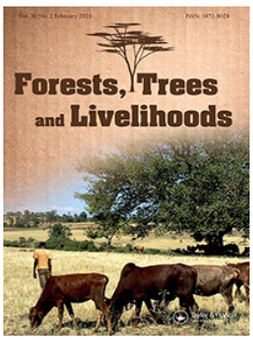

Forests, Trees and Livelihoods

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tftl20

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To cite this article: Christopher Mawa, David Mwesigye Tumusiime & Fred Babweteera (2021) Are community forests delivering livelihood benefits? Insights from Uganda, Forests, Trees and Livelihoods, 30:2, 133-150, DOI: 10.1080/14728028.2021.1904010

To link to this article: https://doi.org/10.1080/14728028.2021.1904010

Published online: 24 Mar 2021.

FORESTS, TREES AND LIVELIHOODS
2021, VOL. 30, NO. 2, 133–150
https://doi.org/10.1080/14728028.2021.1904010

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ARTICLE

Are community forests delivering livelihood benefits? Insights from Uganda

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ABSTRACT

Most developing countries in the tropics have embraced various forms of community-based forest management. Uganda's Community Forestry (CF) approach grants de jure rights to community groups to manage and own proceeds from specified forest resources to enhance socio-ecological benefits. However, two decades following its implementation, there is insufficient empirical evidence linking changes in local community livelihoods to participation in CF. Guided by insights from the Sustainable Livelihoods Approach (SLA), we conducted a cross-sectional survey in seven villages surrounding two de facto CFs in mid-western Uganda to quantify and compare livelihood capitals, strategies and outcomes among 40 households that were members of Communal Land Associations (CLAs) that are mandated to manage the CFs and 91 non-member households. Our results indicate significant improvements in access to natural, social and financial capitals of CLA member households. On-farm income was the main household income source in the area, but households also exhibited heavy dependence on forest environmental income observed to reduce poverty incidence by 12.5% and 5.5% among CLA member and non-member households, respectively. In order to significantly contribute to rural livelihoods, conservation and development interventions should amplify both economic and non-economic incentives to consolidate the gains that have been made while developing human and physical capital.

KEYWORDS

Livelihood asset; capital; community forestry; poverty; Uganda; sustainable livelihoods approach; community-based forest management

Introduction

Globally there has, since the 1980s, been a shift in forest management approaches in favour of those that seek to empower forest-adjacent communities to manage and where possible, own forests in their vicinity (Agrawal and Ostrom 2001). This shift resulted from the recognition that local communities can be effective managers of forests in their localities if appropriately supported. Moreover, since most of the communities surrounding these forests depend on forest resources therein for subsistence and sometimes cash, recognising them as managers or owners of the forests would incentivise them to conserve the forests for enhanced livelihood benefits (Sunderlin et al. 2008). In efforts to achieve this, most tropical countries have embraced several forms of community-based forest conservation initiatives that grant powers to local community groups to either co-manage or legally own specified

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forests and the resources therein. Different labels such as Joint Forest Management (JFM), Community Forestry (CF), Participatory Forest Management (PFM), Collaborative Forest Management (CFM) and Community-based forest management (CBFM) have been embraced in different countries.

The government of Uganda has embraced two main forms of community-based forest management in the forest sector: collaborative forest management and community forestry (GoU 2003). CFM is a co-management arrangement that gives rights to registered local community groups to co-manage specified parts of a state forest with state agencies (GoU 2003). In the CF approach, the state grants powers to a registered local community group to manage and own forest resources in a specified area, thus according to such groups ownership and alienation rights that groups engaged in CFM do not have. These approaches have been actively promoted in Uganda since the late 1990s. They are also clearly spelt out and emphasised in the country's policy and legal documents such as the national forest policy, plan, the National Forestry and Tree Planting Act (NFTPA) and Forest Investment Program.

Local community groups that wish to manage community forests are encouraged to form and register Communal Land Associations (CLAs) and follow an arduous process that culminates in the declaration of the forest as a 'community forest' by the line minister. Other eligible entities that can also apply to own and manage community forests include Community-Based Organisations (CBOs), farmers' groups, companies, cooperative societies and Non-Governmental Organisations (GoU 2003). To-date, only CLAs have been registered to manage and own community forests. Registered CLAs are required to manage the forest resources under their jurisdictions, in line with their management plans, under the supervision of the respective district forest officers. While they have rights to craft bylaws and locally appropriate rules to control resource access, and appropriate costs and benefits from the forests, the NFTPA prohibits the CLAs from changing the land use without the approval of the minister.

Despite the elegant paperwork and efforts to legitimise and promote CF in the country, none of the forests currently managed by CLAs has been declared a 'community forest', two decades after their recognition in the country's policy and legal framework. To-date, only one *de facto* community forest (Ongo community forest) has obtained a certificate of freehold land ownership. This delay in the formal declaration has been reported as one of the factors impeding successful sustainable management of some of the *de facto* community forests by CLAs (Namaalwa et al. 2017).

Recent studies on CF in the country have investigated the conservation outcomes (e.g. Mawa et al. 2020) and community preferences and lessons learnt from carbon offset projects implemented in community forest-adjacent areas (e.g. Namaalwa et al. 2017). However, there is insufficient empirical research evidence on the livelihood outcomes of the *de facto* community forest management under the CLAs. Nonetheless, studies conducted elsewhere (e.g.; Chen et al. 2013; Matiku et al. 2013; Tadesse et al. 2017) have demonstrated the linkages and quantified the effects of the community-based forest management on livelihood assets.

Since the livelihood impacts of community-based forest management approaches are often context- and site-specific (Keane et al. 2019), this study sought to use insights from the Sustainable Livelihood Approach (SLA) (DFID 1999) to quantify and compare the livelihood capitals, strategies and poverty levels of CLA member households and non-members,

following over a decade of active community forest management under two CLAs in Ongo and Alimugonza community forests located in mid-western Uganda. The SLA identifies five major livelihood asset (or capital) categories upon which livelihood strategies are built. These are the natural, human, physical, financial and social capitals (DFID 1999). Since forest management under the CLAs is expected to create or deplete household assets and determine accumulation and access to these assets, a clear understanding of a household's asset pentagon, the main livelihood strategies and outcomes is particularly important for drawing lessons to improve the design of the CF approach. Lessons learnt from these two illustrious sites of *de facto* community forestry in Uganda could be used to inform policy and enhance household-level livelihood contributions of the common property resources in similar contexts elsewhere.

Materials and methods

Study area

Ongo and Alimugonza community forests are located in Masindi district in mid-western Uganda. Ongo CF covers an area of 172.32 hectares in Budongo Sub-county, about 54 km from Masindi town along Masindi – Nyantonzi – Hoima road. It is surrounded by four villages (Abangi, Onieni, Kibali and Ogadra) with a total of 582 households, as of 2018. Although generally a multi-ethnic agrarian community, the indigenous Banyoro, Bagungu, and immigrants from North-Western Uganda and the Democratic Republic of Congo are the most dominant inhabitants (Mawa et al. 2020). Until the early 2000s, Ongo community forest was regarded as an open-access forest located on public land. Local NGOs, in collaboration with the Masindi district forest service have since the early 2000s been supporting the local community members to obtain *de jure* rights to manage the forest. After more than 15 years of seeking for a title of land ownership, Ongo CLA was granted a certificate of freehold land ownership in 2016 (Namaalwa et al. 2017). To become an Ongo CLA member, one needs to be a resident of any of the four villages and pay a one-off one membership (approximately US$ 3) and annual subscription fees (approximately US$ 0.8) to the Association (Mawa et al. 2020). At the time of data collection (2018), the association had over 230 registered members.

Alimugonza community forest covers an area of 28 Ha in Pakanyi sub-county, about 40 km to the north of Masindi town. It borders Budongo central forest reserve (KP 10 compartment) to the west, and three villages of Alimugonza 1, Alimugonza 2 and Pabidi with a total of 210 households as of 2018. Alimugonza CLA is comprised of residents of these three villages and four others (Tantara, Waiga, Kituka and Kabarogota) that do not share direct boundaries with the forest but their residents have access (Mawa et al. 2020). Unlike the Ongo multi-ethnic community, villages surrounding Alimugonza are dominated by the native Banyoro ethnic group and few immigrants from eastern and northern parts of Uganda. CLA members in Alimugonza also pay a one-off membership (approximately US$ 6) and annual subscription fees (approximately US$ 3). Alimugonza CLA had a total of 36 registered members in 2018.

Data collection

We conducted a cross-sectional survey of all the villages that shared boundaries with both Ongo and Alimugonza community forests. We obtained a list of households from the

respective village Local Council Chairpersons and used it to create two sub-groups consisting of CLA member households and non-members. We then used a systematic random sampling technique to select at least 20% of the households from each sub-group. The final sample size was 131, comprising 40 CLA member-households and 91 non-members. We adopted Poverty Environment Network (PEN) household questionnaires (CIFOR 2008) to collect data on general household characteristics and livelihood assets and strategies. The questionnaires were semi-structured and administered in the local languages by trained local research assistants at the respondents' homes or gardens. Interviews were held with household heads or any other adult member of the household who was knowledgeable about the household livelihood assets. We obtained approval to conduct the study from relevant local and district authorities in addition to clearance by the Uganda National Council for Science and Technology before fieldwork.

Data analysis

Consistent with the pitfalls of using cross-sectional survey data for evaluation-related studies (Lan and Yin 2017), we ran a Propensity Score Matching (PSM) model to construct a statistically determined comparison group using relevant observed characteristics in Table 1. This modelling approach allows CLA member households to be matched on the basis of their probability of belonging to a CLA (or propensity score), to non-members. The Average Treatment Effect on the Treated (ATT) would then be calculated as the mean difference in outcomes across the two groups. However, our CLA member households and non-members had similar propensity scores, rendering the counterfactuals obtained from our propensity score model inconsequential. We therefore calculated the mean differences in our outcomes of interest (Table 2) using the unmatched dataset.

Following similar previous studies (Tumusiime et al. 2011; Chen et al. 2013; Nakakaawa et al. 2015; Tadesse et al. 2017), we selected locally relevant indicators of the five livelihood assets (DFID 1999) as shown in Table 2. In order to compute household income (per Adult Equivalent Unit – AEU), from the different income sources, we followed the accounting methods in the PEN survey guidelines (CIFOR 2007). Since literature on direct benefits of community-based forest management initiatives in developing countries generally reports

Table 1. Logit estimates of household membership in CLA in Mid-western Uganda.

Variable	Coefficient	z-value
Years of education of household head	−0.03 (0.06) ^{ns}	0.621
Age of household head (Years)	0.02 (0.02) ^{ns}	0.252
Distance from household to forest (Km)	−0.54 (0.32)*	0.098
Distance from household to market (Km)	−0.07 (0.17) ^{ns}	0.690
Distance from household to motorable road (Km)	0.21 (0.27) ^{ns}	0.451
Adult equivalent units (AEU)	0.07 (0.08) ^{ns}	0.417
Constant	−1.33 (0.87) ^{ns}	0.126
Pseudo R^2	0.04	
Prob > Chi-square	0.314	
Log pseudolikelihood	−77.07	
AIC	168.15	
N	131	

Notes: Dependent variable (membership in CLA) equals one if a household had a CLA member and zero otherwise. Standard errors are in parentheses. * denotes statistical significance level at 10% and ^{ns} means statistically non-significant at 5% level of significance.

Table 2. Livelihood capitals, indicators and measures used to compute the indices.

Livelihood capital	Indicator	Measure
Natural	Access to forest products from community forest	No = 0, Yes = 1
	Access to forest products from plantation forest	No = 0, Yes = 1
	The household has on-farm trees	No = 0, Yes = 1
	Total area of land accessed	Mean value
Physical	Total value of household durable assets	Mean value
	Nature of main house	Temporary = 0.33, Semi-permanent = 0.66, Permanent = 1
Financial	Access to credit	No = 0, Yes = 1
	Total household income	Mean value
Human	Dependency ratio	Mean value
	Adult Equivalent units	Mean value
Social	Number of social groups	Mean value
	Leadership position held	No = 0, Yes = 1
	Trust in village mates	None = 0.33, Average = 0.66, High = 1

a skewed benefit distribution in favour of relatively high-income households (Vedeld et al. 2007), we also compared differences in household income from the different income sources across income quintiles. Following Vedeld et al. (2004), we computed Kuznets Ratio as a measure of the poverty profile of forest environmental income (FEI). The Kuznets ratio was computed as the ratio of the average FEI for the 20% highest-income households to the average FEI for 40% lowest-income households. A ratio below one indicates a higher mean forest environmental income earned by low-income households relative to those obtained by high-income households (Vedeld et al. 2004; Dokken and Angelsen 2015).

Following similar studies (Chen et al. 2013; Tadesse et al. 2017), the selected indicators of livelihood capitals (Table 2) were scaled to make them comparable and ease interpretation. Indicators that were measured on a rating scale (e.g. "nature of main house" and "trust in village mates") were weighted as "0–0.33", "0.34–0.66" and "0.67–1" and interpreted as "temporary/none", "semi-permanent/average" and "permanent/high", respectively. For computational convenience, three critical values: 0.33, 0.66 and 1 were used to replace "temporary/none", "semi-permanent/average" and "permanent/high", respectively. Therefore, such indicators with three choices were measured as: I = temporary/none% × 033 + semi-permanent/average% × 0.66 + permanent/high% × 1. Indicators that were measured on a binary scale (Yes or No) were computed as: I = Yes% × 1 + No% × 0. Finally, indicators that were measured on a continuous scale were classified as follows: if the household indicator value was less than the mean value, it was classified as "poor" with the weight of 0.33; if the value was more than the mean but less than 1.5 × mean, it was treated as "average" with the weight of 0.66; and if it was more than 1.5 × mean, it was classified as "good" with the weight of 1. Following Chen et al. (2013), the composite index for each livelihood capital is calculated using the formula in equation 1.

$$C = \sum_{n=0}^{n} \frac{I_n}{T_n} \tag{1}$$

Where C is the criteria score for each livelihood capital category ($0 \leq C \leq 1$); n is the n^{th} indicator for each capital (n = 1, 2, 3, . . . , n); I denotes an indicator; T is the total number of indicators.

The pooled household livelihood capital (HLC) = $(C_p + C_n + C_h + C_f + C_s)/5$, where C_p, C_n, C_h, C_f and C_s are the respective values of physical, natural, human, financial, and social capital. The mean values of household capitals in CLA member households and non-members were then compared using independent samples t-test. Additionally, we drew an asset pentagon to visualise the household asset portfolio of CLA members and non-members (Figure 2). All statistical analyses were conducted in R version 4.0.2 (R Core Team 2020).

We also investigated the influence of CF on poverty levels by comparing the Foster-Greer -Thorbecke (FGT) poverty indices (Incidence, Depth and Severity) for CLA member households and non-members. We computed the poverty indices with and without forest environmental income to determine their effect on household income. Following similar studies conducted in communities adjacent to protected areas in Uganda (Tumusiime et al. 2011; Nakakaawa et al. 2015), we computed the poverty line as UGX 614,501.50 (USD 164.7) per AEU per annum that we used to calculate the poverty indices.

Results

General household characteristics

The household characteristics of CLA members were similar to those of non-members ($p > .05$) as shown in Table 3. Up to 90% of the sample households were headed by married male adults. The average age of the household head was about 42 years and two-thirds (69%) of them belonged to the dominant ethnic groups in the area. Over 90% were subsistence farmers accessing an average of 2.2 hectares of land for farming. The average household size was 6.5 people (or 4.8 adult equivalents). The households had an average of four dependents for every three adults and were generally located within less than 1 km from the community forests and motorable roads, and on average, 2.27 km away from the nearest market.

Motivation for joining CLA

Most (68%) of the CLA members reported joining the CLAs to improve management of the community forests that were threatened by uncontrolled resource extraction by both community members and outsiders. Slightly more than half (52.5%) were also motivated by the need to protect the forests for future generations while 40% were interested in legitimately accessing high-value forest products from the community forests. The other reasons cited were the need for social inclusion, access to forestland and tree seedlings and to obtain skills from the training opportunities that target members (Figure 1).

Those who were not members of the CLAs cited several reasons for not joining. According to them, the CLAs had little to show on the ground for the time they have been in charge. Moreover, non-members who were local residents could still access the forest to extract non-wood products and firewood from dead or fallen trees on days set aside for community access. About 20% of the non-members accused the CLA committee members on accounts of being corrupt and high-handed in their conduct. The elderly household heads cited lack of energy to meaningfully contribute to the labour-demanding activities of CLAs.

Table 3. General household characteristics of CLA members and non-members in mid-western Uganda.

Household Characteristic	Unit	CLA members (n = 40)	Non-members (n = 91)	Pooled (n = 131)	t-value/ χ2 value	p-value
Sex of HH Head						
Male	%	95.00	87.91	90.08		
Female	%	5.00	12.09	9.92	1.562	0.342
Ethnicity						
Dominant	%	77.50	65.93	69.47		
Others	%	22.50	34.07	30.53	1.752	0.220
Marital status						
Married	%	85.00	91.21	89.31		
Not married	%	15.00	8.79	10.69	0.122	0.358
Main occupation						
Subsistence farming	%	95.00	91.11	92.31		
Off-farm labour provision	%	0.00	5.55	3.58		
Small-scale business	%	2.50	0.00	0.77		
Formal employment	%	2.50	3.33	3.08	4.580	0.456
Years of education of HH Head	Years	5.72 ± 0.44	5.89 ± 0.36	5.84 ± 0.29	0.288	0.774
Age of HH Head	Years	44.75 ± 2.22	40.96 ± 1.43	42.11 ± 1.21	1.439	0.155
Years since HH was formed	Years	19.78 ± 2.02	15.51 ± 1.30	16.81 ± 1.05	1.777	0.080*
Total Household size	#	7.08 ± 0.56	6.29 ± 0.36	6.52 ± 0.30	1.180	0.242
Adult Equivalent Units	#	5.18 ± 0.41	4.59 ± 0.26	4.77 ± 0.22	1.215	0.229
Dependency ratio	#	145.55 ± 20.38	129.59 ± 14.66	134.47 ± 11.90	0.636	0.527
Parcels of land accessed	#	1.15 ± 0.07	1.08 ± 0.03	1.09 ± 0.03	0.978	0.332
Area of land accessed	Ha	2.88 ± 0.70	1.92 ± 0.29	2.21 ± 0.29	1.275	0.208
Distance to community forest	Km	0.60 ± 0.09	0.86 ± 0.10	0.78 ± 0.07	1.879	0.063*
Distance to motorable road	Km	0.64 ± 0.14	0.50 ± 0.07	0.54 ± 0.06	0.873	0.386
Distance to market	Km	2.37 ± 0.35	2.23 ± 0.19	2.27 ± 0.17	0.354	0.724

Notes: HH = Household; % values have been reported for categorical variables; Mean±Standard error have been reported for continuous variables; * denotes statistical significance at $p < 0.1$; t-values are reported for variables measured on continuous scale while χ2 values are reported for categorical variables.

In both community forests, CLA members participated in a wide range of conservation activities spanning from planning, implementation and monitoring of conservation activities. Participation in CLA meetings was the most reported CLA activity (95%) followed by community tree planting (75%) and forest patrols (55%). Other activities that members participated in were trainings (47.5%) and monitoring harvest of forest products on the days set aside for community access (27.5%). Community tree planting in the study area has been promoted by conservation NGOs, mostly targeting on-farm private tree planting. In the community forests, the CLA members have also been supported to carry out enrichment planting in the degraded parts of the community forests. The tree seedlings are locally sourced from community tree nurseries established by the CLA groups.

Effect of community forestry on household livelihood assets

Our results indicate that CLA member households had a significantly higher average livelihood capital value of 0.60 compared to 0.51 for non-members ($t(13) = 3.004$, $p = .010$) as shown in Table 4. Specifically, CLA member households had significantly higher values of natural, financial and social capitals compared to non-members ($p < .05$).

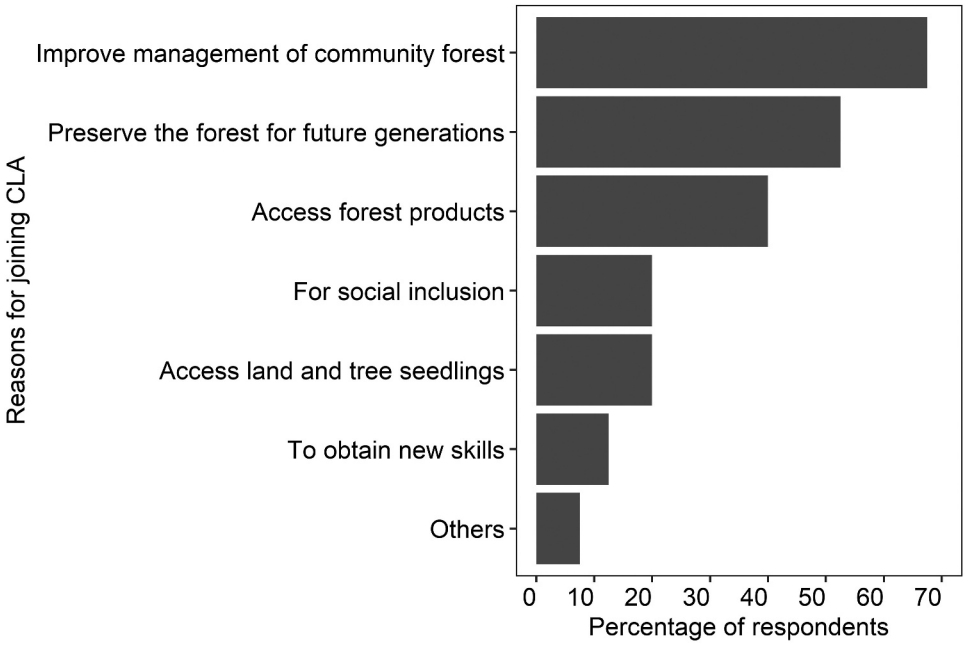

Figure 1. Motivation for joining CLA.

We did not find statistically significant differences in the human and physical capital values.

The differences as indicated in the livelihood asset pentagon (Figure 2) were specifically large for natural capital. This was mostly as a result of increased access to on-farm trees among the CLA members compared to non-members.

Comparison of household income sources

Households in our study area depended on four major income sources: on-farm, off-farm, non-farm and forest environmental income (Table 5). On-farm income was the major household income source for CLA member households and non-members in both relative and absolute terms. It accounted for over 45% of the total household income of both groups. Forest environmental income was the second most important source of income, accounting for 27% and 25% of the total household income of CLA member households and non-members, respectively. On average, CLA member households obtained a slightly higher income from the four livelihood sources, compared to non-members, but these differences were not statistically significant ($p \geq 0.05$).

Household income sources across income quintiles

There were no statistically significant differences in the absolute and relative incomes obtained by CLA member and non-member households in similar income quintiles, across all household income sources (Table 6). However, higher income household generally depended more on on-farm and non-farm income, while those in the lower income groups depended more on

forest environmental income. Among the CLA members, dependence on off-farm income reduced with increasing household income although the differences were not statistically significant ($p > .05$). The trend was not consistent for non-member households.

Forest environmental income: Household dependence on FEI was negatively correlated with total household income for both CLA member households (r = −0.27, $p = .046$) and non-members (r = −0.26, $p = .015$). This pattern is consistent with both the absolute (6.316 and 2.593) and relative (0.756 and 0.365) Kuznets ratios for members and non-members, respectively.

On-farm income: In the study area, dependence on on-farm income was positively correlated with total household income (r = 0.203, $p = .049$). Households in the highest income group (top 20%) obtained significantly higher absolute on-farm income compared to those in the other income quintiles across both CLA-member and non-member households ($p < .05$). However, the relative on-farm incomes were similar among CLA member households and non-members in the same income quintiles.

Off-farm income: Household dependence on off-farm income did not show a clear correlation with total household income for both CLA member households (r = −0.114, $p = .485$) and non-members (r = −0.085, $p = .423$). However, the lower income groups slightly depended more on it, though the differences were not statistically significant ($p \geq 0.05$).

Non-farm income: Among CLA member households, dependence on non-farm income increased with total household income (r = 0.342, $p = .031$). No clear pattern was observed for non-members (r = 0.140, $p = .186$).

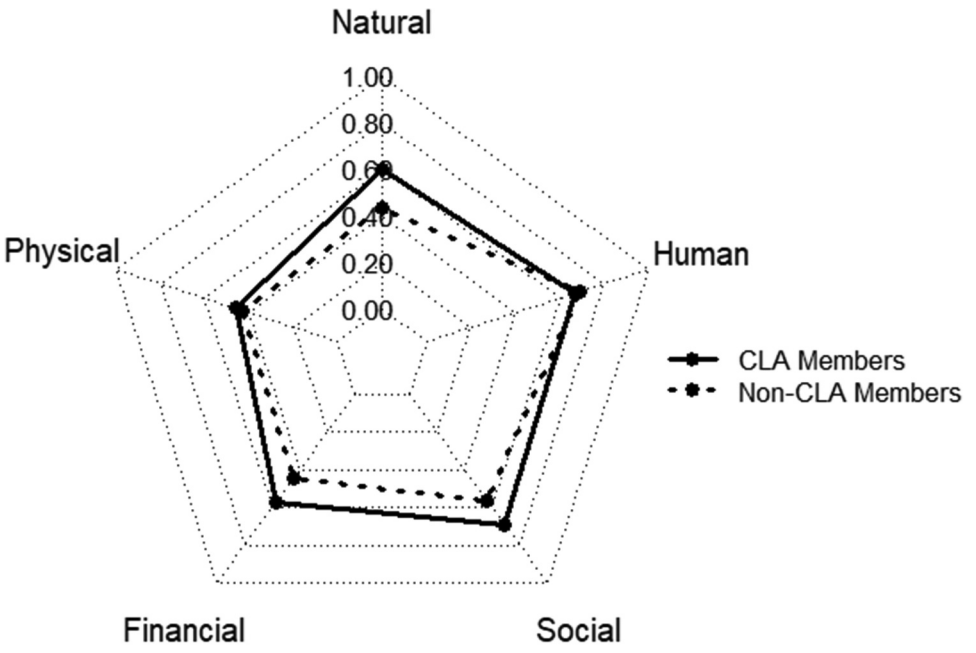

Figure 2. Comparison of livelihood asset pentagons of CLA members and non-members in mid-western Uganda.

Table 4. Comparison of household livelihood capitals among CLA members and non-members.

	CLA members (n = 40)		Non-CLA members (n = 91)			
Livelihood capitals and indicators	Indicator weight	Capital value	Indicator weight	Capital value	t-value	p-value
Natural capital		0.599		0.433	3.769	<0.001***
Access to forest products from community forest	0.975		0.846			
Access to forest products from plantation forest	0.300		0.154			
The household has on-farm trees	0.625		0.297			
Total area of land accessed	0.497		0.437			
Physical capital		0.459		0.433	0.765	0.447
Total value of household durable assets	0.422		0.411			
Nature of main house	0.497		0.455			
Financial capital		0.578		0.449	2.559	0.014**
Access to credit	0.725		0.473			
Total household income	0.430		0.425			
Human capital		0.668		0.691	−0.637	0.526
Dependency ratio	0.781		0.859			
Adult Equivalent units	0.555		0.524			
Social capital		0.694		0.566	3.619	<0.001***
Number of social groups	0.715		0.433			
Leadership position held	0.450		0.209			
Trust in village mates	0.754		0.750			
The village is a good place to live in	0.856		0.873			
Pooled livelihood capital		0.600		0.514	3.004	0.010**

Notes: The asterisks *, ** and *** denote statistical significance at 10%, 5% and 1% levels of significance, respectively.

Table 5. Key income sources of CLA members and non-members.

Income source ('000 UGX)	CLA Members (n = 40)	Non-members (n = 91)	Mean Difference	t-value	p-value
Forest environmental					
Absolute	125 ± 19	92 ± 13	351 ± 318	1.431	0.156
Relative	0.27 ± 0.04	0.25 ± 0.03	0.04 ± 0.02	0.535	0.594
On-farm					
Absolute	366 ± 88	272 ± 55	94 ± 103	0.908	0.367
Relative	0.56 ± 0.04	0.46 ± 0.03	0.47 ± 0.03	0.753	0.454
Off-farm					
Absolute	108 ± 53	97 ± 24	11 ± 58	0.191	0.849
Relative	0.16 ± 0.04	0.18 ± 0.03	0.05 ± 0.05	0.962	0.339
Non-farm					
Absolute	334 ± 287	142 ± 60	192 ± 293	0.6568	0.515
Relative	0.08 ± 0.03	0.10 ± 0.02	0.01 ± 0.04	0.351	0.726

Notes: Mean±standard error values are reported. UGX refers to Ugandan Shillings, local currency. Weighted Average Inter-Bank Foreign Exchange Market Mid-rate for the year 2018 was UGX 3727.79 ≈ US$ 1.0

Effect of community forestry on poverty

Over 70% of the households in our study area lived below the poverty line. Although generally subsistence in nature, forest environmental income reduced the poverty incidence by 12.5% and 5.5% among CLA member households and non-members, respectively. It also reduced both poverty depth and severity among members and non-members, although its effect on CLA member households was slightly higher (Table 7).

Table 6. Comparison of the mean annual total household absolute ('000 UGX) and relative (%) income per AEU by source and income quintile between CLA member households and non-members in mid-western Uganda.

		Forest environmental income			On-farm income			Off-farm income			Non-farm income		
Income quintile		CLA members	Non-CLA members	p-value	CLA members	Non-CLA members	p-value	CLA members	Non-CLA members	p-value	CLA members	Non-CLA members	p-value
Lowest 20%	Absolute	37 ± 16	26 ± 6	0.518	40 ± 15	46 ± 7	0.763	19 ± 19	26 ± 9	0.725	0 ± 0	0.5 ± 0.5	0.329
	Relative	0.38 ± 0.16	0.27 ± 0.06	0.510	0.45 ± 0.16	0.44 ± 0.07	0.965	0.17 ± 0.17	0.22 ± 0.07	0.796	0.0 ± 0.0	0.01 ± 0.01	0.329
20–40%	Absolute	65 ± 18	60 ± 13	0.811	120 ± 21	118 ± 13	0.931	20 ± 19	26 ± 11	0.807	12 ± 12	12 ± 6	0.969
	Relative	0.28 ± 0.07	0.27 ± 0.05	0.842	0.55 ± 0.10	0.56 ± 0.06	0.968	0.11 ± 0.10	0.12 ± 0.05	0.917	0.06 ± 0.06	0.06 ± 003	0.988
40–60%	Absolute	100 ± 19	100 ± 19	0.997	224 ± 36	147 ± 22	0.087	39 ± 24	74 ± 26	0.331	19 ± 12	16 ± 14	0.852
	Relative	0.27 ± 0.06	0.31 ± 0.06	0.626	0.56 ± 0.07	0.44 ± 0.06	0.244	0.13 ± 0.09	0.21 ± 0.07	0.488	0.04 ± 0.03	0.04 ± 0.03	0.990
60–80%	Absolute	175 ± 42	191 ± 37[a,b]	0.787	225 ± 47	272 ± 47	0.495	86 ± 40	90 ± 34	0.936	87 ± 50	30 ± 21	0.306
	Relative	0.30 ± 0.08	0.34 ± 0.06	0.769	0.40 ± 0.08	0.45 ± 0.07	0.636	0.14 ± 0.06	0.15 ± 0.06	0.923	0.15 ± 0.08	0.06 ± 0.04	0.341
Top 20%	Absolute	232 ± 64[a,b]	106 ± 45	0.134	1,309 ± 310 [a,b,c,d]	779 ± 226 [a,b,c,d]	0.190	406 ± 103	270 ± 101[a,b]	0.660	1,744 ± 1,627 [a,b,c,d]	626 ± 264[a,b,c,d]	0.522
	Relative	0.14 ± 0.06	0.10 ± 0.04	0.582	0.54 ± 0.10	0.38 ± 0.07	0.283	0.12 ± 0.07	0.20 ± 0.07	0.449	0.13 ± 0.06	0.31 ± 0.09 [a,b,c,d]	0.123
F		4.23	4.85		15.48	7.87		1.93	4.09		1.33	5.06	
p-value		0.007	0.001		<0.001	<0.001		0.127	0.004		0.279	0.001	
Absolute Kuznets ratio		6.316	2.593										
Relative Kuznets ratio		0.756	0.365										

Notes: The super scripts [a,b,c] and [d] denote statistically significant mean difference with the lowest 20%, 20–40%, 40–60% and 60–80% income groups, respectively, following Bonferroni's pairwise comparison for mean income differences between income groups. UGX 3727.79 ≈ US$ 1.0

Table 7. Effect of community forestry on poverty.

	CLA Members		Non-members		Pooled	
Poverty measure	Estimate	SE	Estimate	SE	Estimate	SE
With Forest Environmental Income						
Poverty incidence	0.725	0.071	0.725	0.047	0.725	0.039
Poverty depth	0.365	0.050	0.423	0.035	0.405	0.029
Poverty severity	0.231	0.042	0.291	0.030	0.272	0.025
Without Forest Environmental Income						
Poverty incidence	0.850	0.057	0.780	0.043	0.802	0.035
Poverty depth	0.499	0.051	0.534	0.037	0.523	0.030
Poverty severity	0.350	0.049	0.406	0.034	0.389	0.028

SE = Standard Error

Discussion

Motivation for joining communal land associations in Ongo and Alimugonza community forests

In our study area, in addition to non-economic motivations such as enhanced local people's sense of belonging, social cohesiveness, and desire to have access to and achieve control over natural resources, up to 40% of the CLA members reported improved access to high-value forest resources as a major motivation for joining. Since both Ongo and Alimugonza community forests had historically been exploited as open-access resources, with no clear regulations on access (Namaalwa et al. 2017), CLA members internalised the opportunity to join the CLAs as a means to participate in regulating resource access. However, the two forests continue to face pressures for extractive uses and currently have low densities of high-value tree species (Mawa et al. 2020). Therefore, while conservation literature underscores the importance of non-economic incentives for sustainability of conservation programs (Ruiz-Mallén et al. 2015), enhancing economic incentives in addition to the non-economic incentives could be more beneficial in our study area where there are limited income-generating livelihood opportunities. Such integration of both economic and non-economic motivational strategies has been shown to be more effective in encouraging and sustaining community support for similar conservation efforts in Indonesia (Nilsson et al. 2016) and Latin America (Ruiz-Mallén et al. 2015).

Effect of participation in community forestry management on household livelihood resources

Natural capital

Participation in CLA has enhanced the members' access to forest resources from the community forests, planted forests and on-farm. Also, CLA members accessed more land for farming, compared to non-members. Being typical rural households, there was a generally high dependence on forest resources for subsistence in the area. While the forest management plans for both forests permit controlled extraction of forest resources from the community forests for all forest-adjacent resident households, the low access reported by non-CLA members could be attributed to their dissatisfaction with the

subsistence nature of the products that they are allowed to extract. This was echoed by a non-CLA member during interviews in the Ongo community:

> This forest [community forest] has historically been used by local residents. It is self-defeating to claim it now belongs to a few people in the community who have been given authority to determine what and how much we [residents] are allowed to extract. They [members] have their tree nurseries in the forest but forbid us from establishing tobacco nurseries at the shores of the stream [in the forest].

Such sentiments, together with the reasons that non-members presented for not joining the CLAs could have influenced their perceived access to resources from the community forests yet such negative attitudes could derail success of such community-based forest management approaches. In their study on barriers to collaborative forest management in Ghana, Akamani et al. (2015) pointed out perceived unfairness in the selection or determination of membership as a key barrier to the success of the approach. It is therefore important that efforts are made to breed positive attitudes among all the forest-fringe community members who access the community forests.

The main forest products that were extracted from the two community forests were poles, firewood, forest foods and herbs. These forest products were mostly extracted for subsistence and thus, minimally contributed to the household cash income. Both CLAs do not permit timber and charcoal extraction by non-members. However, a few non-members illegally accessed the forests for timber (Figure 3), corroborating recent reports of challenges that CLA members face with excluding outsiders who work with non-members in the villages to flout resource access rules and engage in illegal activities (Mawa et al. 2020).

Recent studies in other eastern African countries such as Ethiopia (Tadesse et al. 2017), Kenya (Matiku et al. 2013) and Tanzania (Persha and Meshack 2016) have reported similar increased access to subsistence product harvesting from community or jointly managed

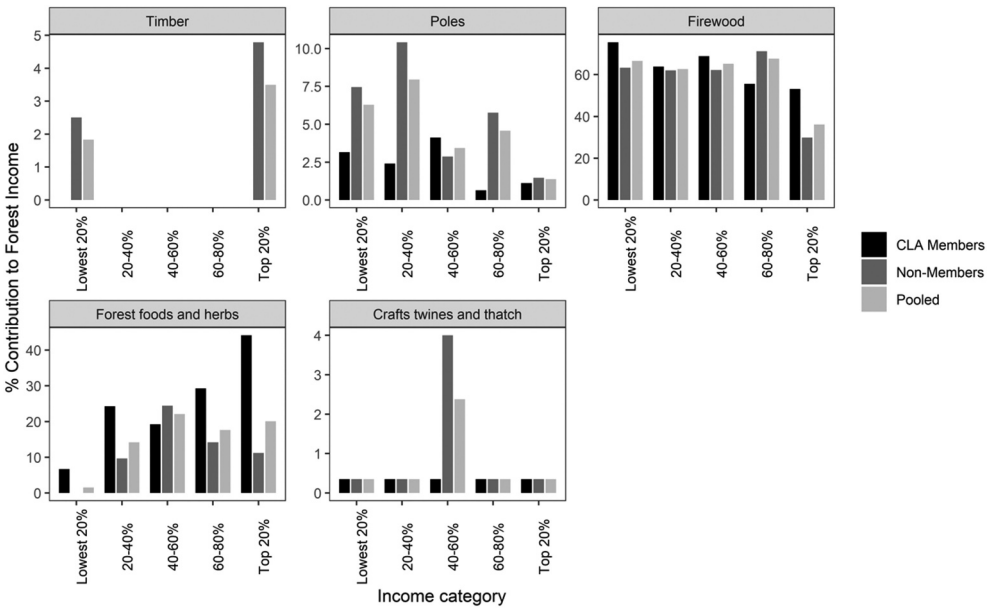

Figure 3. Main sources of forest environmental income from community forests in mid-western Uganda.

forests by participating households. In addition to the subsistence resources that are extracted from the community forests, Non-Governmental Organizations such as Environmental Conservation Trust (ECOTRUST) and more recently, the Jane-Goodall Institute (JGI) have also been promoting tree planting on private land among communities surrounding both Ongo and Alimugonza (Namaalwa et al. 2017; Mawa et al. 2020). Although the trees had not reached merchantable sizes at the time of data collection (2018), the farmers used their prunings and thinnings as firewood and construction poles. These tree planting initiatives mostly target already existing conservation groups, ultimately placing the CLA members at an advantage.

Additionally, CLA members had more access to land for farming compared to non-members. Access to land is critical, and arguably the most important natural capital of rural agrarian communities (Tumusiime et al. 2011). Therefore, this is an important outcome for rural households where farming is the dominant livelihood activity. CLA members access land through the networks created by the CLA, allowing them to be able to rent in or hire land for a specified period from other members. Our findings corroborate those of similar studies in other countries that have also associated community-based forest management initiatives with increased land holdings among members (e.g. Ekanayake et al. 2020).

Physical capital

There were no discernible effects of participation in community forest management on the value of durable household assets and housing conditions. Physical capital investments typically require large one-off payments, which the households in our study area had not attained. Recent literature on the effects of participation in community-based forest management on physical capital has documented mixed results. For example, similar to our case, no significant improvements in household physical capital were reported in the Philippines (Hashiguchi et al. 2016) and Ethiopia (Tadesse et al. 2017) while significant positive improvements were reported in Sri Lanka (Ekanayake et al. 2020) and Bangladesh (Nath and Inoue 2010). In order for the generally low-income households in our study area to invest in meaningful durable household assets, they need to be supported to access conditional credit that can be repaid over an extended period; otherwise, their immediate daily subsistence needs will likely take precedence.

Financial capital

Participation in community forest management significantly enhanced household financial capital. This was particularly noticeable in terms of access to credit that over 70% of the CLA member households enjoyed compared to only 47% of the non-members. Both Ongo and Alimugonza CLAs have encouraged their members to join Village Savings and Loan Associations (VSLAs) and Savings and Credit Cooperative Organizations (SACCOs) in the area to save money and ease access to credit and loans. However, amounts that members access are generally dismal and can hardly be used to make meaningful investments to increase household income. It is therefore important to empower the members with skills and knowledge in financial management and investment to enable them to invest in productive non-farm businesses and intensive commercial agricultural enterprises. Farming was the most important source of income in the area, constituting 56% and 46% of the total household incomes of CLA member households and non-members, respectively. Other income sources were forest environmental, off-farm labour and small-scale

businesses. However, the actual amounts that households generated from the different income sources were not different among CLA members and non-members ($p \geq 0.05$).

For both CLA member households and non-members, those in lower income groups depended more on forest environmental income. Thus, regardless of membership in CLA, there was a higher dependence on forest environmental income by lower-income households, notwithstanding the higher absolute values that the higher-incomes obtain from forest resources (Vedeld et al. 2007; Angelsen et al. 2014). The insignificant differences in total household incomes between CLA member households and non-members in similar income quintiles corroborate findings of Jagger et al. (2018) who did not find significant improvements in incomes of households that were engaged in collaborative resource access arrangements in Uganda's Rwenzori Mountains National Park.

Human capital

There were no significant differences in human capital value between CLA member households and non-members. However, various conservation and development NGOs have trained the CLA members in tree nursery establishment and management, tree planting, improved agronomic practices, apiary and payment for environmental services (Namaalwa et al. 2017) that 47.5% of the members had attended.

Social capital

CLA member households had a significantly higher social capital value compared to non-members. This was especially evident in terms of the number of social groups that they belonged to and the proportion that held leadership positions in the villages (Table 4). Membership in CLA and subsequent participation in group activities serves to increase social interactions, knowledge sharing and collective decision-making. The Forest Sector Support Department (FSSD) in collaboration with the District Forest Service and most NGOs that work in the area take advantage of already existing groups to promote their development programs. Being registered and recognised entities, the CLAs have an advantage over other local groups. Similar findings of higher social capital value among members of conservation groups compared to non-members have been reported in other studies (e.g. Chen et al. 2013; Tadesse et al. 2017). The high level of social capital that has resulted from CLA membership is desirable since social capital generally has a positive association with the success of community-based conservation initiatives with limited perverse impacts (McDougall and Banjade 2015). Both CLA member households and non-members in our study area generally held high levels of trust in their fellow village mates and considered their villages to be good places to live in.

Effect of community forestry on household poverty

Our study households were generally income-poor, with over 70% living below the poverty line (Table 7). Although the community forest resources are mostly extracted for subsistence, the income derived played an important role in reducing the poverty incidence, gap and severity. Therefore, while it may not be sufficient to alleviate rural poverty, the community forest resources in our study area provide necessities that could prevent households from sinking deeper into poverty. The poverty-reducing effect of FEI was more important for CLA member households. Our findings fit within the global literature that

underscores the poverty-reducing role of FEI (Angelsen et al. 2014). Previous studies conducted in other parts of Uganda also ingeminate the importance of income from environmental resources in reducing household poverty. For example, Nakakaawa et al. (2015) and Tumusiime et al. (2011) reported 16.3% and 13% rise in poverty incidence in communities bordering Mt. Elgon and Bwindi impenetrable parks, respectively, if income from environmental resources is excluded.

Conclusion and policy implications

After nearly 20 years of recognition and promotion of community forestry in Uganda's policy and legal frameworks, some positive livelihood impacts are discernible on the ground. The promotion of community forestry has resulted in improvements in access to natural, social and financial capital among participating households. Lower income households among both members and non-members were more dependent on forest environmental income, although those in the higher income groups obtained higher absolute forest environmental income. Forest environmental resources, although largely sourced for subsistence, had important poverty-reducing effects, especially among CLA member households. However, many of the benefits derived by CLA member households are not directly linked to the CFs. Rather, it is the existence of a collective formal and structured entity that brings benefits to its members, almost independently of the purpose of the CLA. It is unclear if the benefits would be similar if the association was concerned with the intensification of agriculture, perennial crop farming, trade or any other activity that requires a minimum of collective organization.

In order to meaningfully contribute to total household income, conservation and development partners should enhance the on-farm and non-farm incomes of CLA members by enhancing access to alternative income generating activities, affordable improved agricultural input, credit and forming cooperatives to benefit from economies of scale. Since our findings suggest the important role that formal, organized collective entities play in enhancing livelihood benefits, future studies should attempt to make equivalent diagnosis in a collective entity oriented towards another objective to understand the share of benefits derived from the existence of a well-organised collective entity and the share from better use of community forests under CLA. In addition, further studies on the meso- and macro-level outcomes of community forestry in the area should be conducted to complement the micro-level effects that this study has reported.

Acknowledgements

Financial support was provided by the Norwegian Program for Capacity Development in Higher Education and Research for Development through the project "Building Capacity for REDD+ for Improved Ecosystem Health and Sustainable Livelihoods in Eastern Africa (UGA-13/0019)". We thank our research assistants, staff at Budongo Conservation Field Station, Masindi District Forest Service, Makerere University Biological Field Station (MUBFS), and our respondents for the immense support rendered during the course of this research. We are grateful to the editor and the two anonymous reviewers for their insightful comments and suggestions on earlier versions of the paper.

Disclosure statement

The authors declare no conflict of interest.

Funding

This work was supported by the Norwegian Agency for Development Cooperation (NORAD) [UGA-13/0019].

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