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Access to community forest benefits: need driven or interest driven?

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ABSTRACT

The poverty reduction, livelihood improvement, and equity promotion potential of Community Forests (CF) from a theoretical point of view are indisputable, but their realization appears more questionable because of the setting and enforcement of rules which limit the access to CFs and forest products. This manuscript is prepared based on the data from 45 CF User Groups (CFUGs) including 1111 households of Nepal. This paper aims to determine the level of access to different forest products (firewood, fodder, timber), redistribution of natural resource value (loan), and CFUG-funded public infrastructure (irrigation, electricity, schooling, water) among different groups of users based on social (caste), political (executive committee membership, political elite), and socioeconomic categories (wellbeing ranks). Pair-wise test was done to understand, if there is any significant difference in access to benefits between these groups. Logistic regression was run to know the relationship of different independent variables with access to forest products and forest-accrued benefits. Statistical analysis reveals very few statistically significant differences in access to benefits between households when grouped on the basis of caste, followed by wellbeing ranks. However, political status and connectedness, namely membership in an executive committee, is significantly and positively associated with more lucrative benefits (e.g., timber, loan). Female-headed households are found always negatively (and significantly in some benefits) associated with all benefits. This study indicates that there is a need for a paradigm shift in studies and policies from caste- and wealth-based analysis to power, political status and connectedness to the decision-making bodies.

Introduction and past evidence

Nepal is well-known on its success in implementation of community-based forest management (CBFM) initiatives. Among other modalities, Community Forestry (CF) is a dominant form of CBFM in which, forest is managed by, for, and with local communities with the objectives of improving forest conditions, enhancing livelihoods of local people and empowering communities in management of the forest resources. CF policies and plans envision that all of the users are equally responsible in conservation and management of community forests (CFs) and have equal rights to access the forest benefits (GON, 2019). Hence, CBFM is considered as an approach that delivers higher socio-economic benefits to forest-dependent communities. This is because they are efficient in responding to community needs and interests promptly and equitably compared to government-controlled forest management (Ribot et al., 2006). However, the latest study highlighted that CFs in Nepal are not being able to deliver their potentials due to number of reasons including equity and governance

(Sapkota et al., 2020). As highlighted by Ribot and Peluso (2003), laws and policy frameworks (either customary or formal) alone can-not guarantee equitable resource access in a complex and hierarchical societal structure as of Nepal.

Even if all the users have equal rights in resource management, the access is determined by the ability of people to derive such benefits from resources (Ribot & Peluso, 2003) and this ability is determined by the power gained by a certain group of people in the heterogeneous socio-economic structure (Ribot & Peluso, 2003; Schlager & Ostrom, 1992). Despite the fact that equity has been promoted as one of the key priority areas in implementation and governance of community forests in Nepal for last two decades (Kanel and Kandel, 2004), equity in accessing forest resource benefits has yet to be realized and always been a critical issue of discussion (Poudyal et al., 2013, 2020; Gritten et al., 2015; Luintel et al., 2017). Significant number of studies have been conducted assessing equity within community forests using diverse tools and approaches. However, these plethora of studies in CF equity have focused on income criteria to analyze equity

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(Adhikari, 2005; Chhetri et al., 2012; Shrestha, 2005; Luintel et al., 2017). Moreover, participation, equitable representation, elite capture, and equity in access to benefits are mentioned in several studies (Adhikari & Falco, 2008; Adhikari & Di Falco, 2009; Bhattarai & Ojha, 2001; Lund et al., 2013; Pokharel, 2008; Shrestha, 2005). They have identified key gaps in CF equity as minimum representation and negligible participation in decision making processes.

They also have noted that poor and *Dalit* households hold less knowledge about, are less well-represented, and participate less in CF management than richer and higher caste group households (HHs). However, they have not studied about forest products and their access pattern. Adhikari & Falco (2008), Adhikari and Di Falco (2009) mentions that low-caste groups have poor representation in community forest user group (CFUG) executive committees (EC); additionally, local elites are advantaged in accessing the decision-making bodies (the ECs). They also state that participation increases the probability of being a member of an EC; however, they have not studied the negative/positive influence of being an EC member in benefit-sharing and are also silent about whether elites benefit more from forest products and forest-accrued benefits or not. They have also not explained the interaction effect of other variables, if any, toward contribution on formulation of such problems. (Adhikari & Lovett, 2006) note that lower caste representation in CFUG EC does not appear to be associated directly with better performance of collective action. Bhattarai and Ojha (2001) studied the distributional impact of CF and found bias against poor, but they are silent about the influence of EC membership, caste system, and redistribution impact of CF fund (infrastructures and loans). To fill this knowledge gap, it is very imperative to have a comprehensive study that assesses an interaction and relationship of various forms of power in CF benefit sharing mechanism and processes. This study therefore was planned and performed to fill this gap gathering on-ground information from 45 community forest user groups of Nepal's mid-hills.

In countries like Nepal, there is always a large difference in the level of income and wellbeing between people, even in a single community. Households ranging from rich to very poor can be found in a single community. It is obvious that poor people depend more on forests for their livelihood because they do not have other alternative sources of livelihood and that richer groups have the option to choose their livelihood strategies. (Balooni et al., 2010), from their study in India explain that elites can have either a positive or a negative role in shaping the benefits and outcomes of Community Based Forest Management (CBFM), and many studies also report the same in Nepal (Bhattarai & Ojha, 2001). Some of the routes to address the issues of equity and increase the potential of CBFM to alleviate/reduce poverty could be (1) securing the access of poor, disadvantaged, and lower caste groups to different forest products; (2) equitable redistribution of natural resource values through taxation of their utilization; and (3) securing equitable access to public infrastructure funded by CBFM-accrued benefits. However, the latter two routes are ignored in many studies (Adhikari et al., 2004; Adhikari & Lovett, 2006; Sharma, 2009; Thoms, 2008), and some studies have included only the second route (Bigombe-Logo, 2003; Chhetri et al., 2012; Fomété, 2001; Lund, 2007; Lund et al., 2013). Securing the access of poor, disadvantaged, and lower caste groups to different forest products is a necessary precondition for securing equity (Sunam & McCarthy, 2010) and is an approach considered by previous researchers (Adhikari et al., 2004; Adhikari & Lovett, 2006; Sharma, 2009; Thoms, 2008) and also by this study.

Although the amounts redistributed through CFUG finances are small compared to private gains through use of forest products (Chhetri et al., 2012; Lund et al., 2013), understanding how these investments are distributed is relevant for acquiring a more complete understanding of the equity in community forestry. There is a lack of literature that analyzes product-wise (firewood, fodder, timber) access through an equity perspective, which is an important gap in

knowledge as firewood, fodder, and timber are allocated in many ways in the Nepalese community forestry.

This paper aims to contribute toward a better understanding of self-reported benefits (access to different forest products, loans, and different infrastructures) within different caste groups and wellbeing groups. The access of particular social (elite) and political (political leaders) groups to different forest products and CF¹ generated benefits has been investigated and compared this with others. Alongside this, the relationship of factors, which affects the access on forest products, and forest generated benefits² has been studied. This study analyzes the relationship of inherent power (e.g., higher caste and lower caste by birth³), emerged power (executive committee members, political elites⁴), and mixed power (wellbeing ranks⁵) toward access using the regression analysis.

Study area and methods

Data collection was undertaken in 45 CFUGs of three mid-hill-districts; namely *Kaski*, *Gorkha*, and *Baglung* in western Nepal. CFUGs were selected randomly from the sampling frame (list provided by then District Forest Office) and were shortlisted based on the designed principles and criteria of this study. The criteria for selecting the CFUGs were (1) minimum of 5 years of age; (2) minimum of 30 member households as users; and (3) minimum of 5 ha of area.

Firstly, information on each CFUG was collected from the operational plan, constitution, and audit reports, which were made available from respective district forest offices. Afterward, each CF was visited to obtain the information about loan flow, timber extraction, and income-expenditure details by reviewing the vouchers, audit reports, minutes, and receipts. The recorded information was validated by triangulating it with key informants. Key informants were past secretary, past chairperson, past treasurer, and teachers. They were selected on the basis of their knowledge of records. Additionally, information regarding investment (especially in public infrastructure) was triangulated with other key informants who were not in executive committee. They were social workers, teachers, and women activists. In some CFUGs, the records on financial stuffs were not available due to a poor recording system. For this, the information was gathered through recollection of past income and expenditure details from informants (Fig. 1).

In all CFUGs, the total list of users/members was updated and wellbeing ranking was done with the help of key informants. Key informants were selected in a way that ensured that they would be able to categorize the HHs from all *Toles* (smaller unit of a village- somehow similar to Hamlet) of a community in question, and familiar with their own criteria for wellbeing ranking. In each of the 45 CFUGs, 10% of the total HHs were selected randomly for administering the face-to-face questionnaire survey. A total of 1111 HHs were surveyed in 3 districts and 45 CFUGs. The questionnaire was developed based on extensive interview and group discussion and was tested thoroughly in two CFUGs before starting the actual survey.

Regression models were developed to analyze the data for 8 dependent binary variables (firewood, fodder, timber, loan, electricity, schooling, irrigation, and piped water) and respective independent

¹ CF (community forest) and forest are used interchangeably unless they are specified

² Forest-generated benefits refers to CFUG-funded loan and infrastructures and is used interchangeably with forest-accrued benefits and benefits

³ People from a higher caste are considered as superior in Nepalese society, and so caste is considered as inherent power in this study

⁴ EC members can define the rules in the community forestry, and political elites (may) influence on defining the rules; thus, these groups are considered to have power that emerged due to their particular role

⁵ Richer people in Nepal are considered to have strong power with regard to accessing common resources. In Nepal, children can legally receive the entire property of their parents, and thus wellbeing rank is considered as having mixed power (inherent and emerged).

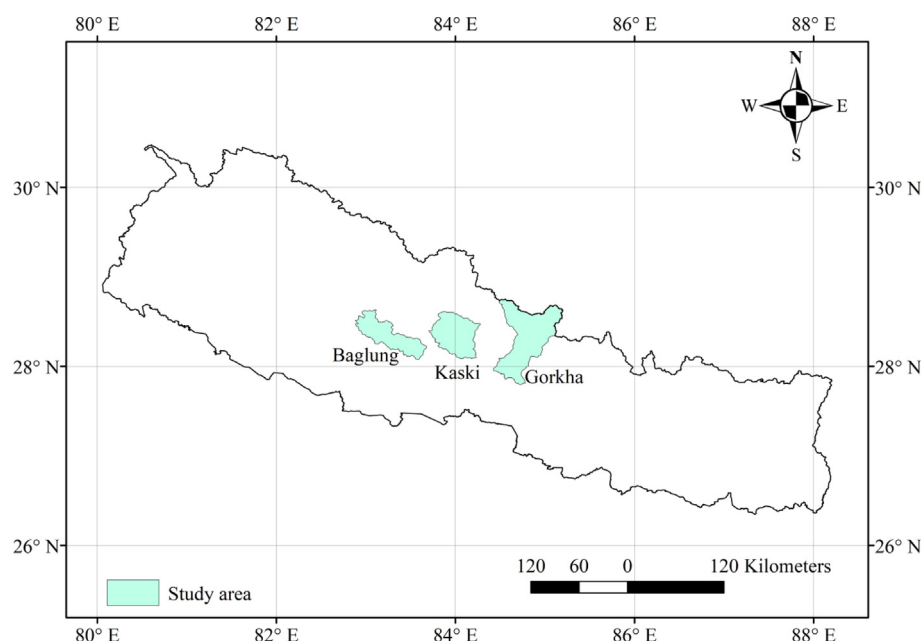


Fig. 1. Map showing study area (three districts on Map of Nepal).

variables. Some independent variables are common, and a few are specific to a particular model. A description of the models and variables is provided below.

Variable description

Independent variables and their expected sign with dependent variables are defined and presented briefly in the Table 1, and dependent variables are described in Table 2.

Statistical analysis

The unit of analysis in all models is the household. Pair wise comparison was done in SPSS to determine if there is any significant difference in level of access between different pairs differentiated by social and political status. Logistic regression was run in STATA to know the relationship between binary dependent variables and sets of respective independent variables. Binary variables were created for each wellbeing category, and all four categories of wellbeing were regressed as independent variables, although the rich category was automatically omitted by the system to remove the effect of multicollinearity. Similarly, membership size, trust, and participation were automatically avoided in the irrigation model to remove the effect of multicollinearity (Table 3).

Results

Descriptive statistics of the variables

The majority (83%) of HHs in the study area are from a higher caste group (other caste). Only 191 HHs (17%) out of 1111 HHs are from Dalit caste group (Table 6). Other castes include *Brahmin*, *Chhetris*, *Gurung*, *Magar*, *Newar*, *Tamang*, and *Kumal*. Dalit Caste includes so-called untouchable groups of *Kami*, *Damai*, and *Sarki*. There is no CFs without a HH from higher caste, with 100% of HHs being of a higher caste in some CF. In contrast, maximum HHs of Dalit in a CF is 60%, and there are no Dalit HHs in some CFs. The majority of HHs fall under the medium and poor category comprising 61% of total HHs. Very poor and rich categories comprise only 29% of total HHs.

Table 1

Description of independent variables.

Variable name	Expected sign	Definition
Caste group (1)	–	Dalit and higher caste based on Nepalese socio-cultural setting; Dalit are coded with 1
Sex (1)	–	Male- and female-headed households (HHs); female-headed HHs are coded with 1
Very poor (1)	–	HHs categorized as very poor from participatory wellbeing ranking
Poor (1)	–	HHs categorized as poor from participatory wellbeing ranking
Medium (1)	+/-	HHs categorized as medium from participatory wellbeing ranking
Rich (1)	+	HHs categorized as rich from participatory wellbeing ranking
HH in EC (1)	+	HHs that are members in executive committees (EC) of CFUG
Political Elites (1)	+	HHs that hold political positions either at a local or higher level
Anyone ever in EC(1)	+	Whether any member of a particular HH was ever in EC or not
Distance	–	Walking distance in minutes from house to forest
Energy (1) ^F	–	Whether a HH has any alternative sources of energy or not
Livestock (1) ^{FO}	+	Whether a HH holds livestock or not
Irrigable land ^I	+	Size of irrigable land in Ropani*
Farm-tree (1)	–	Whether a particular HH does have a farm-tree in own farmland or not
Tap water (1) ^W	–	Whether a particular HH uses water from a tap or not
Spring (1) ^W	–	Whether a particular water uses water from a spring or not
Surface water(1) ^W	–	Whether a particular HH uses water from surface water or not

F- applicable for firewood model only.

FO- applicable for fodder model only.

I- applicable for irrigation model only.

*20 Ropani = 1 Hectare.

W = applicable to water model only.

Table 2
Description of dependent variables.

Dependent variables	Description of dependent (all binary) variables
Firewood	This variable describes whether a HH has appropriated any firewood from the CF in the past 12 months or not.
Fodder	This variable describes whether a HH has appropriated fodder from the CF in the past 12 months or not.
Timber	This variable describes whether the HH reports to have bought any timber from the CF in the past five years or not.
Loan	This variable describes whether a HH has ever taken a loan from the CFUG fund or not.
Irrigation	This variable describes whether a particular HH reported that it had benefited from CFUG-funded irrigation or not.
Electricity	This variable describes whether a particular HH reported that it had benefited from CFUG-funded electricity or not.
Schooling	This variable describes whether a particular HH reported that it had benefited from CFUG-funded schooling or not.
Water	This variable describes whether a particular HH reported that it had benefited from CFUG-funded water (piped water, bore-hole) services or not.

About 17% of HHs are political elites, and 11% of HHs are in the executive committee (EC) of CFUG. The majority of HHs are male-headed, with only 13% of HHs headed by a female (Table 4).

Members of the EC of a CFUG is considered as a higher social status in Nepal. They also have direct access to decision-making concerning forest products and forest-accrued benefits. Similarly, being a member of a political elite group also represents higher social status. This creates the space for grabbing different opportunities in society related to forests and other social activities. A total of 117 HHs are in an EC, and 45 of them are political elites. Table 5 explains the proportion of different wellbeing and caste groups in the EC and political elite group. The general trend is that there is always greater representation of higher caste groups, political elites, and rich HHs in the EC. The result also demonstrates that the members of EC and political elites are more from rich and medium HHs than poor and very poor HHs.

As we see in Table 5, only 15 out of 191 HHs (7%) of Dalits are in an EC, at the same time, 11% (102 HHs out of 920) of other caste HHs are in an EC. The representation from rich and medium HHs in EC is more in comparison to poor and very poor HHs. Similarly, only 13% (25 out of 191) of Dalits are political elites; at same time, 17% of other castes HHs are political elites. One interesting point to note is that more HHs from the 'rich and medium' group, in comparison to the 'poor and very poor' group, are present among the political elites and ECs (19% and 12% and 13% and 8%, respectively, for political elites and EC).

Access and benefits to different products and infrastructures in different groups

The general trend shows that there is no clear distinction in level of access to firewood, fodder, and electricity between different groups.

Table 3
Overview of some independent variables in descriptive form.

Variables	Number of Households (N = 1111)	Percentage HH	Minimum HH % in a CF	Maximum HH % in a CF
Dalit caste	191	17	0	60
Other caste	920	83	40	100
Rich	219	20	0	50
Medium	428	39	4	70
Poor	360	32	8	83
Very Poor	104	9	0	54
HH on EC	117	11	3	45
HH not on EC	994	89	55	97
Political elites	184	17	0	41
Non elites	927	83	59	100
Female headed HH	144	13	0	79
Male headed HH	967	87	21	100

The EC has influence over access to timber, loans, and water. Wellbeing rank and caste group tend to determine the irrigation access. This could be because, higher caste and rich people generally hold more irrigable land. Dependent-variable-wise description is provided below.

Water- there is no clear distinction between the perceived benefits of CFUG-funded water within different caste groups and wellbeing ranks. However, rich HHs, HHs that are in an EC, and politically elite HHs have benefited least from CFUG-funded water. This study investigated whether these groups of HHs have any other alternative water supply sources. It was found that these groups use tap water as their primary water source and depend less on CFUG-funded water services. However, while doing the pair-wise comparison, there is a significant difference between rich and medium and medium and poor HHs on perceived water benefits. Caste group is not found to be a factor that influences access to water benefits.

School- There is no clear distinction in access to schooling between different groups of HHs, but political elites and HHs with presence on the EC have benefited most from CF-funded schooling. Wellbeing rank is found to be a more influential factor than caste group in access to this service. The very poor category of HHs was found to benefit significantly less than the other three categories of wellbeing groups.

Irrigation- Rich groups, non-Dalit groups, and those who are represented in an EC have benefited most from CFUG-funded irrigation. Our study showed that there is a significant difference between Rich (R)-Very Poor (VP), Medium (M)-Poor(P), M-VP, and P-VP groups. Most of the Dalits are poor; they do not have irrigable land. The pair-wise test also proves the same that there is a very significant difference between different wellbeing groups of Dalits and other HHs. What we can conclude is that the poor and Dalits benefit the least from CFUG-funded irrigation. Secondly, HHs that are in an EC have benefited more from irrigation, which shows the capture of benefits by EC members. Furthermore, as explained in Tables 5 and 6, 12% of HHs that are from rich and medium HHs are in the EC, and rich HHs benefit more from the irrigation.

Electricity- There is no clear distinction (means- they are not statistically significantly different from each other) between the groups. However, HHs that are from a rich group and higher caste group have benefited more from electricity. Among the rich, 97% are from a higher caste and 3% are from the Dalit caste, and thus rich HHs from a higher caste have benefited more from CFUG-funded electricity.

Loan- There is a decreasing trend from rich to very poor HHs with regard to loan access. However, overall, HHs that are in an EC have more access to loans. The EC decides who receives the loan, and it seems as though the decision is in favor of EC members. Wellbeing group is found to influence in loan access more than the caste group.

Timber- Poor and medium HHs have appropriated more timber than rich and very-poor HHs. Pair-wise test shows that P-VP, R-P, and M-VP HHs have significantly different access to timber. Poor HHs have more access to timber than very poor and rich HHs, and

Table 4
Descriptive statistics of independent variables.

Variables	Observation	Mean	Std. Dev.	Min	Max
Distance	1111	31.12871	25.9888	0	180
Farm-tree	1111	0.3951395	0.4891008	0	1
Energy	1111	0.2682268	0.4432359	0	1
Livestock	1111	0.9324932	0.2510106	0	1
Caste group	1111	0.1719172	0.3774784	0	1
Sex	1111	0.129613	0.3360284	0	1
Very poor	1111	0.0936094	0.2914157	0	1
Poor	1111	0.3240324	0.468223	0	1
Medium	1111	0.3852385	0.4868708	0	1
Rich	1111	0.1971197	0.3980027	0	1
HH in FUGEC	1111	0.1053105	0.3070914	0	1
Ropani of Irrigable land	72	3.038	4.66	0	39
Political Elites	1111	0.1656166	0.3719035	0	1

Table 5
Representation of different groups in social and political structure.

	Dalit HH	Total (Dalit)	Other HH	Total (others)	R&M HH proportion	P&VP HH proportion
HH on EC	15	191	102	920	12% (79 out of 647)	8% (38 out of 464)
Political Elites	25	191	159	920	19% (123 out of 647)	13% (61 out of 464)
Rich HH	8	191	211	920		

Table 6
Access of different groups.

Groups		Firewood	Fodder	Timber	Loan	Water	School	Irrigation	Electricity
Wellbeing ranks	Rich (%)	26	23	16	10	39	83	67	84
	Medium (%)	36	23	21	16	57	85	23	75
	Poor (%)	33	22	23	21	41	84	53	75
	Very-poor (%)	24	20	14	27	44	85	14	60
Caste group	Dalits (%)	31	19	23	19	45	78	7	69
	Other (%)	32	23	19	17	47	85	44	75
	HH in EC (%)	31	22	32	33	30	87	50	73
Executive committee	HH not in EC (%)	32	22	19	16	48	84	37	74
	Political elites (%)	32	21	24	20	37	90	33	71
Political Elites	Non elites (%)	31	22	19	17	49	83	38	75

medium HHs have more access to timber than very poor HHs. Statistical inference supports our descriptive statistics.

Firewood- There is a significant difference between rich and medium and medium and very poor HHs with regard to firewood access. Rich HHs have more access to firewood than poor HHs, and medium HHs have more access than very poor HHs. Poor and very poor HHs have fewer trees in their farm as compared to medium and rich HHs. An approximately equal proportion of HHs from medium, poor, and very poor HHs use the farm-tree as their primary source of firewood.

Fodder- Descriptive statistics depicts a decreasing trend of fodder access from R to VP HHs; however, the result is not statistically significant. VP HHs of *Dalit* and other castes have significantly different access to fodder as VP HHs of higher castes appropriate more fodder from forests, as presented in [Tables 7–9](#).

Relationship of dependent and independent variables

The following sub-sections of the results explain the influence of different continuous and categorical variables on different dependent variables. The empirical results of the logistic regression model are presented in [Tables 10 and 11](#). The models were estimated taking firewood, fodder, timber, loan, electricity, schooling, irrigation, and water to be dependent variables and variables listed in the first column in each table as independent variables.

In these models, chi square values for firewood, timber, schooling, irrigation, electricity, and loan are significant at less than 0.001 level

of probability. This demonstrates that the explanatory power of the regression model is statistically sound and indicates significant relations between independent and dependent variables.

Firewood- Distance has a negative and significant relationship with firewood access. It is obvious that carrying firewood from a long distance is difficult, and therefore people living farther from the CF appropriate less firewood. HHs from older CFs seem to appropriate less firewood than those from younger ones because as a tree grows it produces less firewood but more woody and timber products. As discussed earlier, HHs having alternative energy in their house appropriate significantly less firewood than others. Notably, there is a decreasing trend in possession of farm-trees from rich HHs to very poor HHs (R, M, P, VP = 54, 39, 32, 29%) and only 25% of *Dalits* have a farm-tree, but 42% of other castes have a farm-tree in their land. It is also noted that the use pattern of firewood from farm-land as a primary source with 56, 44, 44, and 46% by R, M, P, and VP HHs, respectively.

Fodder- This model does not depict anything significant.

Timber- Poor people seem to appropriate significantly more timber than others, as mentioned above, which might be due to higher inflow of remittance. A person who is in an EC of a CFUG appropriates more timber than others. Age of forest has a significant relation with timber appropriation because as a forest ages, the trees are better for timber appropriation.

Electricity- Very poor and poor groups of HHs seem to benefit significantly less than other groups of HHs. CFUGs seem to be biased by caste, that is, lower caste groups benefit less than higher caste groups, although the result is not statistically significant.

Table 7
Pairwise tests of different groups.

	Pairs	p values							
		Firewood	Fodder	Timber	Loan	Electricity	School	Irrigation	Water
Different wellbeing groups in pairs	R-M ¹	0.05*	0.9	0.2	0.1	0.18	0.5	0.032*	0.04*
	R-P	0.3	0.8	0.06**	0.007*	0.2	0.9	0.28	0.8
	R-VP	0.7	0.6	0.7	0.1	0.03*	0.7	0.002*	0.6
	M-P	0.5	0.7	0.4	0.2	0.9	0.6	0.014*	0.03*
	M-VP	0.06**	0.6	0.07**	0.09**	0.08**	0.9	0.025*	0.2
	P-VP	0.12	0.7	0.02*	0.3	0.05*	0.7	0*	0.6
Respective wellbeing pairs of Dalits and other caste	R-R ²	a	0.1	0.7	0.1	a	0.8	a	0.8
	M-M	0.7	0.9	0.7	0.4	0.4	0.1**	0*	0.4
	P-P	0.5	0.6	0.1	0.8	0.2	0.038*	0*	0.1**
	VP-VP	0.4	0.08**	0.9	0.7	0.6	0.9	0*	0.3

a = absence of rich *Dalits*.

1 = R-M (having different letters in a pair) represents Rich and medium of all caste and so on.

2 = R-R (having same letters in a pair) means Rich and Rich of other caste and *Dalits* and so on.

* = significant at 5% level.

** = significant at 10% level.

Table 8
Alternative water supply sources between different groups.

Groups	Tap water	Spring	Well/borehole
Political elites	95%	7%	7%
Non-elites	79%	6%	6%
EC members	82%	42%	4%
Non-members	81%	30%	7%
Rich	86%	36%	2%
Others	80%	41%	8%

Table 9
Farm-tree users by different wellbeing categories.

Categories	% of HHs that have a farm-tree	% of HH that use a farm-tree as primary source
Rich	54	57
Medium	39	44
Poor	32	44
Very poor	29	46

Irrigation- This is one of the CFUG-funded benefits, which is influenced most by local elite, rich HHs, and higher caste HHs. Lower caste HHs benefit significantly less than higher caste HHs. Medium HHs receive more benefits from CFUG-funded irrigation services than very poor and poor HHs (Table 7), but Table 11 demonstrates that, if a HH is from a medium category, it benefits significantly less than others. This might be because medium groups have the highest number of

HHs and, on average, they possess less irrigable land per HH than very poor HHs.

Schooling –The Dalit caste group has benefited significantly less from this service. Wellbeing ranking does not have a significant influence on schooling. The bias against *Dalits* might be intentional or *Dalit* children do not join the school due to their business in other house works, such as labor to help their parents.

Water- Medium HHs have a significant relation with water benefits funded by CFUG. There is a negative and significant relationship between CFUG-funded water services and spring water and surface water.

Loan- It seems that medium, poor, and very poor HHs have a positive significant relationship with loan access compared to rich HHs. In contrast, female-headed HHs and the *Dalit* caste group have a negative coefficient, but this is not statistically significant. The above table shows that HHs that are in the EC have a significant chance of getting a loan, and VP groups that are in the EC have received loans the most. The pair-wise test between the pairs below in Table 12 shows that rich wellbeing rank has significantly different access compared with the other three. The rest of the pairs do not have any statistically significant differences. The relationship of previous membership of EC with loan access was also investigated, and the result is statistically significant. Both current and previous membership in the EC appear to be a powerful factor in making the decision of loan allocation.

Overall, it appears that the bias of access to different forest products and forest-accrued benefits more strongly relates to wellbeing rank and sex and not the caste group. Moreover, elite groups capture most important benefits. The elite groups, the EC member, and ex-

Table 10
Regression analysis of different forest products access and independent variables.

	Firewood			Fodder			Timber			Loan		
	Exp. sign	Coef.	p value	Exp. sign	Coef.	p value	Exp. Sign	Coef.	p value	Exp. Sign	coef.	p value
Caste	–	–0.090	0.632	–	–0.169	0.428	–	0.259	0.201	+	–0.068	0.763
Very poor	–	–0.139	0.650	–	–0.082	0.792	–	–0.192	0.589	+	1.377	0.000
Poor	+ / –	0.325	0.118	+	–0.041	0.846	+	0.471	0.038	+	0.988	0.000
Medium	+ / –	0.331	0.091	+ / –	0.000	1.000	+ / –	0.303	0.170	+ / –	0.580	0.030
Sex	–	–0.683	0.003	–	0.151	0.477	–	–0.056	0.807	–	–0.146	0.547
HH in FUGEC	+	0.091	0.688	+	–0.004	0.987	+	0.619	0.010	+	0.767	0.002
Political elites	+	–0.042	0.825	+	–0.074	0.715	+	0.202	0.328	+	–0.054	0.808
Distance	–	–0.007	0.012	–	–0.001	0.638						
Alt energy	–	–0.762	0.000									
Farm-tree	–	–1.286	0.000	–	0.046	0.765	–	–0.024	0.880			
Anyone ever member of CF before							+	0.083	0.656		0.566	0.004
Livestock				+	0.132	0.661						

Table 11
Regression analysis of different CFUG-funded infrastructures and independent variables.

	Electricity			Irrigation			Schooling			Water		
	Exp. Sign	Coef	p value	Exp. Sign	Coef	p value	Exp. Sign	Coef	p value	Exp. Sign	Coef	p value
Caste	–	–0.099	0.716	–	–2.721	0.063	–	–0.555	0.019	–	0.037	0.919
Very poor	–	–1.142	0.010	–	–0.414	0.793	–	0.443	0.243	–	0.008	0.988
Poor	–	–0.483	0.206	–	–0.461	0.666	–	0.253	0.337	–/+	–0.008	0.985
Medium	–	–0.502	0.187	–	–1.830	0.076	–	0.215	0.381	–	0.785	0.054
Sex	–	–0.240	0.451	–	–2.046	0.040	–	–0.326	0.236	–	0.377	0.365
HH in FUGEC	+	–0.174	0.609	+	1.416	0.191	+	0.051	0.874	+	–0.650	0.205
Political elites	+	–0.172	0.543	+	–0.256	0.775	+	0.535	0.063	+	0.229	0.555
Anyone ever in CFUG EC	+	–0.017	0.945	+	–0.587	0.447	+	0.127	0.563	+	–0.609	0.063
Tap water											–0.451	0.260
Spring											–0.740	0.019
Surface water											–1.248	0.048
Ropani of irrigated land					0.012	0.845						

Table 12
Loan access by wellbeing category of EC member HH.

Wellbeing Rank	Percentage of HHs that are in an EC and get a loan
Rich	17*
Medium	36
Poor	39
Very poor	43

*Pair-wise test shows that rich are significantly different with 3 others (medium, poor and very poor) at 5% level and other pairs are not different significantly. See annex for values.

EC members appear to have less interest in firewood and fodder but they have a significant influence on timber, loans, and irrigation. Building the relationship with EC, maintaining it and, impressing and influencing the EC members appear to play a key role in access to important forest products and forest-accrued benefits.

Discussion

Alike to previous studies, this study has included many dependent variables; three major forest products, four infrastructures that are most funded by CFUG and loan provided from CFUG. These all variables are not equally important to every user but are of difference importance for different users. For example, firewood, fodder, and loans are very important for poor and *Dalit* HHs, and irrigation is important for the HHs that hold irrigable land. Among forest products, timber is the most important in terms of generating income/revenue; however, total revenue generated from CFUG is negligible when compared to HH's private gain from forest products' extraction (Chhetri et al., 2012). Therefore, access to firewood, fodder, and timber can be considered to be more important than access to CFUG-funded infrastructures to uplift the livelihood of rural poor people. The following sub-sections present the product-wise and benefit-wise discussion.

Firewood

Pair-wise comparisons between different wellbeing groups show that rich groups have the highest access and very poor groups have the least access (with significant result in some pairs), and the result is biased against female-headed households. This result supports the findings of a number of similar studies on equity in community forests of Nepal (Chaudhary et al., 2017; Adhikari et al., 2004; Kumar, 2002; Lama & Buchy, 2002; Shrestha, 2005). Our findings support the classification of different users by distance from forest, with those living farther from a forest having less access to firewood. This supports the findings of Acharya et al. (2020) (in case of ecosystem services), Kerapeletswe and Lovett (2002), and Sapkota and Odén (2008). Con-

versely, our results do not support the findings of Adhikari et al. (2004) that reported that distance to forest does not really hinder firewood extraction. This might be due to lack of alternative energy and farm-trees at that time. Alternative energy and farm-trees are significantly and negatively correlated with firewood access. There is a decreasing trend of possession of farm-trees from rich to very poor HHs (54% – 29%), and 42% of higher castes and 25% of lower castes have farm-trees on their own land. Our result indicates that rich and higher caste groups have higher access to firewood (from forest) than poor and *Dalit* groups. Proportionally, *Dalits* and poor get less firewood from the forest. It is a form of benefit captured by rich and higher caste groups, which is a finding that is in the line with Chaudhary et al. (2017) and Adhikari et al. (2004) but contradicts Sapkota and Odén (2008) and Sunam and McCarthy (2010). Further, Leone (2019) concluded that if a woman is in a CFUG EC, it significantly decreases the firewood extraction from forest, but we have not analyzed it.

Fodder

Dalit, female-headed, poor, and very poor HHs are negatively correlated with fodder access from the forest. Our findings again support other studies which find the bias due to caste, gender, and wellbeing group (Chaudhary et al., 2017; Adhikari et al., 2004; Lama & Buchy, 2002; Maraseni et al., 2005; Naidu, 2011). Livestock rearing is positively correlated with fodder access; it is obvious that people without livestock do not need fodder. Nineteen percent of *Dalit* and twenty-three percent of higher caste have access to fodder from forests among the HHs that own the livestock. The bias against *Dalits* has been noted again, and this result supports the findings of Sunam and McCarthy (2010).

Timber

Timber access is biased toward poor, *Dalit*, and female-headed HHs which supports the findings of previous studies in Nepal (Chhetri et al., 2005; Maharjan et al., 2009; Malla et al., 2003; Nightingale, 2003; Sunam & McCarthy, 2010) but is opposite with a finding from Bhutan's community forests (Buffum et al., 2010). More interestingly, political elites had a negative correlation with access to firewood and fodder, but this group has a positive correlation with timber. This indicates that the elites are more interested in valuable products. HHs that are in the EC have a significant positive correlation with timber access, which supports the finding of Iversen et al. (2006) and Chaudhary et al. (2017). Data shows the higher farm-tree presence among rich HHs, but timber access is biased toward the poor. One of the reasons behind this might be that rich HHs do have a farm-tree but they have not extracted timber because Nepal gives more emphasis on process and administrative procedure while extracting timber (Aryal et al., 2020; Poudyal et al., 2020).

Loan

Our findings show that there is a good allocation of loans to *Dalit* and poor households, which shows that CFUGs are following the government guideline to allocate at least 35% of CFUG income for pro-poor's livelihood upliftment. Our study supports the findings of Maharjan et al. (2009) but contradicts Pokharel (2008) who argues that poor HHs are less likely to get loan support from CFUG funds. Pokharel et al. (2011) finds mixed results; they found that poor and female-headed households are less likely to get loans, and our result supports the latter only. Pokharel et al. (2011) also find that 34% of loans provided are invested in non-income generating activities, and thus we simply cannot argue that the allocated loan is used to uplift the livelihood of the poor.

Irrigation

Generally, poor and *Dalit* people live in remote areas where there is a lack of access to good infrastructure. Moreover, poor people normally do not have irrigable land. Irrigation is one of the most important infrastructures funded by CFUGs and is an area where keen interest from elites and rich HHs is clearly seen. Our result reports that the benefit is biased against poor, *Dalit*, and female-headed HHs, which supports the findings of Adhikari et al. (2004) and Pokharel (2008). HHs that are in an EC and are political elites are likely to get more benefits than others. Ojha et al. (2009) have reported that development of infrastructure like irrigation and water canals support the livelihood upliftment of rural poor people. However, the result indicates that only the elites are benefitting from such investments. One reason behind this might be, due to the geography and settlement pattern in Nepal. Poor and *Dalit* people usually live in marginalized and remote land, while the rich and higher caste groups live in more accessible and productive areas.

Electricity

Our result depicts a case similar to irrigation which is biased against poor, *Dalit*, and female-headed HHs. An issue paper published by NSCFP (2007) explains that CFUG investment in infrastructure really does not trickle down to the poor and disadvantaged groups; our study supports the same. Unequal distribution of access to electricity might be due to a combination of the unique settlement patterns of Nepalese community and elite capture in community programs.

Water

We do not have many variables that are significantly related with water. However, female-headed, *Dalit*, and poor HHs correlate negatively as in other cases. Principally, there should have been more equality in access to water than the other three infrastructures because everybody needs water and it does not need any investment (i.e., you should have irrigable land for irrigation, you should be able to pay the monthly fee of electricity to take electricity benefits). However, the EC decides where to invest and how to invest the CFUG funds, and there is more representation from higher caste, rich, and male-headed HHs in EC, and thus the decision seems to be in their favor. The finding supports the explanation of NSCFP (2007), but slightly contradicts Adhikari et al. (2004) who reported that poor HHs benefited least and that rich HHs benefited most. Additionally, the result indicates that HHs that do not use CFUG-funded water use other water sources like tap water, spring water, and surface water.

Schooling

Poor, *Dalit*, and female-headed HHs are negatively correlated with receiving benefits of schooling. Descriptive statistics are contradictory

with others (Adhikari et al., 2004; Joshi, 2005). They reported that little or no benefits trickle down to the poor and *Dalits*. Additionally, they also reported that the poor benefit least and that the rich benefit most from schooling, but this study does not support this claim. Very poor HHs and medium HHs are benefitted most. *Dalit* caste has a negative coefficient with schooling in regression analysis, though this is not statistically significant. The enrolment rate among poor and *Dalit* children is low (Groot, 2007). Thus, the question is if poor and *Dalit* children are not enrolled in school, how can financing the school benefit them?

With regard to firewood and fodder, it is unknown whether the members can sell the products extracted from CFs or not. The interest in extraction and access (especially of elite and rich people) is sometimes determined by whether they are allowed to sell the products or not. Another possibility is bartering of such products for other stuffs. Normally, the sale of firewood and fodder from the forest is not allowed, but they can be bartered for other stuffs. Another interesting point is that people who have more trees (rich and higher caste) on their farmland depend more on CFs for firewood and fodder, and this is the opposite of what was expected. However, the reason is unknown. It may be that they (lower caste and less well-off) find it easier to use the products from their farm-tree and they allocate the remaining time for labor work and money-earning tasks. It may also be due to easier access to markets or decreasing dependency on forest or that they are prevented from accessing the forest. There is no data on why they use less forest products and use higher products from farm-tree than others. In my experience, poor and *Dalit* people prefer to spend their time in daily wage-based jobs. They collect less firewood as compared to rich and higher caste people because, if they go to forest, they only can get firewood. If they opt for a wage-based job, they can earn for food, some cash, and an energy source (kerosene, firewood) to cook the food.

With regard to timber, the amount of price subsidy is unknown. If the price subsidy on timber is low, then the poorer segment of the communities is likely to be benefitted less but generates more revenue. Conversely, if a subsidy is high, then all HHs have good access to timber but revenue generation becomes low, which consequently decreases the public finance potentiality of CF. We do not have data on whether a HH can resell the bought timber in the market or not. If they can resell the timber in market, there is a possibility of rich and elites taking the timber. Additionally, data is lacking on who applied for timber and how many of them got it. May be rich and very poor HHs had not applied for timber and thus they did not get it or they might not have received due to biased decision of EC members. Similarly, EC members and political elites have more access to timber. One reason might be that ECs are the decisive body and political elites have influence over EC, and thus they could have acquired the timber. Another possibility is that people who are not in an EC and are not political elites do not know the procedure and time⁶ to get the timber, which is why these groups are getting lower access.

With regard to loans, the CFUG guideline (2009) of Nepal strictly says that at least 35% of the CFUG fund must be spent on pro-poor livelihood upliftment activities. There is a provision of punishment (maximum is withdrawal of CF) if a CF does not follow the rule, GoN (2019). This indicates that CFUGs are following the government guideline as the loan is allocated to users for livelihood upliftment activities. However, it is unknown whether the users have spent the money in livelihood upliftment activities or not. The data is lacking on the amount of loan, amount of applied and obtained loan, whether rich people and higher caste HHs had applied for a loan or not, how many HHs made the application toward getting a loan, and how many of them obtained it

⁶ The ministry of forests and environment, Nepal, frequently bans and allows felling for timber in CFs and national forests just by forwarding a circular to divisional forest offices. The Divisional Forest Office then forwards these circulars to CF ECs. Thus, there is a possibility that all the users may not get the information in a timely manner, but EC does receive it in a timely manner.

(different social and political categories). Further, income and expenditure of CFs and transparency of income and expenditure are also unknown, and thus it is not clear how CFs allocate (fairness and decision making) their funds in loans and other pro-poor focus activities.

EC members play a pivotal role in decision-making regarding the decisions on fund investment and benefit sharing. CFUG guideline has mandatory provision that there should be at least 33% women in the EC and proportionate representation of *Dalit* caste, poor households, and other marginalized groups in the EC of the CFUG (GON, 2014). The data is lacking on the income, expenditure, and fairness in the decision-making process. The installation and allocation of such services (infrastructures) might not have been approved through full participation of EC members or not endorsed by general assembly of all users including poor and *Dalits*; for example, if piped water and electricity is installed (or helped financially in installation by CFUG) in a particular hamlet of a CFUG but there are no *Dalits* and poor HH. Then how do poor and *Dalit* get access to such services? The linkage of this type of dataset (like this paper) with transparency and decision-making process of CF would help to know further about this issue. One-third of users in this case do not have irrigable land, and thus they never can benefit from irrigation. Additionally, poor and *Dalit* groups are geographically marginalized as they reside in remote and marginal areas. Higher caste and rich people reside in the valley, while poor and *Dalits* reside in the upper side of the catchment. One of the possibilities to get lower access by poor and *Dalit* on irrigation is that they may have been residing in the upper side of the catchment and there is limited irrigated land in the upstream area. Adhikari et al., (2004) has explained the same scenario but their data has significant differences with regard to landholding size between different wellbeing groups. There is no data regarding the area of land irrigated by CFUG-funded irrigation by different social and political groups. Data regarding the area of irrigated land would be helpful to determine the relative and absolute benefits reaped by different users from CFUG-funded irrigation. Further, rich households hold slightly more irrigable land on average than the other three categories of HHs. With regard to water, rich, higher caste, EC members, and political elites have lower access to CFUG-funded water. Further investigation on this reveals that they use alternative water sources (mostly tap water), but it has not been investigated whether this tap water is also funded by CFUG or not. Any type of bias toward access to forest products and forest-accrued benefits may lead toward conflict in the CFUG, which has also been concluded by Maraseni et al. (2019).

While looking at independent variables, some interesting points are notable. There is a negative correlation of female-headed households with access to all benefits. It seems that female-headed households are less represented in EC despite the provision of 33% women representation. Even if women are in EC, they cannot express their views in CFUG meeting. Even if they express their views, their views are not heard (Adhikari & Di Falco, 2009). With the interventions of women, poor and marginalised community focused activities in later days, these groups are found to be empowered and supported. Maraseni et al. (2014) found that REDD plus payment fund in CFUG were used toward poor, women, *Dalit*, and marginalised groups whereas Chaudhary et al. (2017) have highlighted the effectiveness of women focused climate change adaptation interventions in CF.

Despite the numerous issues in equitable access and sharing of CF benefit as we found in this study and supported by number of previous studies, models we presented above reveals that caste is not found to be a factor that influences the access. There might be multiple reasons that play positive role for this output. One of the reason could be we used fixed factors like farm-trees (in firewood, fodder, and timber) and landholding size (in the case of irrigation) in our models. Moreover, the increased social mobility, exposure and social interactions and increased awareness could be an additional factor. Our study found that income groups, positions in EC and the political access and influence still play vital role in accessing the benefits indicating

the need of diverting our studies from caste and income based CF assessment to role of power and political positions of members for strengthening CF governance.

Conclusion and policy implications

Firstly, it can be concluded that there is a difference in access level between different groups differentiated by wellbeing status, caste, and political status. However, statistically, there is no significant difference (except only few) in access to forest product and forest-accrued benefits due to caste. Further, different pairs of wellbeing groups are found to have statistically significant differences. In most cases, well-off HHs have better access than less well-off HHs. HHs that are in an EC and are political elites have significantly more access with regard to important benefits such as timber, irrigation, and loan. Secondly, this study concluded that wellbeing rank or income level of the HH is a factor that determines the access to forest products and forest-accrued benefits. Similarly, the gender of the head of HHs is another factor that is found to have an influential role in determining the access. The results depicted that male-headed households tend to have better access than female-headed HHs. Alternative energy, farm-tree, and distance are significant factors that determine the access rate to firewood from the forest. Ex-membership of EC, current membership of EC, and political elite status are found to influence the access to major forest products and forest-accrued benefits.

Overall, it appears that rich, elite, and male-headed HHs tend to capture the important benefits. These groups show less interest in minor products such as fodder and ordinary infrastructure such as water services but show a keen interest and intend to capture valuable benefits such as timber, loans, and irrigation. Wellbeing has a significant influence in some pairs. Rich and medium HHs have a higher influence on access to forest products and forest-accrued benefits; however, those who have reaped such benefits are inevitably some type of elite (politically or EC member, see in result). HHs that are poor, female-headed, and not in an EC have several disadvantages in terms of accessing forest products and benefits. The EC plays a crucial role in defining the forest-product extraction rules, CFUG-funding decisions, and loan distribution; therefore, it is crucial in the functioning of the CFUG institution and each user's access to benefits.

Our analysis indicates that there is a need for a paradigm shift from traditional analysis using caste- and wealth-based analysis to power-based analysis in accessing the benefits of a CFUG. Previous studies have focused on inequality due to caste and wellbeing rank, but this study finds political and executive committee connectedness to be more important factors. Therefore, future policies should focus on in-depth analysis of differences among HHs due to political structure (social structure as well in some degree) of the community in order to address the interest of different groups and issues of equity. Further, it should be investigated that whether particular HHs have an interest in investment in particular infrastructure or not. As poor and *Dalit* HHs tend to have less landholdings than rich and higher caste HHs, poor and *Dalit* HHs may not wish to invest the CFUG fund in irrigation services. Thus, the focus of future studies and policies should be more focused on equitable distribution of forest products rather than on investing in infrastructure. Moreover, demand-driven infrastructures should be of priority for investment by CFUGs in the future. Therefore, future policies and CF rules at local level should focus on developing the instructional context and arrangement which can identify the real need of important forest products and CFUGs investment priorities considering the principle of equity.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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