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Is collaborative forest management in Nepal able to provide benefits to distantly located users?

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ABSTRACT

Collaborative forest management (CFM) is a joint forest management approach between government and community. It covers distant communities too, who live out of 5-km periphery of the forest and involves them in forest management. This paper assesses whether the distant communities are deriving benefits from CFM in the form of timber, fuelwood and fodder. A total of 350 households was surveyed using a structured questionnaire. The result indicated that distant users were getting more timber compared to the users who lived close to collaborative forest and it was opposite in case of fuelwood and fodder. About 75% and 85% of fuelwood and fodder needs was fulfilled from the private source- trees grown on private farmland. Although CFM approach is able to supply timber to distantly located households, rich and male-headed households are disproportionately receiving high benefits. Provisioning small timber to the poor for house construction in place of sawn timber which is very expensive, may enhance welfare of the poor.

1. Introduction

There is a growing consensus that local communities manage common pool resources (CPRs) more efficiently and effectively (Agrawal, 2001; Ostrom, 1990; Twyman, 2000). Before 1970s when community forestry (CF) was not introduced in Nepal, forests were either under the state control or private (Arnold, 1992). People were legally isolated from appropriating any kind forest products from the nearby forest. Even though forests were controlled by the government, they were open to everyone and everyone's property due to the government's failure to provide an effective forest management mechanism. This led to a free ride, which resulted into a rapid depletion of forest in Nepal (Arnold, 1992; Fisher et al., 2007). In order to curb the accelerated forest degradation and deforestation, the CF program, a community-based forest management (CBFM) regime, was introduced (Acharya, 2002). The underlying principle of the program was people are likely to have more interest in conserving forest or other CPR that is close to them. Numerous studies have shown that the CF program has contributed in local economy boost-up and restoration of degraded forest resources (Niraula et al., 2013; Pandit and Bevilacqua, 2011; Rai et al., 2016).

Despite the CF's contribution in forest restoration and conservation, the program fails to address certain issues. For instance, benefit appropriation is not equitable. Appropriation is determined by the user's well-being, gender and caste. A study carried out in the mid-hills of Nepal points out that the poor households face more restricted access to community forests than the relatively better off households and the so-called higher caste collects more forest products than the so-called lower caste (Adhikari et al., 2004). In the same study, they found that the female-headed households appropriate less amount of forest products than the male-headed. In terms of cost associated with CF management, the poor bear higher percentage than the rich households (Adhikari and Lovett, 2006).

Besides the discrepancy in benefit sharing among the forest users, the CF program has a flaw in user identification (Pant et al., 2017). In the mid-hills, where the program was first introduced, forest user identification was not a major issue since the human settlements and forest patches are physically very close (Bampton et al., 2007). As a result, there was less or a minimum conflict during the process of user identification. However, the case of the Terai is different. Unlike the mid-hills, the socio-ecological landscape of the region is very complex. The distribution pattern of population and forest resource is not even. Forest patches and human settlements are apart in the region. Issue of proximate and distant users has greatly influenced forest management

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and use in the region (Pravat and Humphreys, 2013). Uneven distribution pattern is the reason of conflict between the proximate and distant users (Karna, 2008). There are examples of violence and confrontation among users over the control and use of the forest resources in the region (Bampton et al., 2007; Ebregt et al., 2007). Even though attempts have been made to include the distant users into forest management under the CF policy, in most cases they have been excluded (Bampton et al., 2007). The failure of CF policy in recognising the distant users as a part of forest management led to evolution of a new form of participatory forest management regime, known as collaborative forest management (CFM) to ensure that distant users are included in and benefited from (HMGN, 2000).

In the last 15 years, the CFM has come a long way. A total of 24 CFM groups, covering 63,933 ha of forest in 11 Terai districts of Nepal, have already been formed, which is approximately 20% of the forest area in Terai, excluding protected areas (DoF, 2017). CFM has been legitimized by amending the Forest Act 1993 (MoLJPA, 2016). Considering the potential contribution of CFM in national economy and gap reduction between demand and supply of timber in Nepalese market, the forest department has initiated a production-oriented forestry in some collaborative forests (Rai et al., 2017). The production forestry, which is known as scientific forest management (SFM), divides forest into different coups, defines harvest controlling area and determines growing stock based on the rotation age.

The conflict between distant and proximate users over the control, management and use of forests has been resolved under the CFM model by including the distant users in forest management. Even though inclusion of distant users has broadened the benefit distribution from the collaborative forest in the Terai, the issue of equity in resource appropriation is not properly addressed. For example, CFM rules allow users to freely collect dry and dead branches as fuelwood, leaf litter and fodder regularly. However, the distant users cannot enjoy these benefits because of the additional time to get the forest area and forest product transportation cost (Lumbini CFM, 2014; Tilaurakot CFM, 2010). The opportunity cost of collecting such products to them may be high. Unlike fodder, fuelwood and leaf litter, users cannot extract timber for free. The CFM committee uses hired labourers to extract timber following the forest operational guidelines (Rai et al., 2017). Even though both users pay for timber, the distant users have to spend an extra time and bear transportation cost to get the same amount of benefit. Since the extra time and transportation cost are not factored into revenue distribution, equity in resource appropriation is still questionable under the CFM model too (Mahanty et al., 2009).

Against the above backdrop, this paper is an attempt to examine whether the CFM rightly addresses the issue of the distant users, which the CF fails to accomplish in the Terai region of Nepal. Whether the distant users are less or equally or more benefited from this approach compared with the nearby users is the central question to have addressed through this study. Specifically, three forest products, timber, fuel-wood and fodder were taken into consideration as benefits. What factors are responsible in determining the amount of these products appropriated by both users is also discussed. Our working hypothesis is because of additional costs involved, the distant users are likely to appropriate/collect less amount of forest products compared to the nearby users. The study presented here was carried out in two CFM groups: Lumbini CFM of Rupandehi District and Tilaurakot CFM of Kapilvastu District of Nepal.

2. Study area and methods

2.1. Study area

This study was carried out in two districts in western Terai of Nepal, Kapilvastu and Rupandehi. One CFM group in each district was selected for household survey (see Table 1 for details). The Lumbini CFM group of Rupandehi district covers 16 village development committees (VDCs) with 1321 ha of forest and 25,934 households as forest users. The Tilaurakot CFM group of Kapilvastu district covers one municipality and 23 VDCs, which manages 2778.5 ha of forest with 22,622 households. The forest operational plan of the Tilaurakot CFM and the Lumbini CFM was approved in the fiscal years 2009/10 and 2014/15 respectively. The forest-household ratio was higher for the Tilaurakot CFM while the Lumbini CFM was denser than the Tilaurakot CFM (Table 1). Even though the productive forest area of Lumbini CFM is smaller, the tree volume is three times higher than that of Tilaurakot CFM. The forest of the study CFM groups is dominated by two species, *Shorea robusta* and *Terminalia tomentosa.* Our choice of these two groups as study sites was mainly due to the fact that they are pioneers of scientific forest management (SFM) in the region.

Table 1
Forest attributes of Lumbini CFM and Tilaurakot CFM.
Source: (Lumbini CFM, 2014; Tilaurakot CFM, 2010).

Description	Lumbini CFM	Tilaurakot CFM
Total Forest Area (ha)	1321	2778.5
Set-aside (ha)	204.2	76.5
Productive forest (ha)	1045	2702
Seedling (Nos/ha)	14,029	2877
Sapling (Nos/ha)	2012	2080
Pole (m^3/ha)	35.51	92.15
Tree m^3/ha	212.6	73.10
Household	25,934	22,622
Major species	*Shorea robusta, Terminalia tomentosa*	*Shorea robusta, Terminalia tomentosa, Schleichera oleosa*

The two groups receive technical assistance from the District Forest Office (DFO) to carry out forest management activities. Unlike CF, hired labourers are used by the CFM groups for timber and fuelwood harvesting. Harvested products mainly the logs (timber) and fuelwood are collected at sales depot from where the CFM committee distributes them to its users. The users have to pay for these products. The distant users have to pay an additional cost of transportation. The revenue generated from the forest products sale is spent in five different activities including community development (30%), poverty reduction (30%), forest management (25%), natural hazard mitigation (5%) and institutional development (10%) (Tilaurakot CFM, 2010).

2.2. Basic theory and empirical model

The distance-decay effect also applies in resource appropriation from the common pool resources such as forests (Sapkota and Oden, 2008). The households that happen to live closest to the forests are likely to collect more forest products than the households living farthest. This is because the distant users may require additional time to travel to the forests and pay certain fare for transportation. Even though the CFM claims that the distance-decay issue has been resolved by securing the access of distant users to forest, because of time and transportation cost, the distant users may not be able to appropriate equal benefits. Therefore, it is expected that the distant users are likely to collect less amount of forest products than the nearby users.

In order to examine the claim of the CFM program, this study estimates the functional relationship between demand and its determinants. Here, we consider three forest products, timber, fuelwood and fodder representing demand, because forest users of the Terai region mainly collect/extract these products (Rai et al., 2016). The home-to-forest distance and other socio-economic variables are taken as determinants of demand. The model proposed for analyzing the influence of the factors on appropriating the key forest products is specified below and the descriptive statistics of the factors are presented in Table 2.

Table 2
Socioeconomic characteristics of the sample).

Variables	Description	Mean
HF-distance	Distance from home to forest	12.06 (7.40)
CF-Member	If respondent is member of other community forest user group = 1, otherwise = 0	2.54%
Age	Age of the respondent	46.10 (13.35)
Education	Years of education	4.03 (4.43)
Gender	Sex of respondents. Male = 1 and Female = 0	84.51%
HH-size	Number of people in family	8.64 (4.78)
Occupation	Agriculture as the main source of income coded as 1 otherwise 0	82.54%
Land-Holding	Average land-holding by HH (equivalent to unirrigated land[a]) in Katha	35.47 (40.58)
ToT-Timber	Total-timber collected in the last 5-years in cft	5.57 (15.28)
Timber-CFM	Timber collected from CFM in the last 5-years in cft	4.27 (14.59)
ToT-Fuelwood	Fuelwood collected in the last 12-months in headload (bhari)	55.84 (75.88)
Fuelwood-CFM	Fuelwood collected from CFM in the last 12-months in headload (bhari)	13.78 (45.14)
ToT-Fodder	Fodder collected in the last 12-months in headload (bhari)	28.46 (104.26)
Fodder-CFM	Fodder collected from CFM in the last 12-months in headload (bhari)	3.99 (27.71)

Note: figure in the parenthesis is standard deviation.
[a] Price of irrigated land is 1.67 higher than the price of unirrigated land. Hence, total landholding is unirrigated land plus irrigated land × 1.67.

$$Y_i^v = \beta_0^v + \beta_1^v DIST + \sum \beta_i^v X_i^v + \varepsilon_i^v \tag{1}$$

where Y_i^v represents the demand of timber, fuelwood and fodder within a given time period, β_i is the coefficients, *DIST* is the distance between house and forest in kilometer, X_i stands for other socio-economic variables and ε represents the error term. Other socio-economic variables include gender, age, education, occupation, household size and land-holding (Table 2). Selection of these variables is based on the review of existing literature, which have shown relationship between the selected variables and use of forest products (Adhikari et al., 2004; Rai et al., 2012; Sapkota and Oden, 2008).

2.3. Econometric issues

Which regression model is the best fit is largely determined by the nature of dependent variable. The dependent variable here (Eq. (1)) is amount of forest products, which is expressed either in cubic feet (Cft) or head load (*BHARI*) and holds the positive values only. Therefore, for the kind of data we have, which is non-negative, use of either Poisson or Negative Binomial estimator is a best fit. The Poisson distribution assumes equality between the mean and the variance of the concerned variable. Poisson process is a popular method to specify such discrete type data function. Specification of a model that satisfies the non-negative integer and truncation problem is called truncated Poisson distribution (Yen and Adamowicz, 1993). This can be expressed as:

$$f(Y_i = y_i \mid Y_i \rangle 0) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!(1 - e^{-\lambda_i})}, \quad y_i = 1, 2, \cdots; \; i = 1, 2, \cdots, n \tag{2}$$

where, Y_i is a discrete random variable for the number of forest product unit taken home by individual household i, and y_i is its realized integer value of that concerned variable, λ_i is parameter to be estimated as

$$\ln(\lambda_i) = \beta X_i + \varepsilon_i \tag{3}$$

where X_i is a vector of exogenous variables, β is the parameter vector, and ε is a random error term.

In the case of over-dispersion problem, Poisson method underestimates the standard error (Grogger and Carson, 1991). If equality between the mean and the variance of the dependent variable does not hold, then the Negative Binomial estimator is more appropriate (Nepal et al., 2007). To account such high uncertainty, use of the negative binomial distribution gives more accurate estimates of the coefficient. The truncated negative binomial estimator is expressed as;

$$f(Y_i = y_i \mid Y_i > 0) = \frac{\Gamma(1/\alpha + y_i)}{\Gamma(1/\alpha)\Gamma(1 + y_i)} \frac{(\alpha\lambda_i)^{y_i}(1 + \alpha y_i)^{-(y+1/\alpha)}}{1 - (1 + \alpha y_i)^{-(1/\alpha)}}, \tag{4}$$

where $\Gamma(\cdot)$ is the gamma function. The parameter α determines the degree of dispersion in the estimates. If $\alpha \longrightarrow 0$, the gamma distribution converges to the Poisson distribution (Creel and Loomis, 1990).

Since, it is difficult to handle the problems of truncation, over dispersion, and endogenous stratification simultaneously. In most of the case it is corrected for endogenous stratification under the assumption of equal dispersion. For this, following equation has been developed (Shaw, 1988):

$$\Pr[Y_i = y_i \mid Y_i > 0] = \frac{e^{-\lambda_i} \lambda_i^{(Y_i - 1)}}{(Y_i - 1)!}, \tag{5}$$

Thus, it may be sufficient to model the number of units collected during last year minus one (D-1) with a conventional Poisson distribution (Haab and McConnell, 2002).

For empirical purposes, both Poisson and Negative Binomial models are estimated using the log-linear demand function for forest products. In this paper, we report only the results of the Poisson model because of the model fit and consistency in the results.

$$E(Y_i^v \mid DIST, X) = \exp(\beta_0^v + \beta_1^v DIST + \sum \beta_i^v X_i^v) \tag{6}$$

where, *X* refers to all covariates except *DIST*. For the log-linear demand function, it can be shown that how the change in independent variables leads percentage change in dependent variables.

2.4. Data collection

A detailed survey of 350 households was conducted using a structured questionnaire. As a part of questionnaire development, three participatory rural appraisal (PRA) techniques were applied. First, two focus group discussions (FGDs) were carried out with forest users of Tilaurakot CFM to understand local context. Second, executive members of both CFM groups, and officials of District Forest Office of Kapilvastu and Rupandehi districts were consulted for further scrutinizing and verifying the information collected from the focus group discussion. Third, a transect walk in the forest area of both CFM were performed with the executive committee members. These activities greatly helped design a draft questionnaire. The draft questionnaire was later pre-tested. A total of 25 household interviews were conducted during pre-testing. The purpose of pre-testing was mainly to make questionnaire compatible to the local situation and manage the flow of the questionnaire. The questionnaire was later revised using feedback from pre-testing.

2.5. Selection of sample households

We followed multi-stage sampling. Selection of sample households started with stratification. All villages of the two CFM groups were stratified into two categories, proximate (nearby) users and distant users based on the 'home-to-forest distance' as 'within 5 km (< 5 km) and beyond (≥ 5 km). It is a well-accepted rule in CFM that users living out of 5 km periphery of their forest are distant users (Lumbini CFM, 2014; Tilaurakot CFM, 2010). In total, ten VDCs were selected for this study. In Tilalurakot CFM group, six VDCs were randomly selected i.e. three VDCs from each stratum. Similarly, in Lumbini CFM group, four

VDCs were randomly selected: two VDCs from each stratum. Finally, one ward[1] from each selected VDC was randomly selected to select sample households for the survey.

Systematic random sampling was applied while selecting sample households. This means the first household in each ward was selected randomly and the rest households were systematically selected at a predetermined interval. The interval varies with ward depending on the number of households. 'Interval' was calculated as ratio of total households and number of sample households. For instance, in the first stratum of Tilaurakot CFM every 9th household was selected while the interval was 10 in case of Lumbini CFM. A face-to-face interview was conducted with household heads using the structured questionnaire.

3. Results

3.1. Key forest products appropriation from collaborative forest

Majority of respondents in the study area depended on agriculture. They depended on forest for a number of forest products including leaf litter and non-timber forest products (NTFPs). However, they considered timber, fuelwood and fodder as key forest products for their livelihoods. The amount of the key products collected is presented in Table 2. The analysis of collection in this study shows that the users were heavily dependent on collaborative forest for timber. Above 75% of timber needs was fulfilled from the CFM alone. Rest of the timber needs was fulfilled from other sources including community forest and private source. However, they were less dependent on CFM for fuelwood and fodder. Only 14% and 24% of fodder and fuelwood needs were fulfilled from their collaborative forests. The distance from home to forest might be a reason for the low amount of fodder and fuelwood collection. The users fulfilled the rest of the fodder and fuelwood needs from private sources: they had grown trees on their farmland. Community forest is another source for these products for some users who have become a member of a community forest user group (CFUG).

3.2. Model results

In order to assess the determinants of forest products collection, six separate regression models were developed for the key forest products: timber, fuelwood and fodder. Here, amount of these forest products collection/appropriation is the dependent variable in each model while home-to-forest distance and other socio-economic variables are considered as explanatory variables (Adhikari et al., 2004; Rai and Scarborough, 2013; Sapkota and Oden, 2008). For each forest product, two models were estimated. The first three models (M1, M2 and M3) presented in Table 3 are the basic models that include all the variables as covariates. The last three models (M4, M5 and M6) in Table 4 are the interactive models i.e. an interaction of distance with other socio-economic variables to see if the interaction brings changes in resource appropriation from the collaborative forest.

3.2.1. Results of basic models

All the three estimated Poisson regression models were found to be significant at 1% level (Table 3). There were seven explanatory variables used in the basic models that showed both negative and positive association with the dependent variables. In the models, home-to-forest distance, gender of the respondent and landholding size were found to have statistically significant impact on appropriation of all the key forest products while age of the respondent, education, occupation and household size had mixed impacts. Specifically, timber appropriation was significantly affected by home-to-forest distance, gender of the respondent, household size and landholding size out of which three had positive impact except for the variable household size. In the estimated model for fuelwood appropriation, all the variables were found to be statistically significant and negatively associated. In the model estimated for fodder appropriation, home-to-forest distance, gender of the respondent, education, occupation and landholding size had significant influence. Variables home-to-forest, occupation and landholding size had negative association with fodder appropriation from the collaborative forests.

The positive coefficients of home-to-forest distance, gender of the respondent and landholding size show the amount of timber appropriation increased with increase/change in these variables. For example, as home-to-forest distance increased by 1 km, the amount of timber appropriation increased by 0.16 cubic feet. However, increase in household size by 1 would decrease the timber appropriation by 0.03 cubic feet.

The negative association of all variables indicates that the amount of fuelwood appropriation decreases with increase/change in the variables' values. Model 2 shows that the amount of fuelwood appropriation decreased by 0.17 bhari for 1 km increase in home-to-forest distance. For 1 year increase in age of the respondent, the amount decreased by 0.015 bhari.

The estimated model 3 shows the impact of gender and education of

Table 3
Coefficients of determinants included in the basic model (M1) for demand estimates of timber, fuelwood and fodder collection.

Variables	Timber	Fuelwood	Fodder
HF-distance	0.165***	− 0.170***	− 3.125***
	(37.32)	(− 50.49)	(− 35.75)
Gender	0.819***	− 0.552***	0.267***
	(4.25)	(− 16.64)	(4.10)
Age	0.00340	− 0.0149***	0.00192
	(1.53)	(− 11.11)	(0.63)
Education	0.00287	− 0.0235***	0.0519***
	(0.41)	(− 5.55)	(6.00)
Occupation	0.0467	0.853***	− 1.410***
	(0.56)	(19.25)	(− 14.21)
Household size	− 0.0294***	0.0616***	− 0.0113
	(− 4.79)	(18.99)	(− 1.37)
Land holding	0.00647***	− 0.0113***	− 0.0510***
	(16.30)	(− 15.33)	(− 24.15)
Constant	− 2.412***	4.061***	9.776***
	(− 10.33)	(51.35)	(50.26)
Obs.	337	337	337
Pseudo R-square	0.374	0.337	0.734

Note: t statistics in parentheses. * $p < 0.1$. ** $p < 0.05$.
*** $p < 0.01$.

Table 4
Interaction coefficients of home-to-forest distance with covariates.

Variables	Timber	Fuelwood	Fodder
Gender × HF-distance	0.123***	− 0.0665***	0.218***
	(13.61)	(− 13.35)	(4.71)
Age × HF-distance	− 0.0000303	− 0.00314***	− 0.0264***
	(− 0.26)	(− 22.45)	(− 20.58)
Education × HF-distance	0.000483	− 0.00461***	− 0.0196***
	(1.38)	(− 8.43)	(− 4.85)
Occupation × HF-distance	0.00570	0.00516	− 0.686***
	(1.25)	(1.02)	(− 13.45)
Household-size × HF-distance	0.000265	0.00782***	− 0.0293***
	(0.90)	(18.71)	(− 4.43)
Land-holding × HF-distance	0.000402***	− 0.000962***	− 0.0197***
	(16.08)	(− 12.96)	(− 13.36)
Constant	− 1.107***	3.976***	6.706***
	(− 12.37)	(175.26)	(79.65)
Obs.	337	337	337
Pseudo R-square	0.390	0.261	0.671

Note: t statistics in parentheses. * $p < 0.1$. ** $p < 0.05$.
*** $p < 0.01$.

[1] Ward is the smallest local unit.

the respondent to be positive on fodder appropriation from the collaborative forest. The coefficients indicate the amount of fodder appropriation increased by 0.05 bhari and 0.27 bhari for 1 year increase in education and for male-headed household respectively. The influence of occupation on fodder appropriation from the collaborative forest was negative. The model 3 shows that the amount of fodder collection decreased by 1.4 bhari when a household's occupation was agriculture.

3.2.2. Results of interactive models

All the three estimated models (M4, M5 and M6) were found to be significant at 1% level (Table 4). New variables were created by interacting home-to-forest distance with six other socio-economic variables to see the changes in resource appropriation from the collaborative forest. Results of these models reinforced our results of basic models in Table 3. Model 4 shows that home-to-forest distance when combined with gender and landholding size had positive and significant impact on timber appropriation. Model 5 shows that decrease in fuelwood appropriation was significant when home-to forest distance was combined with gender, age and education of the respondent, household size and landholding size. Model 6 shows all the six combined variables had a significant impact on fodder appropriation. While combination of home-to-forest distance with gender yielded a positive impact on fodder appropriation, the rest five combinations were negatively associated.

4. Discussion

One of the reasons for emergence of collaborative forest management model is the failure of the community forestry program in addressing the 'proximate vs distant user' issue in the Terai (Ebregt et al., 2007). Our study results indicate that the CFM has been successful at achieving its goal of making forest accessible to the distantly located households. It has substantially supplied timber and fuelwood to its distant users. However, our hypothesis about resource appropriation based on the distance-decay effect is rejected, particularly the timber appropriation. Our study confirms that the distant users are likely to collect more amount of timber than the nearby users. The reason for such an interesting result, which is opposite to expectation, is the dual membership of nearby users. The nearby users have access to both community forest and collaborative forest. Since the community forest provides timber to its users at a lower rate than the collaborative forest (Dhakal and Masuda, 2009), the nearby users are more dependent on their community forest for timber. The reason for the timber of the community forest being less expensive is the forest users extract it by themselves while hired labor is used in collaborative forest.

As expected, the distantly located households are less dependent on their collaborative forest for fuelwood and fodder. In line of our finding, a study carried out by Sapkota and Oden (2008) in one of community forests in the Terai confirmed the distance-decay effect in resource appropriation. In another study from a Terai district, Dhakal et al. (2012) found that the distant households preferred planting trees on their farmlands to fulfill their needs of fodder and fuelwood. With proximity and access to forests, users more easily get these forest products fulfilled from the nearby forest and are therefore reluctant to plant trees on their farmlands (Dhakal et al., 2012). According to CFM rules, users are not restricted to fodder and fuelwood collection (Lumbini CFM, 2014; Tilaurakot CFM, 2010).

However, this 'free appropriation' policy is not practicable for the distant users since extra time and cost are involved. Apart from this, the practice of free grazing in the study area during fallow period when no agricultural crops are grown has greatly reduced the pressure on the forest for fodder. However, leaving land fallow is not an intended practice. People are forced to do so because of lack of irrigation facility. In the case of water availability, the scenario would be different.

Both the basic and interactive models showed that landholding size and home-to-forest combined with landholding size had a positive impact on timber appropriation and a negative impact on fuelwood and fodder appropriation. Landholding size is an indicator of well-being in rural Nepal (Maharjan and Joshi, 2011), and this might be the reason why the users with bigger landholdings purchased more timber. The negative association indicates that the users with bigger landholdings appropriated less amount of fuelwood and fodder from the collaborative forests. This is true because studies have shown that landholding size is positively associated with tree planting on private land (Dhakal et al., 2012; Pandit et al., 2015). Smallholder farmers are more risk-averse than bigholder farmers. This might be the reason of the smallholder farmers being reluctant to grwoing trees on their land and depending more on collaborative forest for fuwlwood and fodder.

Critics blame the CF policy for promoting elite domination, gender and caste discrimination in resource appropriation from community forests (Adhikari and Lovett, 2006; Kumar, 2002). Even though the CFM has addressed the issue of distantly located forest users to a greater extent, there still exists the equity issue in forest products distribution under this model too. Our findings suggest that comparatively better off and male-headed households are likely to collect more timber and fuelwood than the poor and female-headed households (Table 3). Similar result was found in a study by Malla et al. (2003). Since the poor users cannot afford cash to buy these two key forest products, they are apparently excluded from the benefits of collaborative forest. This kind of difference over forest resources appropriation may create a social conflict in the long-run (Rai and Scarborough, 2013). This clearly suggests that the equity issue is not properly addressed by the CFM itself and there is a danger of CFM to be transformed as an elite dominated form of forest management in future like the community forestry.

5. Conclusion

The CFM has profoundly been able to address the weakness that the community forestry has- ignoring the distant users. It has provisioned and supplied forest products particularly timber, fodder and fuelwood to its distantly located members who are unable to participate physically in the forest management activities. This has developed positive feelings in both distantly located and nearby communities towards forest management. Our hypothesis about timber appropriation based on the distance-decay effect is rejected by this study. This suggests that this is not true all the time that there is a negative relationship between distance and forest products appropriation. Appropriate intervention such as membership provision for distant users can reverse the relationship.

Even though the membership bias of community forestry has been properly resolved by the CFM approach, there are issues of high significance yet to be addressed. The issue of equity still exists in CFM as in the community forestry. Our study showed rich households were getting more benefits (timber) compared to the poor. By legal provision, the poor are not deprived of appropriating forest products from the forest but practically they are as they cannot afford timber even if they need it because of lack of money. There is no mechanism developed under this forest management system to address this issue, which is very demanding. Another issue of prime significance is a gender issue. This study found male-headed households had received more timber than the female-headed households. The reasons might be male-headed households are better -off so they have higher purchasing power or they have better access to resources, being a 'male' of a patriarchal society. Whatever the reason is, the female-headed households are deprived of getting as much benefits as their male counterparts.

We suggest four strategies to address the above issues prevailing in the CFM. First, since the poor households cannot afford timber (Malla et al., 2003), providing them with small timber may fulfill their needs. Second, the poor (smallholder farmers) have no enough land to plant trees on to fulfill their fuelwood and fodder needs. Fodder is not a big issue for them because they do not endow many livestock. Therefore, major concern is the fuelwood appropriation. The only source available to the distant poor users for fuelwood collection is the collaborative forest. For the proximate poor users, they have alternatives; they can go either to community forest or collaborative forest. Given the extra time and transportation costs involved every time the distant smallholder farmers go to the forest, they are paying more. Therefore, it is advisable the CFM should review its current pricing mechanism to make sure the equity issue is genuinely addressed. Third, the collaborative forest covers different land-use including forest, public land, and settlements. Growing multipurpose trees in the public lands as a part of forest management may supply more fuelwood, small timber and fodder to the distant users and the poor as well. Fourth, women are to be socially mobilized and encouraged to participate in forest management activities, thereby their interests can be incorporated in the forest operational plan.

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