBZUC and BZC, respectively. As per Buffer Zone Management Directives (1999), LBZUC is the most important institution among all as it distributes the revenues to buffer zone communities. The Park office prepares a Forest Operational Plan (FOP) and hands over a patch of community forest to a buffer zone community. The FOP outlines harvestable quantity of forest resources, harvesting blocks, price and prescribed forestry works. 84% households were involved in FOP preparation. In return for revenue sharing, the park office expects in-kind (labour) contribution from community in biodiversity conservation. 17% respondents said that the park office highly emphasized local consultation for fixing price of forest resources. 32% said that park's emphasis was fine while 50% were not aware. The half of respondents having no idea of consultation was a big gap. Yearly in-kind contribution of a household for biodiversity conservation was nearly 2 days. The share of forest committee meeting was the highest (58%). Despite park's much talked focus on people's participation, reality is bleak. The study recommends that that contribution should be increased and be more focused on fighting forest fire, plantation, creating water holes for wild animals, non timber forest products (NTFPs) utilization, fire line construction etc. No significant relation was found between in-kind contribution with income level, education and landholding. The study adopted both quantitative and qualitative survey methods. Two stages sampling techniques were applied. Sample households were randomly selected and every third household was approached for survey.

Key words: Buffer zone, biodiversity conservation, in-kind contribution, household income, community forest.

INTRODUCTION

National Parks and Wildlife Conservation (NPWC) Act, 1973 is the first legal instrument in protecting biodiversity in protected areas of Nepal. The marked shift was witnessed in 1996 when Buffer Zone Management

Regulation entrusted Buffer Zone Management Committee to collect revenues from natural resources and utilize as per forest operation plan (Personal Commun. Chief Warden, Mr. Bed Dhakal). Buffer Zone Management Regulation makes provision for 30 to 50% of park revenues for conservation and economic development in buffer zones. The rationales for delineation of buffer zone and revenue sharing are to compensate local communities affected by wild animals (Poudel et al., 2007). In Nepal, the BZ communities are characterized by social inequalities, in terms of class, caste and ethnicity, sustaining impoverishment and vulnerability of marginalized groups (Guneratne, 1998; Muller-Boker, 1999)

The Buffer Zone Management emphasizes in creating local stake on biodiversity conservation and economic development by encouraging their representation in buffer zone institutions and programs. This is mandatory step needs to be taken by park office as per policy framework of Buffer Zone Management Regulation. Out of 145 households, 5.2% was representing in executive committee of LBZUC which receives the 30 to 50% revenues from national park office. A buffer zone management committee, 21 user committees and over 332 user groups have been functioning in buffer zone to reduce the biotic pressure in the park by generating resources to meet their needs (LNPBZMP, 2013). The present study only considered those households which represent in executive committees and therefore having a role in the decision making process. The main aim of the buffer zone program usually funded by national park office is to reduce anthropogenic pressure in the core area by reducing poverty through livelihoods and infrastructure development. 92.4% households provided in-kind contribution for biodiversity conservation that include plantation, nursery management, forest patrolling, fighting forest fire, forest committee meeting. The greatest share was from forest committee meeting. No contribution was observed in silviculture practices despite prescribed in forest operation plan. The silviculture practices include pruning, singling and thinning to enhance the quality of forest. In summary, a household annually contributed nearly two days. The study concludes that contribution should be increased as current labour days were very low. Buffer zone model is a participatory approach to conservation however low level of local contribution did not support it in reality. Regression result indicates that there were no significant relationship between in-kind contribution with income level, education and landholding.

Total household income was calculated and the share of the buffer zone program which includes forest conservation and non-timber forest products was measured. Other income sources were agriculture, livestock, business, wage, service, pension and remittance. The mean (HH/year) and total income were found to be US$ 1,394.5 and US$ 202,209 respectively. The buffer zone program constitutes mere 4% share. This is the direct benefits that local communities were getting from buffer zone program. The highest share was from remittance (46.3%)

Local community also accrues indirect benefits. The survey reveals that currently local community has easy access on forest resources viz. fire woods, grasses and leaf litters. After SBZCFUG managing forest since 2007, the forest has been improved due to restriction of grazing and regular patrolling. Prior to 2007, local people had to go to Park Forest for these resources. The forest inventory was not carried out; but perception of local people suggests that forest has been improved. The substantial benefit was recorded in reduction time for collecting forest resources. Buffer Zone program saved 2351 working days' worth US$ 11,198 annually. 8 h equal to one working day was calculated. While in calculating the worth, NPR 500 as a wage for unskilled labour was assumed. Reduced resources collection time implies reduced opportunity cost. This was the aggregate social welfare for Tamang community.

MATERIALS AND METHODS

Consultation meeting was done with the chief warden of Langtang National Park Office, Rasuwa to collect information on the potential study area. Langtang National Park was officially set up in 1971 with an area of 1,710 km^2. In 1998, an additional 420 km^2 was added to the park as a buffer zone (Karki, 2000). Framework of key parameters (Table 1) was applied during consultation meeting. The potential sites were measured against three categories of parameter, that is, ecological, social and institutional. The objective of using a framework is select study sites in systematic manner to reduce observable selection biases.

The Buffer Zone Management Directives (1999) make provision for local institutions at different levels. Buffer Zone Management Committee (BZMC) lies at the top. BZMC has a representative from District Development Committee, government body responsible for development of respective district. At middle, there is Buffer Zone User's Committee (BZUC) which receives revenue from park office and implements buffer zone programs at Buffer Zone Community Forest User's Group (BZCFUG) level (Figure 1). Syaubari Buffer Zone Community Forest User's Group (SBZCFUG) of Laharepauwa, Rasuwa was selected (Figure 2) as a study site based on the frame work of parameters. SBZCFUG is located in ward number 8 of Laharepauwa village development committee. SBZCFUG has been managing buffer zone community forest (141 ha) since 2007. Oak, Pine, Alder and Rhododendron are the dominant tree species. The

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Table 1. Frame work of parameters for identifying study areas.

S/N	Ecological parameter	Social parameter	Institutional parameter
1	Community belongs to Middle mountain (1,200-3,000 msl), characterized by mixed broadleaf and conifer forests	Pre-dominantly Indigenous community or mix community living for long time in that vicinity	BZCFUG functional over five years
2	Size of the community forest > 100 ha	Highly depended on forest resources for subsistence livelihoods	Implementation of Forest Operational Plan and BZCFUG's contribution in biodiversity conservation
3	The forest ideally includes shrub land or grazing land	Community with over 150 HHs – variance on income would be ideal	Institutions inclusive in terms of gender, poor and disadvantaged groups
4	The BZCF ideally be at the close proximity or adjoined with park forest	Community's reliance also on park areas	The UG has devised the rules/regulations pertinent to park office
5	Forest functions as wildlife habitats	Local livelihoods impacted by human wildlife conflict	UG initiated or aware on HWC issues or initiated preventive measures

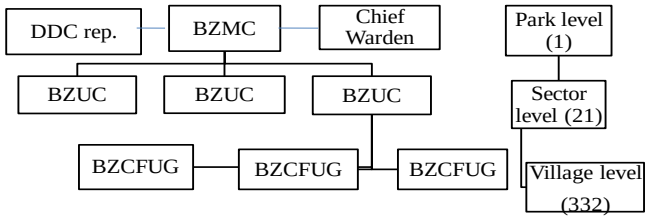

Figure 1. Organizational structure of BZ institutions (adopted from HMG/N, 1999).

total household number is 225 which spread over four villages Kavre tole, Lama tole, Gumbudanda and Bastala (LNPBZSP, 2013). Two stages sampling strategy was applied; (i) purposive selection of village development committees and (ii) systematic random selection of households The number of household was calculated in all four villages based on the proportion. The first household was selected randomly and thereafter every third household was approached for interview. In total, 145 households were interviewed from 27 September to 04 October, 2015. The name list of users from forest operation plan was used as a sampling frame. The semi-structure questionnaire was used to collect data on in-kind contribution in biodiversity conservation, income by sources, land holding, education, and representation in BZ institutions. The data was analyzed in STATA. The descriptive summary and regression were executed. Local dialect is spoken in community and therefore support in translation was taken from local enumerators when required. Focus Group Discussion was carried out around mid September, 2015 for collecting community level data such as forest resources collection time, status of forest condition, reason for forest improvement etc.

RESULTS

Representation in executive committees of local institutions

Out of 145 households, 21.8% are represented in the executive committee for local institutions. 13.8% households were involved in SBZCFUG. 5.2% had access on LBZUC. Representation in User's Committee is the most important as it operates above village level and receives revenue and programs for community development (Silwal et al., 2012). Only 2.1% represents in BZ cooperatives. After the declaration of the buffer-zone, the communities have been receiving funds since 1996.

92.4% households provided in-kind contribution for biodiversity conservation (Figure 3). The park office expects and encourages in-kind contribution for creating local ownership in biodiversity conservation. Highest contribution was observed in forest committee meeting. Construction of community building received 79 labour days but it was indirectly related with biodiversity conservation. Building alone does not improve the forest and wildlife habitats .This was more related with institutional support. Unfortunately no contribution was observed in Silviculture practices which include pruning, singling, selective thinning, etc. and are to enhance forest quality. Laharepauwa community contributed 715 labour days in three years (2012-2014). Each household yearly contributed nearly two days.

The biodiversity conservation primarily include plantation, nursery management, NTFPs, forest patrolling (Figure 4a), forest committee meeting (Figure 4b), fighting forest fire and construction of community building. Forest fire is the key threat to Syaubari community forest as it has pine forest in one of the blocks with steep gradients and road passing through the forest.

84% households participated in the preparation of forest operational plan. Usual practice is that one member participates from a household. The forest operational plan is an important document outlining forest boundaries, harvestable quantity, harvesting blocks,

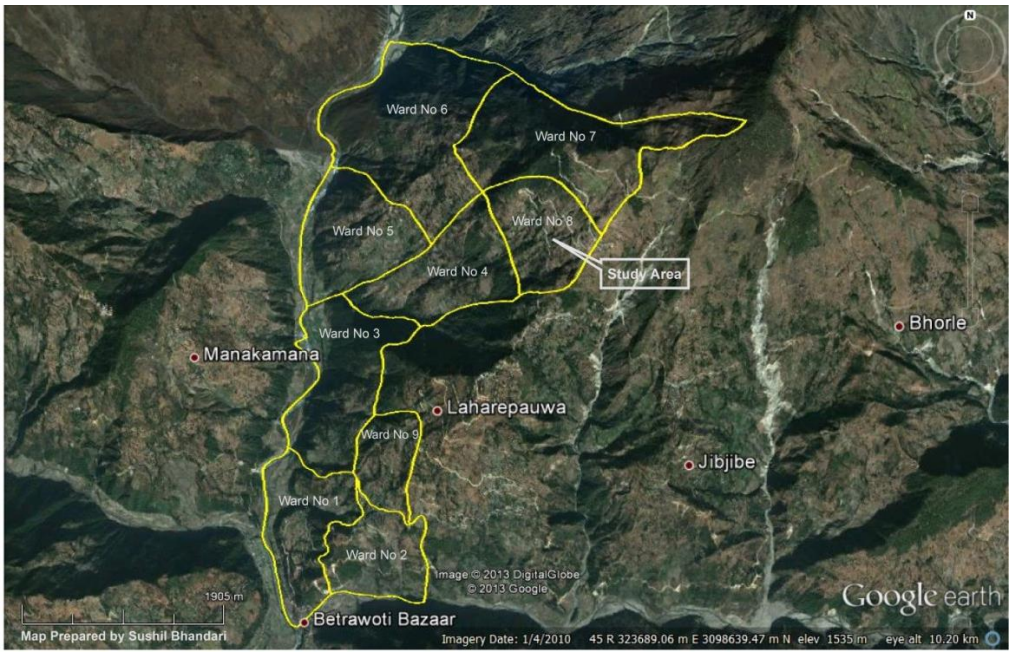

Figure 2. Map of study area.

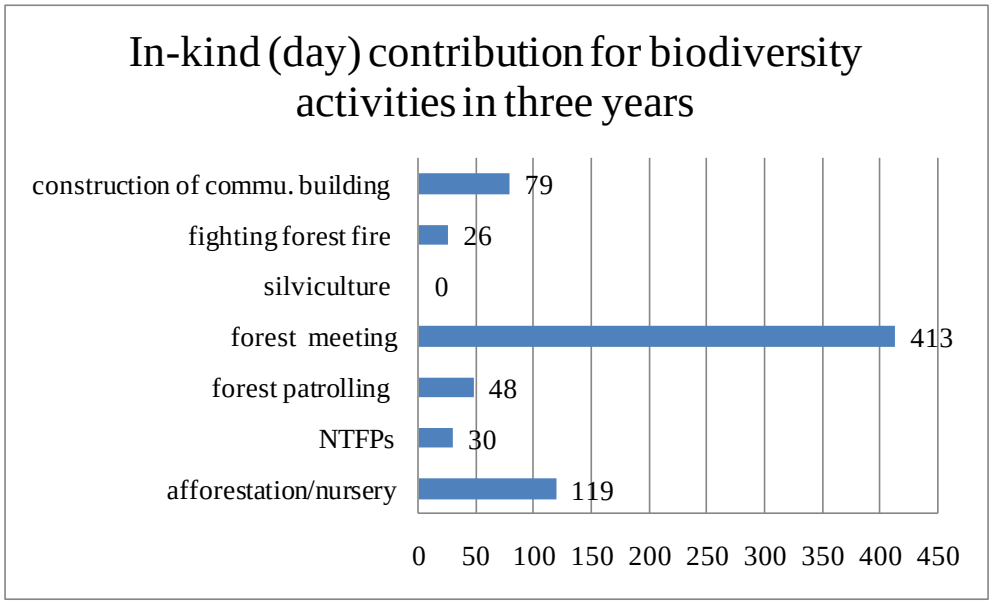

Figure 3. Labour contribution for biodiversity conservation.

resources collection seasons and price. Local people responded that the park office sent the staff for consultation during FOP preparation. There are many areas where park office staff needs to ensure the local involvement. One is local consent while fixing price of forest resources. 17% respondents said that the park office highly emphasized local consultation while fixing price. 32% said that the park office just emphasized while 51% were not aware. 51% is a big gap. One possible explanation for this big gap might be that male members who were consulted did not share to their female members. On women representation, 32% respondents

Figure 4. Villagers patrolling in forests (a); Users attending forest committee meeting (b).

said that the park office puts much focus to ensure that women are represented while 45% found it just fine. Nearly 23% did not know about it.

Socio-economic characteristics of sample households

Out of 145 sampled households, men and women respondents constituted 53.8 and 46.2% respectively. The central region of Middle Mountain (1,200 to 3,000 msl) is the home of Tamang people. Tamang are predominantly and traditionally agro-pastoralist relying heavily on forests and pastureland for subsistence living. The relative importance of animal husbandry to individual households is governed by many factors, including the availability of summer and winter pastures and a reliable fodder supply (Karki, 2000). Tamang accounts 90.3%. Newar (8.3%), another mid hill group stands second followed by Brahmin (1.4%). Average family size was 5.4. The education status was poor as over 61% respondents were illiterate. Illiterate was defined as those who cannot read and write. In literate category, highest 20% had education only up to primary level (five grade). The situation of higher education was bleak with less than 1%. Poverty, low level of awareness on education and out-migration has contributed to poor education status.

Household income sources

Local residents in buffer zones of Langtang National Park are primarily agro-pastoralist, of which animal husbandry is an essential component and an integral part of the social, economic and religious life (Karki, 2000). This is well supported by the fact that 97.2% respondents are farmers. They grow primarily maize, millet and paddy. In recent years, few farming households have shifted to cash crops such as potatoes, vegetables (Bikram Lopchan's pers. comm.) primarily due to the crop damage by wild boars, barking deers and monkeys. It was not surprising that direct reliance on forest was higher (95.9%) as Tamang are traditionally agro-pastoralist. 87% households derive income from collecting wintergreen (*Gaultheria fragrantissima*), a medicinal herb. This is denoted by NTFP in the graph. The Park office, WWF Nepal and the private sector funded oil plant. Villagers collect leaves and twigs of wintergreen from community forest during Mid-August to November and sell raw materials to oil plant. Business constitutes 35.9% while Job 5.5% (Figure 5).

The higher involvement of Tamang in business is due to the wide spread practice of brewing local wine (*raksi*). Others include small grocery shops, tea shops and poultry farms. Households with remittance were nearly 26.2% but their share was substantial. Not much income was observed from pension.

A significantly large proportion of the respondents (97.9%; N = 145) were involved in farming followed by forest resources collection (95.8%). Local people collect firewood, fodder and leaf litter for household use. The mean annual income of household from forest resources and NTFP were respectively US$ 55 and 2.5. Despite of large proportion, the economic benefit from NTFP was found very low due to limited season. Earlier, winter green herbs were used only for animal bedding. As currently villager are restricted to collect wintergreen herbs from community forests other than designated period, benefits from NTFP and forest resources are attributed to Buffer Zone program. SBZCFUG invests in forest conservation activities, hires forest guard for patrolling, carries out planting of cash crops such as broom grass (*Thysanolaena maxima)* and Chiraito (*Swertia chirayita*), mobilizes users for fighting forest

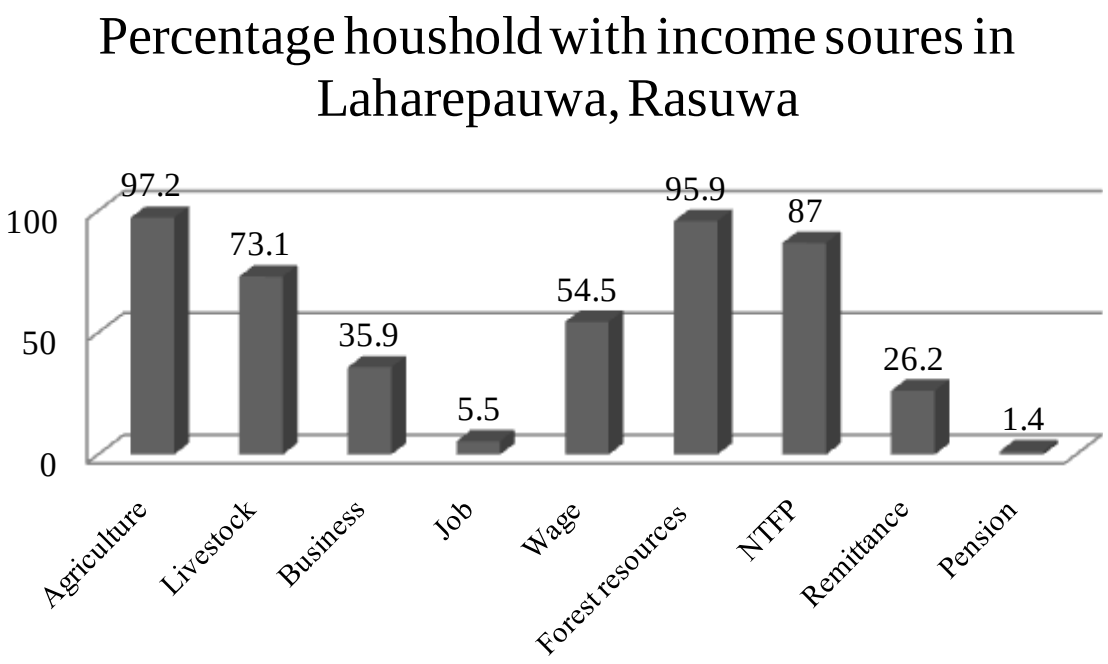

Figure 5. Household incomes sources.

fires, holds forest meeting and issues harvesting permit. In return, user households provide labour (in-kind) contribution for biodiversity conservation.

Household with livestock herding was 73%. Buffaloes, cow, goats were the common livestock. Daily wage constitutes 54.5% and seasonal occupation for most of the farming households. The people of Mountain adopt multiple survival strategies by diversifying their livelihood options (Jodha et al., 2002). Farming households adopts wage labour during slack agriculture season. Kalikasthan, Jhibjihbe and Trisuli bazaar are the nearest markets where local people work as a wage laborer. The annual income per household was US$ 576.4.

Agriculture income has been shrinking due to the increased labour costs. This has pushed farmers to shift from on-farm activities to off-farmed wage labour and small business. Also farmers were found to be less sure about the arrival of monsoon which might have caused by climate change. The land type is largely un-irrigated and therefore greatly relies on monsoon.

8 Remittance occupies a highest share and this trend-in-rise is not unique to study area. This is rather a nationwide phenomenon. According to the report of Department of Immigration of Tribhuvan International Airport 1500 plus Nepali youths out-migrate daily to foreign job market. In Laharepauwa, the total and mean (HH/year) income was found to be US$ 202,209 and US$ 1,394.5 respectively. The percentage share of buffer zone program (Forest conservation and NTFPs) was 4%. Remittance stands highest with 46.3%. Agriculture and livestock were collectively contributing 12%. Others account 16% which includes business, job and pension (Table 2).

Forest resources collection time and opportunity cost

The survey revealed that the forest resources collection time has been reduced after local institutions managed community forest. The community managed forest since 2007. The community based management has resulted in to improved forest and easy accessibility of forest resources, that is, fuel wood, fodder and leaf litter. Though local users have an access to timber, the study found that local people extract timber rarely and only for household use. The quantity of timber is thus not accounted in income calculation.

Mean annual quantity (HH/year) of fuel wood, fodder and leaf litter collected from community forest were respectively 6.74, 7.84 and 6.39 bundles. Villagers are not allowed to collect forest resources throughout the year. Local community uses liquid petroleum gas to supplement fuel woods. The bundle (*bhari*) is the local unit varies in weight by forest resources type. Generally, a bundle of fuel wood weighs 25 to 30 Kg whereas bundle of fodder and leaf litter weigh 12 to 18 Kg. Earlier a villager spent 9.8 h, 9.7 and 9.6 h, respectively for collecting a bundle of fuel wood, fodder and leaf litter. Currently the mean collection time has been reduced to 2.1, 2 and 2 h (Figure 6). This has saved annually 51.9, 60.5 and 18.2 h for forest dependent households. This is

Table 2. Mean and total income by income sources.

Sources of income	Frequency	Mean income (US$)	Std. Err.	Total income (US$)	Share (%)
Agriculture	141	50.4	5.48	7,104.8	3.51
Livestock herding	106	156.2	19.30	16,562.2	8.19
Business	52	456.4	105.85	23,732.9	11.74
Job	8	544.0	200.85	4,352.4	2.15
Daily wage	79	576.4	69.77	45,533.3	22.52
Forest resources	139	54.9	1.91	7,635.9	3.78
NTFP/ Winter green	126	2.5	0.32	311.6	0.15
Remittance	38	2,461.8	406.41	93,547.6	46.26
Pension	2	1,714.3	571.43	3,428.6	1.70
Total Income				202,209	100.00
Mean Income (HH/year)				1,3945	

Note: US$1 = NPR 105.

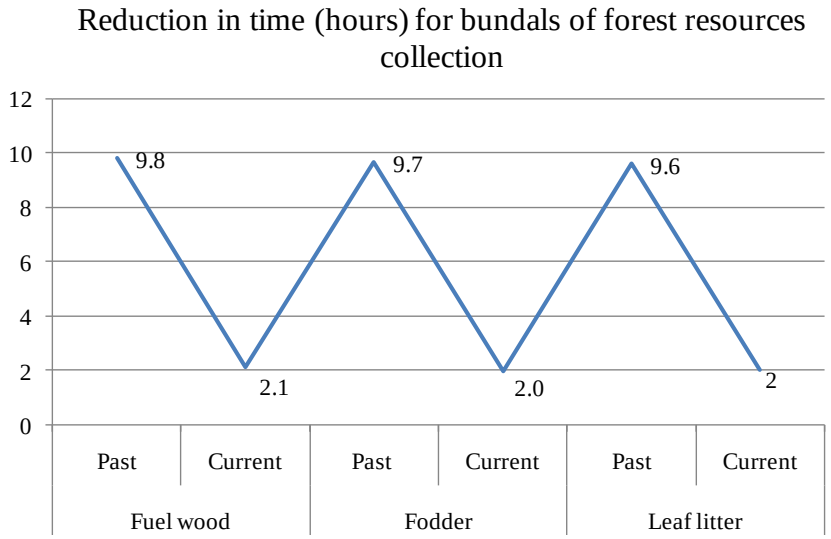

Figure 6. Resources collection time (hours).

the indirect benefit of buffer zone program which saved 2351 working days' worth US$ 11,198 annually. Reduced resources collection time entails reduced opportunity cost. Local people's judgment of conservation is based on what benefits it brings to them, their participation is possible only if conservation enhances the local economy (Bajracharya et al., 2007). This is the aggregate social welfare for Tamang community.

Association of in-kind contribution with income, education, remittance and landholding

The result of linear regression indicates that there were no significant relationship between in-kind contribution with income, education level, remittance and landholding. The low R^2 value suggests that change in independent variable did not explain the variability in contribution. The possible explanation is that the demand of contribution by SBZCFUG was so low that users might have easily met compliance irrespective of incomes, education, remittance and landholding. The result might be different if contribution would be on voluntary basis so users have freedom to choose. The current contribution is mandatory as enforced by user's group. The annual contribution of 2 days per household was very low. The negative sign of coefficient of remittance suggests that higher remittance tend to reduce the contribution but as value of coefficient is very low (-0.00000289), the effect was insignificant. The p values were above 0.05 in all cases and therefore

Table 3. Association of in-kind contribution with income, education and Landholding.

Statistics	Income from wage	Education level	Remittance	Landholding
Number of observation	145	145	145	145
R^2	1.70%	1.33%	8%	0.81%
Probability >	0.11	0.16	0.09	0.28
DF(Residual)	143	143	143	143
Coefficient	6.90E-01	0.27	-2.89E-06	0.09
Standard Err.	4.37E--01	0.19	1.67E-06	0.086
P value	0.117	0.16	0.09	0.28

no significant relation at 95% confidence level. The regression results are presented in Table 3.

DISCUSSION

Buffer Zone is based on Integrated Conservation and Development Program (ICDP) model and therefore encourages the local participation in conservation and development (Bajracharya et al., 2007). However this model is often criticized for its greater reliance on development objectives. Agi Kiss, an Environment and Biodiversity Lead Specialist, The World Bank, has argued that conventional conservation projects, including the ICDPs have failed to address the true causes of biodiversity loss at the scale on which they operate as it focused too much on carrying out project activities and too little on creating incentive for conservation. These assumptions might hold some meaning as indicated by low level of contribution in conservation. The chief warden, Mr. Bed Dhakal said that the biggest challenge in buffer zone management is to strike the balance between conservation and development. Local community had development high in their agenda, most often, especially if they have not generated income from eco-tourism.

In ICDP, community participation in protected area management is primary criterion, which has the dual goal of conserving the biodiversity and improving the socioeconomic conditions of the local people (Kothari et al., 1998). The fundamental principle of ICDP is that the protection of delicately balanced habitat and maintenance of its biodiversity can be achieved only with the support of local communities. Only 5.2% households represented in LBZUC which distributes revenues to communities. There were, however, concerns that there is poor participation of the groups of the poor and marginalized in buffer zone programmes (Budhathoki, 2004; Paudel, 2005a). There is a dearth of data on effectiveness of buffer zone program particularly on mountain national parks. It is likely if there are no or low representation in UC, revenue and program would not come to village. Poverty, poor education and lack of adequate awareness might have resulted in low representation. The park office provides 30 to 50% of revenues to BZUCs for conservation, livelihoods and community development (personal comm. with Chief Warden).

The Langtang National Park emphasizes mainly in-kind, labour contribution. There has been always a trade-off between conservation and development. However, very low level of contribution observed in plantation, nursery management, forest patrolling and fighting forest fire. Majority of contributions were observed in forest meeting and community building construction. No single day was contributed for silviculture practices.

The villagers experienced forest fire in 2012 which destroyed pine forest partially. Villagers somewhat managed to have put off fire but did not assess damage. The damage area and quantity of forest products could have been measured with the support of park office. The productivity forest meeting should be reviewed. More contribution should be asked from community in returns of revenue sharing and buffer zone program. Labour contribution should be sought in creating water holes to restore the habitats. The prolonged winter drought and erratic rainfall have dried up or shrank water holes inside community forest. Nearly two labour days household per year was very low. If user's committee would be more proactive engaging community for contribution, there would have been greater ownership on biodiversity conservation. It is likely that due to low demand, independent variables such as income, education, remittance and landholding did not explain changes in contribution. Perhaps the most notable is reduction in forest resources collection time. It has greatly relieved thework burden of women as were the major workforce for collecting natural resources. Prior to 2007, villagers had to spend nearly 10 h to collect a bundle of fire woods, fodders and leaf litters. Overgrazing and forest fire were frequent and local community did not have sense of ownership simply because they were not involved in conservation. Once forest was handed over to buffer zone community and provided user's group member with forest training and institutional support,

forest cover has been improved over time. SBZCUG annually opens forest for seven days. Local people spent nearly 2 h for getting a bundle of forest resources. SBZCFUG finds monitoring work easy during open periods. Some households started planting fodder trees on private land. If this saved time will be spent in cash income, economic welfare is possible for Tamang community.

Conflict of Interests

The authors have not declared any conflict of interests.

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