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Contribution of REDD+ payments to the economy of rural households in Nepal

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ABSTRACT

Reducing Emissions from Deforestation and forest Degradation (REDD+) is a global climate change mitigation strategy. Under the proposed REDD+ framework, financial incentives are provided, primarily to developing countries, for forest conservation to reduce carbon emissions. Projects labelled as REDD are being implemented in a wide variety of settings in different countries. Developing an effective benefit-distribution mechanism between implementing agencies and local communities is a key challenge for the implementation of REDD+. We examined whether the REDD+ payment mechanism adopted in a REDD+ pilot project in Nepal is beneficial to the local forest users. We estimated economic contribution of the REDD+ payments to the total household income, calculated the role of payment in reducing income inequality at the household level and examined socio-economic heterogeneity represented by wealth and ethnicity among the payment recipient households. REDD+ payment provided economic benefits to the poorest households but the economic contribution of the payment to the household economy is very nominal and is insufficient to invest in livelihood enhancement activities. REDD+ payment to some extent helps to reduce income inequality among the households. Social heterogeneity of a household overshadowed household wealth status during the payment distribution among the sampled households creating social tension. Therefore, either alternative payment models or investment in community projects might yield better outcomes.

1. Introduction

Deforestation and forest degradation are considered as the second major contributor to global warming responsible for about 12% of global greenhouse gas emissions (Lawrence & Vandecar, 2015; Van der Werf et al., 2009). Although the rate of deforestation has slowed down globally in recent years, about 13 million hectares (ha) of forests were lost annually from 2010 to 2015 (FAO, 2015). Therefore, tackling deforestation and forest degradation is essential for climate change mitigation (Angelsen, 2017). Reducing deforestation and forest degradation in developing countries has received considerable attention in global environmental policies over the last decade (Ryan, Berry, & Joshi, 2014). To combat climate change by reducing deforestation, an incentive-based mechanism that aims to reward financially for any emissions reductions called REDD+ was initiated in 2007 by the United Nations Framework Convention on Climate Change (UNFCCC) at Conference of the Parties to the Convention (COP)-13. Since its inception, substantial changes were made in the scope of REDD+ that include subsequent introduction of environmental and social safeguards such as conserving biodiversity, reducing poverty or enhancing livelihoods, strengthening indigenous rights, improving governance, and increasing capacity for climate adaptation (Angelsen, 2017; UNFCCC, 2012). Safeguards also ensure REDD project to consult the local people in their activities, promote adaptation while responding to climate change (Atela, Quinn, & Minang, 2014). Although rulebook on REDD+ by UNFCCC has completed and all countries were encouraged to implement and support REDD+ in Article 5 of the Paris Agreement (UNFCCC, 2015), the financial needs—major component of REDD+ has not yet met (Norman & Nakhooda, 2014). Nevertheless, REDD+ initiatives have already been initiated outside the auspices of the UNFCCC such as a multilateral UN-REDD programme, Forest Carbon Partnership

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Facility and Forest Investment Program hosted by World Bank, and bilateral, private and donor funded REDD+ lebelled projects (Angelsen, 2017). Several REDD demonstration projects are already in place across developing countries (Atela et al., 2014). Nepal's REDD+ pilot project, where this study is conducted, is one of those demonstration or pilot projects implemented by non-governmental organizations with support from a donor.

1.1. REDD+ pilot project in Nepal

In Nepal, a REDD+ pilot project was implemented through existing community forest management (CFM) program. The objectives of both—REDD+ project and CFM program—overlap each other as both aims at conserving forests and supporting local livelihoods. The forestry programs focused on forest conservation along with supporting livelihoods are utmost important in developing countries like Nepal as it has 1.1% deforestation rate from 1990 to 2015 (FAO, 2015) and 25% of the people live below the poverty line for whom forest resources are one of the major sources of their subsistence livelihoods (UNDP, 2014). Nepal's CFM, which is one of the major forestry programs in the country that covers 30% (1.8 million ha) of total forest area of Nepal, is considered as a successful program to reduce deforestation as well as supply sustainable forest products to the local people (DoF, 2015; MFSC, 2013). Therefore, the operationalization of REDD+ that aims to reward forest conservation through CFM can apparently produce a win-win outcome. Furthermore, the local communities benefit from economic incentives through the REDD+ project and global communities benefit through carbon sequestration in the forests managed by local communities (Agrawal & Angelsen, 2009; Angelsen & Brockhaus, 2009; Groom & Palmer, 2012).

CFM in Nepal refers to the forests controlled, managed, and utilized by local people living in and around forest areas through a local institution called Community Forest User Groups (CFUGs) in the form of community forests. The CFUGs are comprised of forest users of different caste, ethnicity, gender, culture, and religious and economic backgrounds. With the technical support from District Forest Office (DFO), CFUGs develop an operational plan (usually a five to ten-year plan) and their constitution for day-to-day group functioning and managing forest resources, which has to be approved by the local DFO before forests are handed over to the community. Thus, CFUGs are legal, and autonomous bodies having full power, rights, and responsibility to protect and manage forest resources inside community forests. All households affiliated as members of CFUGs can utilize forest products such as timber, fuelwood, and fodder for their subsistence use but not-for-sale and benefit from other ecosystem services (watershed protection, erosion control, water purification) provided by community-managed forests (Bhandari, K.C., Shrestha, Aryal, & Shrestha, 2016). Sometimes users have to pay certain fees to the committee of CFUGs to get permits to obtain forest resources. The fees collected from permits are used by the CFGUs for social welfare activities such as building schools and community buildings and providing training. Some households, who can obtain such resources outside from the community forests such as private lands, do not extract resources from the community forests to avoid such fees. Members of CFUGs elect an executive committee of usually 11 people to manage operations of the community forests. In many instances, women and socially disadvantaged groups are well represented on the executive committees of CFUGs. Therefore, an additional advantage of superimposition of REDD+ on existing CFM is, it does not require a new institutional mechanism to operationalize project activities.

In Nepal, the Ministry of Forest and Soil Conservation (MFSC) has developed a national Readiness Preparation Proposal (R-PP) and REDD+ strategy with the support of the Readiness Fund provided by the Forest Carbon Partnership Facility (FCPF) in the first stage (MFSC, 2012). The second component of FCPF was Carbon Fund designed to promote and implement action programs to reduce carbon emission (Acharya et al., 2015). While Government of Nepal was preparing a national R−PP and REDD+ strategy, a pilot action program was implemented by a partnership of non-governmental organizations. A pilot project was launched by three intermediary organizations—International Centre for Integrated Mountain Development (ICIMOD) in partnership with Federation of Community Forestry Users Nepal (FECOFUN) and Asian Network of Sustainable Agriculture and Bio-resources (ANSAB)- for 105 CFUGs from three watersheds in three districts of Nepal. Financial support came from the Climate and Forest Initiative of Norwegian Agency for Development Cooperation (NORAD) from 2010 to 2013. In the pilot project, a funding mechanism was established and so-called 'financial reward' was handed over to the participant CFUGs for their contribution to conserving forests that have maintained carbon. Out of 105 CFUGs, 58 CFUGs in the Charnawati watershed (Dolakha district), 16 CFUGs in the Kayarkhola watershed (Chitwan district), and 31 CFUGs in the Ludikhola watershed (Gorkha district) received USD 120,579, USD 69,055, and USD 73,666, respectively, in three years (ICIMOD/ANSAB/FECOFUN, 2013).

Along with the inherent criteria of REDD+ to reward financially for maintenance and increment of carbon stocks, the pilot project has additional social criteria that include representation of the poor, women, *Dalit* and indigenous (*Janajati*) people in CFUGs. The inclusion of social criteria in the payment mechanism was to support socio-economically disadvantaged users of the CFUGs. To distribute fund, sixty percent of weight was given for social variables, based on the representation of poor (with a weight of 20%), women (15%), *Dalit* (15%), and *Janajati* (10%) in the CFUGs. The remaining forty percent of weight was given for environmental variables, based on the performance of individual CFUGs in forest carbon stock maintenance (24%) and annual carbon increment (16%) (Operational guidelines for FCTF, 2011). Furthermore, an addition of social variable was believed to provide maximum benefits to marginalized groups in terms of livelihood enhancement activities and circumvent elite capture that was evident in CFM in Nepal (Adhikari, 2005; Dhakal & Masuda, 2009; Iversen et al., 2006). Once CFUGs received payment, the executive committee decided how to mobilize and invest the money following the affirmative measures provided by the project. Most of the cases, the payment money was provided as an interest-free loan in the form of cash or in-kind to member households of the CFUGs so that they could invest it in livelihood enhancement and income generating activities. Recipient households were selected by the executive committee of CFUGs based on the affirmative measures that include social criteria including ethnicity (*Dalit*, *Janajati*), gender and economic status (poor households, households headed by single women). Overall, the REDD+ payment, known locally as "REDD+ seed money," was intended for livelihood enhancement activities that help poverty reduction in a long run (Shrestha, Karky, & Karki, 2014). Recipients have to return the money after a certain period to the committee so that other household can lend it on a rotational basis. Therefore, it is highly important to understand the effectiveness of 'seed money' and how the individual households economically benefitted from the program.

A lesson learned from the REDD+ pilot project, completed in Nepal in 2013, are considered to be beneficial for implementation of future REDD+ programs. Recent studies in the pilot project areas have revealed that the project helped to enhance carbon and biodiversity (Pandey, Cockfield, & Maraseni, 2014) and change conservation behaviour (Saito-Jensen, Rutt, & Chhetri, 2014) while

others have pointed out program's inadequacies (Bushley & Khatri, 2011; Maraseni, Neupane, Lopez-casero, & Cadman, 2014; Neupane & Shrestha, 2012; Newton et al., 2015; Poudel, 2014; Saito-Jensen et al., 2014; Shrestha & Shrestha, 2017). For example, Saito-Jensen et al. (2014) cautioned that the social tensions might jeopardize the carbon sequestration goal if the payment mechanism of the project was not designed and implemented carefully. Likewise, Maraseni et al. (2014) found that the REDD+ payment is inadequate compared to the additional costs incurred by the communities; the increased demand for communities' participation in the project activities outweighed its benefits. Shrestha and Shrestha (2017) revealed that REDD+ pilot project doesn't have a role on enhancing community participation. On a different note, Poudel (2014) pointed out that the pilot project followed top-down approaches and failed to involve the local communities during the planning of REDD+ processes. However, these studies examined aggregated responses at the community level given the fact that economic impact of the payment is accrued at the household level. For example, Poudel (2014) study was based on the perceived benefits of the key informants, while the study of Maraseni et al. (2014) was based on the performance of CFUGs. Therefore, those studies did not capture the nuances and heterogeneity exist within communities in terms of wealth and socio-political hierarchy hence they have a limited application.

To reduce deforestation and forest degradation while supporting rural livelihoods, understating the way of living and income generation of forest dependent rural communities is essential (Loaiza, Nehren, & Gerold, 2015). Understanding the linkages between REDD and poverty requires a nuanced approach that disaggregates between different social groups and individuals (Peskett, Huberman, Bowen-Jones, Edwards, & Brown, 2008). Our analysis disaggregates the data and responses at the household level to capture socio-economic heterogeneity among households and within the community. This study is guided by three research questions: 1) How much does forest income contribute to the total household income? 2) What percentage of the REDD+ payment contributed to the total household income? 3) Did the payment help to reduce income inequality across the households? We also examined if the socio-economic criteria in the payment mechanism have met. The findings of this study are important for future implementation of REDD+ programs in Nepal and elsewhere. Our study is significant for several reasons. First, it identifies the importance of forest income to the household income in the most recent context after prolific growth of remittance economy in Nepal. Second, since payment distribution mechanism of REDD+ pilot project targeted the payment to poor and marginalized people, our study provides insights into whether the payments are beneficial to the household economy of forest users especially to poor and marginalized people that can enable policy makers to improve future REDD+ payment distribution mechanisms under CFM in Nepal and elsewhere. Third, the study examines the effectiveness of safeguard that may provide the basis for designing economically viable future REDD+ payments that safeguard forest dependent communities. Finally, the evaluation if REDD+ payments reduce income inequality that contributes to the existing discourse on the role of forests in fostering economic equality (Babulo et al., 2009; Kamanga, Vedeld, & Sjaastad, 2009).

2. Materials and methods

2.1. Study area

The study was conducted in two watersheds—Ludikhola and Charnawati watersheds—of the three watersheds where REDD+ pilot project was implemented (Fig. 1).

Both watersheds lie in Western and Central Mid-hills of Nepal. Ludikhola watershed has a total area of 5,750 hectares (ha) and is situated in Gorkha district, which is about 150 kilometers (km) west of Kathmandu (the capital city of Nepal). The 31 CFUGs of Ludikhola watershed conserve and manage 1,888 ha of the forest area and provide benefits to 23,685 people of 4,110 households. Similarly, Charnawati watershed has a total area of 14,037 ha and is situated in Dolakha district, which is about 134 km north-east of Kathmandu. Fifty-eight CFUGs of Charnawati watershed conserve and manage 5,996 ha of forest areas and provide benefits to 42,609 people of 7,870 households (ANSAB/ICIMOD/FECOFUN, 2012).

2.2. Data collection

We collected information about community forests (e.g., date of establishment, forest size, the number of affiliated households in CFUGs, location, and REDD+ payment recipient CFUGs) from District Forest Offices and FECOFUN of Gorkha and Dolakha districts. Twenty CFUGs, 10 from each watershed, were selected based on the size of the forest, the number of users, and institutional history for this study. In Ludikhola watershed, the selected 10 CFUGs cover 757 ha community forest areas and benefit 11,403 people of 1,930 households. The selected 10 CFUGs of Charnawati watershed cover 980 ha community forest areas and benefit 7,224 people of 1,569 households (Table 1). The majority of households of both watersheds are engaged in crop production and animal husbandry for their livelihoods and depend on forests for timber, fuelwood, fodder, and leaf litters.

Household surveys were conducted from May to July 2013 with a set of structured and semi-structured questionnaires. Prior to the household survey, we conducted meetings and interviews with key informants (the executive members of the CFUGs). We first listed all the villages affiliated with selected CFGUs after consulting the executive committee of the corresponding CFUGs. In the villages, fifteen to twenty percent of households from each CFUGs were randomly selected for an interview without distinguishing households that received payments. Altogether, 540 respondents were interviewed from both watersheds (Table 1). Households receiving payments included poor, women, *Dalits* and *Janajatis*.

The questionnaire consisted of five parts: demographic features of the households, the household's physical capital holdings, income sources of the households, the location of households, and the information about REDD+ payment (if the respondent's households had received it).

2.3. Definitions and income calculations

The primary objective of the household survey was to collect detailed information of all income sources, including forests and REDD+ payments within the last 12 months. We followed the methods of Cavendish (2002) to account for total household income in an absolute term, the sum of annual cash income and income accounted for subsistence activities. We divided the household's total income into two major categories - farm income and non-farm income. Farm income includes crop income and livestock income. Non-farm income includes off-farm income, remittances, forest income, and REDD+ payment. We used an adult equivalent unit (aeu) for comparisons among households. An aeu is a method of adjusting demographic variations among households by converting the actual size and demographic composition of a household to a common scale by using certain conversion factors (Babulo et al., 2009). We followed Angelsen et al. (2014) for calculating aeu based on the Organisation for Economic Co-operation and Development (OECD) scales (Atkinson, Rainwater, & Smeeding, 1995), which is also used in many World Bank

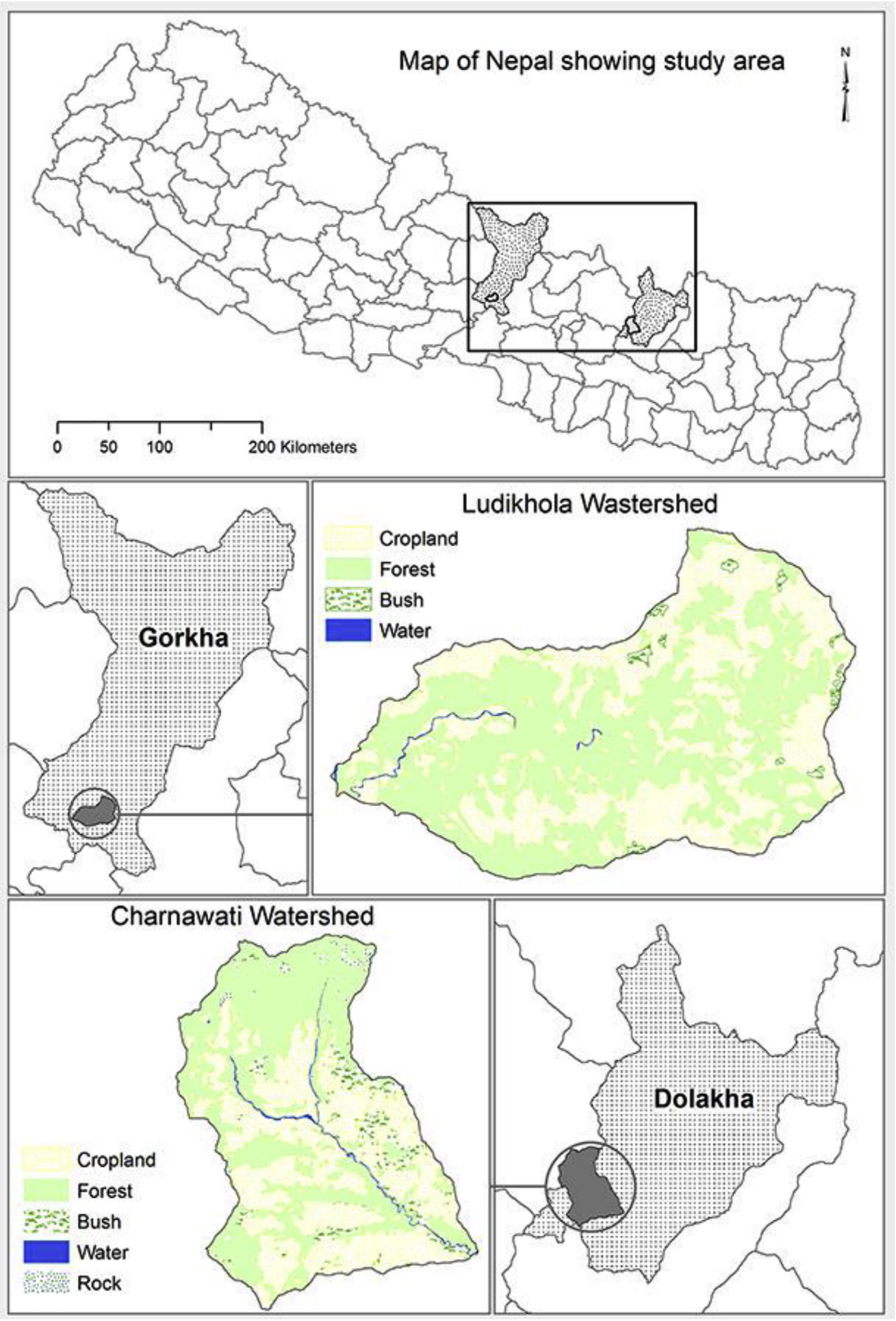

Fig. 1. Study area showing Ludikhola and Charnawati watersheds of Gorkha and Dolakha districts of Nepal.

analysis. Children below 15 years and adults above 65 years are assigned a weight of 0.5, while all other members, ages range from 15 years to 65 years are assigned a weight of 1 (Angelsen et al., 2014).

Household labor, except casual non-household labor, was excluded from the income calculation. Gross crop income is the product of the yearly crop production in quantity and the local market price (Shrestha & Bawa, 2014; Zenteno, Zuidema, de Jong, & Boot et al., 2013) for agricultural and horticultural products. The costs of inputs such as fertilizer, seeds, and hired labor (not household labor) required for crop production were summed and deducted from gross crop income to obtain the net crop income. Thus, crop income refers to the net crop income. However, labor sharing was not included to calculate the value of inputs. Labor sharing, called '*Parma*' locally, is a common practice in the studied villages during the peak season of agricultural production. Similarly, we followed the method of Rayamajhi, Smith-Hall, and Helles (2012) to calculate net livestock income that consists of livestock sales, livestock products, and services as well as costs incurred to produce livestock products such as feeds, veterinary medicines, and construction materials used for making livestock huts. However, we excluded incremental stock value changes as those values are captured in the value of assets (Charlery & Walelign, 2015; Angelsen & Dokken, 2015). Off-farm income refers to the cash income derived from various sources, including business, service, pension, and casual employments (e.g. construction, carpentry, tailoring, and shoe making). Remittances include money received from family members residing outside Nepal.

In the study areas, households collect forest resources such as fuelwood, timber, fodder and leaf litters for subsistence activities from community forests and non-community forests. Thus, forest income refers to the sum of the income of forest resources collected from community forests and non-community forests. Non-community forests include government forests, private forests, and croplands. The market prices of wood, fuelwood, and fodder were used to estimate the forest income (Babulo et al., 2009; Rayamajhi et al., 2012; Vedeld, 2004; Vedeld, Angelsen, Bojö, Sjaastad and Berg, 2007). Thus, the community forest income is the market value of forest resources collected only from the affiliated community forest. Similarly, non-community forest income is the market value of forest resources collected from government forests, private forests, and croplands. The forest resources collected from community forests by individual households are only allowed for household use, not for sale. Relative forest income is the share of forest income in the total household income (Kamanga et al., 2009). Similarly, relative community forest income is defined by the share of the income derived from the community forest in the total household income. REDD+ payment refers to the cash, in-kind, or interest-free loan received by the members of the CFUGs. The contribution of REDD+ payment is the share of payment in total household income.

2.4. Data analysis

The statistical analysis used in this study was descriptive statistics and analysis of variance (ANOVA). The data from both the watersheds were pulled for analysis. The data analysis was done in two parts. In the first part, the total household income of all sampled households (N = 540) included crop income, livestock income, off-farm income, remittances, forest income, and REDD+ payment to analyze the contribution of different income sources in the total household income. All the incomes are reported in US dollar (US$1 = 86 Nepalese Rupee, NRs during the time of the survey in 2013). The total sample population (N = 540) was divided into four equally sized income groups or quartiles (n = 135) based on the total annual income, i.e. the poorest (0–25%), poorer (25–50%), poor (50–75%), and less poor (75–100%). The poorest as name indicated are extremely poor households and less poor are comparatively better-off households. We did not used 'rich' for the better-off households as most of them are poor in the national standard. The statistical validity of these income quartiles was tested by using one-way ANOVA.

In the second part of our analysis, we measured the role of REDD+ payment on income equalization among rural household, if any. We further examined the difference in the Gini-coefficient values and examined Lorenz curve to measure the equalizing effect of REDD+ payment on the total household income, including REDD+ payment and excluding it from the total household income.

Measurement of income inequality helps to estimate the distributional effect of REDD+ income among the users. Thus, at

Table 1
Description of the sample CFUGs.

Name	Household number	Sampled households (%)	Payment recipient households (% of sample)
Ludikhola Watershed, Gorkha District			
Birenchok	290	30 (10.3)	10 (33.3)
Ghaledanda Rana Khola	550	51 (9.3)	9 (17.6)
Kyamune Danda	50	12 (24.0)	0 (0)
Laxmi Mahila	68	20 (29.4)	6 (30.0)
Ludi Damgade	455	46 (10.1)	14 (30.4)
Ram Laxman	180	32 (17.8)	16 (50.0)
Shikhar	130	30 (23.1)	17 (56.7)
Shree Mahalaxmi	99	29 (29.3)	8 (27.6)
Siraute	90	25 (27.8)	4 (16.0)
Sitalu Pakha	18	8 (44.4)	1 (12.5)
Charnawati Watershed, Dolakha District			
Amale Kharka	28	8 (28.6)	0 (0)
Bhir Muni Devithan	57	9 (15.8)	3 (33.3)
Bolde Setidevi	215	36 (16.7)	7 (19.4)
Charnawati	297	46 (15.5)	4 (8.7)
Mahankal	92	17 (18.5)	2 (11.8)
Napkeyanmara	135	24 (17.8)	2 (8.3)
Palung Mahila	61	14 (23.0)	4 (28.6)
Shrijana	232	55 (23.7)	12 (21.8)
Simpani	88	18 (20.5)	4 (22.2)
Tharlange	364	30 (8.2)	6 (20.0)
Total	3,499	540 (15.8)	129 (24.0)

first REDD+ income was included in the total income and then it was deducted from total income. The resulting Gini-coefficients were then used to determine if REDD+ payment contributed to income equalization among recipients. Furthermore, the existing payment mechanism focuses only on the poor; therefore, measurement of income inequality provides evidence of whether the monetary reward is skewed towards the poor people through REDD+ and whether REDD+ payments can alter the existing income inequality. We also compared social heterogeneity (ethnicity) among the recipient households and their economic status.

3. Results

3.1. Basic sample characteristics

The socio-economic characteristics of households are given in Table 2. Out of a total 540 respondents, 308 were male and 232 were female. Altogether 129 (24%) households were REDD+ payment recipients in our sampled population. The average household size was 5.6 people and the average land holding was 0.6 ha per household. The average distance to the community forests was closer than the average distance to the nearby market centre from the homes of the members of CFUGs.

3.2. Household income diversification, share of income by source and by income quartile

The mean annual household absolute and relative incomes (per aeu) based on different income sources is given in Table 3. The average annual household income is US$ 594.5 per aeu. Off-farm income was the largest source of income, contributing an average 43.2% in the total household income and was the major determinant of the household's income status followed by the crop income (24.8%), forest income (14.5%), livestock income (8.8%) and remittances (7.4%). Out of the 14.5% share of the forest income in total household income, the share of income derived from non-community forests (8.4%) was greater than from community forests (6.1%). Out of 540 households, 70% of the households extracted forest products from community forests and 62% of households extracted those products also from non-community forests to support their livelihoods.

Table 4 presents the annual average household income per aeu of various income sources in addition to the share of each income source in average household income for each of the different income groups. The poorest households were reliant on income from crops (39.8%), and forests (23.6%), whereas the dominant income sources for the less poor households were off-farm income (56.3%). The shares of the crop, forest, and livestock income decreased with the increase in the total household income, while the share of off-farm and remittances increased with increase in the total household income. In monetary terms or in absolute terms, we observed a large variation while comparing forest income among income quartiles. The average annual forest income of the poorest households was the lowest (US$ 32.9) in comparison to the less poor households (US$ 82.9).

The average REDD+ payment was almost similar among the income quartiles but the share of payment in total household income was significantly higher in the poorest households (3.2%) than the less poor households (0.3%) ($F = 10.9$, $p \leq 0.001$). In our sampled data, 24% of households received the REDD+ payment that includes 39, 32, 33 and 25 households from poorest, poorer, poor and less poor households respectively. This indicates that greater number of recipient households belongs to low income quartiles than upper quartile. The results of the one-way ANOVA showed that the differences in all income sources among the four income groups were statistically significant except for the REDD+ payment ($p < 0.0001$) suggesting that there was no difference in the amount among the income quartiles (Table 4). Interestingly, social hierarchy overshadowed economic status during the payment distribution among the sampled households; the poorest households that belongs to *Brahmin* and *Chhetri* were less likely to receive payment than the poorest *Dalit* and *Janajati* households (Table 5).

3.3. Contribution of REDD+ payment to inequality

We used Gini-coefficients to measure whether the REDD+ payment is effective slightly in reducing income inequality among total sampled households. The results from Gini-coefficient showed that the supplemental forest income from the REDD+ payment helps reduce income inequality among the households. However, the decrease in Gini-coefficient from 0.4400 to 0.4373 was negligible (less than 1 percent). Likewise, the additional income through REDD+ payment to the household income did not change the area between the line of equality and the Lorenz curve—a graphic representation of the equalizing effect of REDD+ payment on total income inequality (Fig. 2).

4. Discussion

As the results showed that the households in the study area have the acute level of poverty; almost half (45%) of these sampled households have an average income of less than $1.00 per day per aeu. This figure is comparable to the national statistics on poverty showing that about 25.2% people of Nepal were living on less than $1.25 a day (UNDP, 2014). Therefore, the inclusion of poverty reduction goal in REDD+ program in which money will flow to poor households has poverty implications and understanding the contribution of REDD+ payment to the total household income in the REDD+ pilot areas has a huge policy implication for implementation of REDD+ programs in future.

Forest income represents 22.2% of total household income in tropical and sub-tropical countries (Angelsen et al., 2014), 39% in Africa (Cavendish, 2002; Mamo, Sjaastad, & Vedeld, 2007) and 3–31% in Asia (Chhetri, Larsen, & Smith-Hall, 2014; Rayamajhi et al., 2012). Our results showing forest income contributes 14.5% of the total household income is comparable to the previously reported forest income in other countries. Overall, forests account for the third largest share of average total household income, next to off-farm income and crop income. However, the share of forest income from non-community forests is higher than the income from community forests. Lower contribution of community forests could be due to the compulsory provision of fees in order to derive forest resources from the community forests. During our field survey, we observed that users are fulfilling their needs of forest resources outside from the community forests such as government forests, agroforest in private lands to avoid fees. The mechanism under REDD+ to reward financially for carbon increment might have provided an impetus for users to conserve community forests to receive a higher amount of payment in subsequent years in the cost of degrading non-community forest areas. The previous study reported changes in individual behaviours such as careful harvesting of forest products and greater participation in controlling fire and modification of harvesting rules after implementation of the REDD+ project (Saito-Jensen et al., 2014). Poudel (2014) also indicated that the REDD+ program has induced communities to collect forest resources from private and other land types. A similar observation was reported by Reyes-Garcia et al. (2013) in Mexico where conservation paradigm of community-based conservation has shifted from multifunctional landscape to strict protection in response to the national and international funding opportunities

Table 2
Socio-economic characteristics of forest user groups of Ludikhola and Charnawati watershed, Nepal.

Household socio-economic factors	Total (N = 540)	Ludikhola Watershed (N = 283)	Charnawati Watershed (N = 257)
	Mean (SD)	Mean (SD)	Mean (SD)
Family size (head count)	5.6 (2.4)	6.03 (2.4)	5.2 (2.4)
Family size (aeu[a])	4.6 (2.1)	5.0 (2.0)	4.2 (2.1)
Household land size (ha[b]/household)	0.6 (0.5)	0.7 (0.6)	0.5 (0.4)
Distance to CF from home (km)	1.8 (1.6)	1.5 (1.1)	2.1 (1.9)
Distance to market from home (km)	4.1 (3.4)	3.2 (3.4)	5.0 (3.1)

[a] aeu = adult equivalent unit.
[b] ha = hectare.

Table 3
Total annual mean absolute and relative income per aeu based on different income sources.

Income sources	Absolute income (US$[a])	Relative income (%)
	Total (N = 540) Mean (SD)	Total (N = 540) Mean (SD)
Crop income	107.7 (152.4)	24.8 (24.1)
Livestock income	38.9 (103.5)	8.8 (17.3)
Off-farm income	306.9 (413.8)	43.2 (35.3)
Remittances	79.9 (295.2)	7.4 (21.0)
Forest income	57.7 (91.1)	14.5 (17.2)
Community forest income	25.0 (73.1)	6.1 (10.5)
Non-community forest income	32.7 (56.7)	8.4 (13.9)
REDD+ payment	3.3 (8.4)	1.2 (4.7)
Total income	594.5 (564.4)	100

[a] US$1 = NRs 86.

and incentives. Some scholars also argued that the wealthier households exert their power to restrict the land use practices to poorer households in which they rely on for subsistence to receive incentives in payment for ecosystem service programs (Dressler & Pulhin, 2010). However, we did not observe such exclusion based on the wealth status in our study area. Because of the lack of baseline data on forest income and detail history of forest utilization from our studied areas before REDD+ pilot project inception, it is hard to ascertain if the presumed greater extraction of forest resources from non-community forests can be attributed to the REDD+ incentive.

Forests account for four times more income for the poorest households than for better-off households (23.6% versus 6.4%), as the better-off households derive the majority of their income from other sources such as off-farm and remittances. In contrast, the poorest households have limited income sources and forest income is the second largest contributor after crop income. Our results confirm the findings from previous studies in Nepal and elsewhere that the share of total income from forest income decreases with the increase in total household income (Adhikari, Di Falco, & Lovett et al., 2004; Angelsen et al., 2014; Babulo et al., 2009; Chhetri et al., 2014; Kamanga et al., 2009; Mamo et al., 2007; Nielsen, Pouliot, & Bakkegaard, 2012; Sapkota & Odén, 2008; Shrestha & Bawa, 2014; Vedeld et al., 2007). The results indicating the higher contribution of forest income to the poorest households than better-off households do not mean that the poorest households derive more income

Table 4
Total annual mean household absolute and relative income per aeu across income groups by income sources.

Income sources	Poorest (0–25%)		Poorer (25–50%)		Poor (50–75%)		Less poor (75–100%)	
	(N = 135)		(N = 135)		(N = 135)		(N = 135)	
	Mean (SD)	Mean relative (%)	Mean (SD)	Mean relative (%)	Mean (SD)	Mean relative (%)	Mean (SD)	Mean relative (%)
Crop income**	52.4 (42.8)	39.8	78.5 (61.4)	24.8	117.4 (122.8)	20.3	182.7 (250.9)	14.6
Livestock**	20.2 (33.3)	14.6	27.2 (47.5)	8.6	37.7 (84.2)	6.7	70.4 (176.5)	5.4
Off -farm income**	29.9 (53.9)	16.6	149.2 (107.0)	45.7	315.9 (203.6)	54.2	732.4 (590.0)	56.3
Remittances**	3.8 (20.8)	2.2	10.9 (45.5)	3.4	43.3 (122.6)	7.0	261.6 (536.4)	16.9
Forest income**	32.9 (33.9)	23.6	51.9 (49.3)	16.6	63.2 (63.5)	11.2	82.9 (156.3)	6.4
REDD+ payment	3.7 (7.5)	3.2	2.7 (6.8)	0.9	3.3 (9.7)	0.6	3.6 (9.3)	0.3
Total income	142.8 (67.0)	100	320.4 (49.0)	100	580.8 (93.8)	100	1333.8 (658.6)	100

Significant difference of mean between different income groups (F-test). **$P \leq 0.0001$.

Table 5
Total number of payment recipient households in different income groups and ethnicity.

Ethnicity	Poorest	%	Poorer	%	Poor	%	Less Poor	%	Total	%
Brahmin and Chhetri	10	25.6	7	21.9	5	15.1	6	24	28	21.7
Dalit	15	38.5	11	34.4	12	36.4	10	40	48	37.2
Janajati	14	35.9	14	43.7	16	48.5	9	36	53	41.1
Total	39	100	32	100	33	100	25	100	129	100

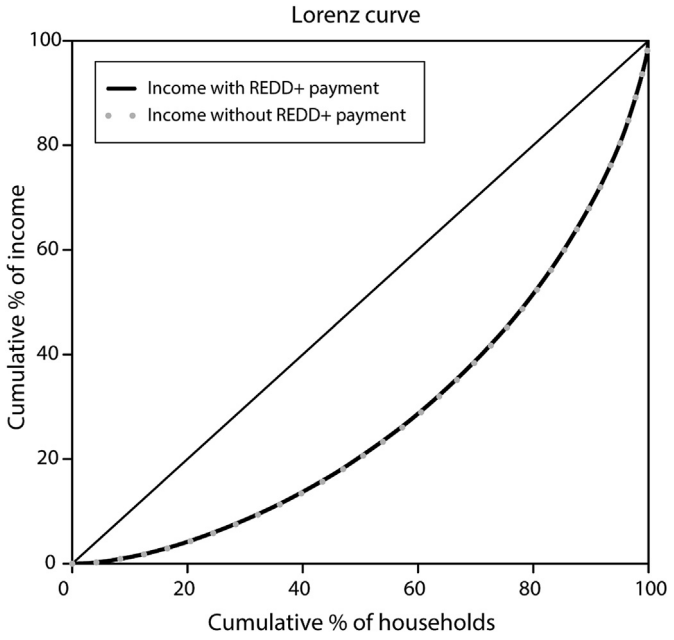

Fig. 2. Lorenz curve for household income with and without the income from REDD+ payment.

from forests than the better-off households. In fact, the opposite was observed in absolute terms. The better-off households can afford to pay fees to harvest resources such as timber (Malla, Neupane & Branney, 2003) while the poorest households rely more on forest resources that cost less or no money such as fodder and fuelwood (Gautam, 2009; Sapkota & Odén, 2008). Similar results of multiple interests and disparity in resource utilization were revealed in Bhutan that influential households were collecting high-value products while poor households were collecting subsistence products (Moktan, Norbu & Choden, 2016). As a result, poor households who cannot pay the permit fees are excluded from obtaining timber and fuelwood from the community forests and compel to fulfil their needs by collecting resources from non-community forests (Maharjan, Dakal, Thapa, Schreckenberg & Luttrell, 2009; Malla et al., 2003). This type of systematic exclusion might cause frustration among poor households in constraining their participation in conservation. Therefore, incentivising poor households by provisioning social criterion in REDD+ pilot project can address such frustration of poor and incorporate them in forest conservation.

Our results suggested that social criterion has safeguarded the marginalized households but not necessarily the poorest ones. This is also confirmed CFUGs' yearly work plans and their meeting minutes. The majority of the recipient households were *Dalit* and *Janajatis* and the proportion of REDD+ payment to household income decreases as average household income increases. However, in absolute term, the average payment was distributed almost equally among the different quartiles. This suggested that social safeguard mechanism and affirmative measures are essential to provide intended benefits to the marginalized households in the communities. The recipients' number that belongs to the poorest *Brahmins* and *Chhetri* (non-*Dalit* and *Janajatis*) is lower as compared to the poorest *Dalit* and *Janajatis*. During our interview, we observed that some of *Brahmins* and *Chhetri* respondents mentioned that the REDD+ project is for *Dalit* communities only indicating that the mechanism is favourable for *Dalit* and *Janajatis*. This might create a new social tension within communities and dissatisfaction among non-*Dalit* and *Janajati* communities as suggested by Saito-Jensen et al. (2014). Therefore, caution should be taken to address social tension and dissatisfaction, otherwise, this might ultimately undermine the carbon sequestration goal of REDD+. It is argued that pro-poor targeting is justified around social justice in the fight against climate change globally and pro-poor targeting for REDD could spur greater synergies between mitigation and adaptation in a country scale such as in Kenya (Atela et al., 2014). However, at the local scale, there might be little effect on deforestation avoidance under REDD+ if REDD+ payment consistently favours the poorest households only who extracted fewer forest resources compared to the better-off households as in this case (Loaiza et al., 2015). Therefore, cautions should be made to balance this trade-off.

Bottazzi, Cattaneo, Rocha, and Rist (2013) indicated that the payment for sustainable forest management would improve household incomes. However, our result suggests that the share of REDD+ payment accounts only 1.2% of the total household income on average and the average amount paid was very nominal (US$ 13.9 per aeu). During our interviews, 39% of respondents, who received payment mentioned that the payment was not sufficient to invest in livelihood enhancement activities. In some cases, households had to take an additional loan to make an investment in the income-generating activities specified by the REDD+ project. For example, the amount provided by REDD+ might be sufficient to purchase goats or pigs (in some cases goats and pigs were given directly) but not enough to build their shelters. Additional loans can create debt traps or further marginalize the poor as cautioned by Springate-Baginski and Wollenberg (2010), Caplow, Jagger, Lawlor, and Sills (2011) and Tacconi, Mahanty, and Suich (2013), thereby defeating the purpose of REDD+ payments. If the financial incentives provided under REDD+ scheme is weak compare to other incomes, the willingness of local communities to participate in REDD+ will be low (Loaiza et al., 2015). Therefore, research to follow up recipient households to measure the effectiveness of payment is essential. If debt traps persist, alternative payment models may be needed to avoid debt traps. In that case, rather than paying small amounts to the individual households, investment in community projects could yield better outcomes. It would be beneficial if REDD+ mechanism should be used to help improve the governance capacity of existing CFM for sustainable forest management (Bottazzi et al., 2014) and the distribution mechanism should be focused on investment in community infrastructure that would be potentially benefited the entire community (Sommerville, Jones, Rahajaharison, & Milner-Gulland, 2010).

Although the project has terminated, the CFUGs will be continuously mobilizing 'seed money'. In order to achieve the carbon and social goals of REDD+, CFUGs should be able to address the dissatisfaction among non-*Dalit* and *Janajati* communities by lending seed money to the poorest households that belong to *Brahmins* and *Chhetri*. Furthermore, the current nominal amount should be increased while decreasing transaction costs so that it can have a meaningful impact and avoid debt trap. Regular follow up of the recipient households is essential to measure the effectiveness of the program and more time might be required to assess the real impact of the program on household incomes and alleviation of poverty.

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