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Exploring Farmers' Engagement in Tree Planting and Management in Deforested Areas in Cameroon's Western Highlands

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Abstract

The paper explores the motivations, challenges, negotiating strategies and barriers of communities' participation and engagement in tree planting and management in deforested area in Cameroon's Western Highlands. We interviewed 120 respondents, including 92 participating farmers, 21 non-participating farmers and 7 field-based staff. We used the interview responses of the farmers as constitutive items to develop dimensions and scales of motivations, challenges and barriers to ecosystem restoration volunteering. The principal components analysis with oblique (Direct oblimin) rotation together with the scree plot and eigen values (total variance explained) was used to reduce the number of items in each dimension. The Cronbach reliability statistics was used to test the reliability constitutive items in each dimension. The linear regression analysis was used to examine how the different dimensions of motivations, challenges and barriers influence community ecosystem restoration stewardship volunteering. Community volunteering were initially driven by environmental factors only when personal economic and less so community benefits were met. Social dimension items were least perceived and were non-significant predictors of the community ecosystem restoration stewardship. Retaining and committing the restoration stewards to tree planting were mainly limited by management, financial, psychological and geographical location challenges. Non-participation and -involvement of some farmers was driven by economic, information, psychological and personal barriers. Negotiating strategies and recommendations are proposed to overcome the identified challenges and barriers. The local knowledge on ecosystem restoration stewardship motivations, challenges, barriers and negotiation strategies will inform policy and practice and improve on the success and sustainability of community-led ecosystem restoration initiatives in Cameroon and in other Central African countries.

Keywords: ecosystem restoration motivations; ecosystem restoration challenges; ecosystem restoration barriers; negotiation strategies; ecosystem restoration volunteering; sustainable land management

Introduction, scope and main objectives

Smallholders' cultivation intensions of arable crops has shifted from farming to meet household subsistence needs and food security to farming for profit to improve and sustain household income and economic resilience (Ewane and Lee 2020; Ewane 2021; Ewane et al. 2021). As such, agricultural and settlement land expansion are the main direct causes of deforestation and land use land cover change in Cameroon's Western Highlands (Ewane 2021; Ewane et al. 2021). As a response to the increasing deforestation in tropical rainforest-rich developing countries, substantial governmental and international NGO investments are being made in reforestation to restore ecosystem functions and services, and improve the resilience of local livelihoods (Le et al. 2014). Addressing global environmental issues is limited by financial, time, and labour constraints (Cabin et al. 2010; Geist and Galatowitsch 1999). Thus, achieving ecosystem restoration and conservation goals increasingly depend on community volunteer participation and commitment (Asah and Blahna 2012). Therefore, smallholder farmers form important stakeholders in ecosystem restoration initiatives involving tree planting and management in different landscapes and regions in developing countries (Valencia-Mestre et al. 2020). Because deforestation is largely explained by smallholder famers' shift from subsistence to extensive commercial crop production, these famers are better placed to lead reforestation efforts, since efforts that do not directly engage them are less likely to succeed. This because when

people volunteer in ecosystem restoration and conservation projects, they reduce the funding costs and increase the commitment to achieve the conservation needs associated with such projects (Asah and Blahna, 2012).

Farmers' decision to effectively and sustainably engage in tree planting in their farmlands is influenced by several factors (Meijer et al. 2015; Le et al. 2014), both intrinsic and extrinsic motivations (Bernnett et al., 2018). Studies have demonstrated that environmental factors are the most important motivator of voluntary pro-environmental behaviors (Bruyere and Rappe 2007; Bramston et al. 2011). Yet, personal social, community interaction and ego defense and enhancement factors have also been reported to have more direct influence on people's participation and commitment to urban conservation projects than environmental factors (Asah and Blahna 2012; Asah and Blahna 2013; Asah et al. 2014). Therefore, the salient factors influencing conservation volunteering success or failure are country- and place -specific.

Communities' ecosystem restoration and conservation volunteering participation, involvement, commitment and retention has been underwhelming and unsustainable in Cameroon. This is evident by the non-attainment (<30% per year) of annual tree planting targets and the annual targeted number of farmers to participate and engage in the ecosystem restoration and conservation projects in Cameroon's Western Highlands. However, the factors that motivates farmers to voluntarily participate in ecosystem restoration and conservation projects have received little or no research interest in Cameroon. Participation does not only depend on motivations; participants sometimes face challenges and non-participants face barriers that must be negotiated and overcome to increase participation. The study aimed to understand the motivations, challenges and barriers to farmers' voluntary participation in the ecosystem restoration initiative. In addition, we aimed to explore the negotiating strategies project staff use in overcoming challenges and barriers, and the recommendations to increase volunteer participation, involvement and commitment in the ecosystem restoration initiative.

Methodology

1-Study area

The study area is a project area of 350km^2 in the Mount Bamboutos landscape, located between longitude 9°57'5" E to 10°10'50" E and latitudes 5°31'50" N to 5°47'50" N of the Greenwich Meridian. The Mount Bamboutos landscape stretches across four divisions, eight sub-divisions, and over 20 villages located in the West, Northwest and Southwest regions of Cameroon (Figure 1). The divisions within the study area consists of Lebialem division (specifically Bamumbu, Fossimundi and M'muockmbie Chiefdoms) in of the Southwest region; Mezam division (Pinyin, Buchi and Menka Fondoms) in the Northwest region; and Bamboutos and Manoua divisions (Bangang, Babadjou and Bafou Chiefdoms) in the West region of Cameroon (Figure 1). The Mount Bamboutos ecosystem (highest elevation of 2740m) is located within Cameroon's Western Highlands, and is the third highest peak in West Africa, after Mount Cameroon (4,095m) and Mount Oku (3,100m). It is the main watershed giving rise to several major rivers in Cameroon and is endowed with fertile volcanic soils (though degrading evident by extensive use of chemical fertilizers) and favourable climate. The study area has an estimated population of about 20,000 to 30,000 people in 2018 based on a baseline field survey data. The local populations are mainly engaged in subsistence agriculture, including large and small-scale livestock rearing on the hill slopes to sustain household food security and income and economic resilience (Ewane et al. 2021). The ecosystem restoration activities include mainly tree planting and management in farmlands, riparian forest, water catchments and community land reserves and participatory local land use planning and zoning.

2-Sampling participants

The sampling participants were drawn from the nine Chiefdoms/Fondoms, including the Mbororo pastoral community of the project area. In order to understand volunteer motivations and challenges, we targeted farmers who have been participating in the ecosystem restoration activities since 2018. This group of participants also included members of the village forest management communities (VFMCs), representatives of traditional rulers,

"quarter heads" and nursery technicians, who double as farmers, leading nursery management and tree planting activities in the village communities. In order to understand volunteer barriers, we also targeted non-participating or less frequently participating farmers in the ecosystem restoration initiative. Staff of the local partners and the main implementing NGO, who have been coordinating, supervising and implementing the ecosystem restoration activities in the village communities were also targeted to understand motivations, challenges, barriers to participation, and negotiation strategies and recommendations to increase participation.

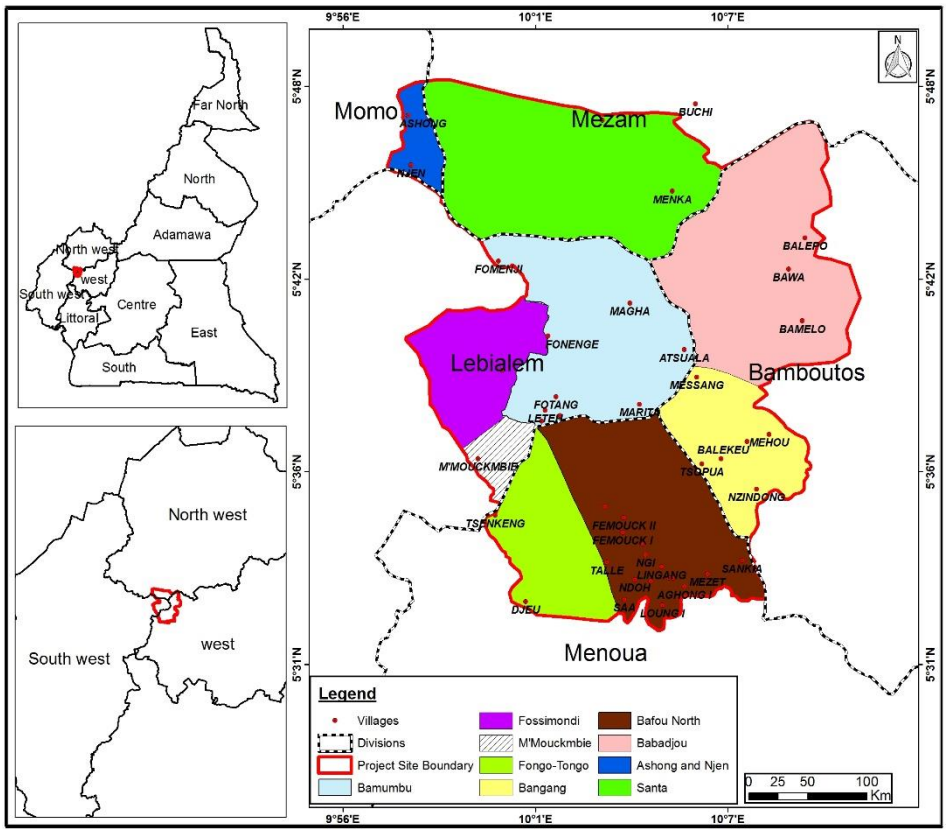

Fig. 1: Location of the study area and sample villages in the Mount Bamboutos landscape in Cameroon.

3-Sampling technique/Interviews

The sampling technique followed an interview survey of 120 respondents, including 92 participating farmers, 21 non-participating farmers and 7 field-based staff from June to September 2021, which falls within the active tree planting season. The participants were introduced to the that people volunteer in part because it performs certain beneficial functions, but without exposing the contents of previous motivation scales, following the functional approach to motivation (Asah and Blahna 2012). The farmers participated in short interview questions lasting 3 to 5 minutes focusing on motivations, challenges, barriers and recommendations. The project staff and nursery technicians completed semi-structured open-ended questionnaire, followed by phone conversations that lasted about 10-15 minutes to obtain more insights and perspectives on farmers' motivations, challenges, barriers, negotiation strategies and recommendations. Open-ended questions and interviews enable respondents to express their opinions and experiences in their own words and from their own frames of reference (Bengston et al. 2011). This primary instrumentation approach ensures that responses are culturally-inclined, place-specific and based on local realities, as opposed to using preexisting researcher-determined secondary instrumentation and closed-ended questions (Asah and Blahna, 2012).

4-Data analysis

We used the interview responses of the farmers as constitutive items to develop dimensions and scales of motivations, challenges and barriers to ecosystem restoration volunteering. As a data reduction method, principal components analysis (PCA) extraction method, oblique (Direct oblimin) rotation, the scree test and eigen values (≥1) were used to reduce the number of constitutive items to be retained in each dimension and uncover the most important constitutive items explaining each dimension of motivations, challenges and barriers. We used the PCA with oblique (Direct oblimin) rotation because the methods allow the factors to correlate (Costello and Osborne, 2005). The Cronbach reliability statistics (values ≥0.60) was used to test the reliability of the constitutive items in each dimension. Since the data collection involved farmers living within the same cultural and geographical environment, we generally expected constitutive items and their dimensions to have some correlation. The linear regression analysis was used to examine the relationship between different dimensions of motivations, challenges and barriers and their influence on community ecosystem restoration volunteering participation, involvement, commitment and retention.

Results

1-Ecosystem restoration volunteering participation and involvement

The PCA revealed that community ecosystem restoration volunteering were driven by 4 dimensions of motivations (environmental, economic, community and social). Protecting the environmental, particularly restoring watersheds and mitigating climate change were initial motivators of ecosystem restoration volunteering participation. However, sustaining volunteer involvement, commitment and retention was motivated by personal economic and community benefits, and least motivated by social drives (Table 1). Committing and retaining ecosystem restoration volunteers were mainly limited by management, financial, psychological and geographical location challenges (Table 2). The non-participation and -involvement of some farmers in the ecosystem restoration volunteering was driven by economic, information, psychological and personal barriers (Table 3).

Table 1: Principal component analysis results showing constitutive items and respective means, standard deviations, and Cronbach alpha values of the dimensions of volunteers' motivations (*N* = 99).

Dimensions of motivations and constitutive items	**Mean**	**Standard deviation**	**Cronbach alpha (α)**
Environment	29.8	28.89	0.75
To help protect the environment; regulate climate change			
To protect watersheds and improve on the flow of water for agriculture and domestic uses			
To restore our forest and wildlife habitats, especially with disappearing tree species such as *Prunus africana*			
Economic	11.80	12.24	0.83
To benefit from the daily financial incentives to sustain my livelihood (feeding, transport and subsistence)			
To earn money in the future from the harvesting of *Prunus africana* bark, kola nuts and avocado			
Community	9.40	10.49	0.62
To give to the future generation, our children trees that are almost disappearing in the village			
To help serve our village people in the future; "God can not lie to us"			
Social	8.80	10.16	0.22
To have medicinal trees such as *Prunus africana* and *Voacanga* to help treat people of diseases			

Some negotiating strategies used by the restoration staff included involving traditional rulers, "quarter heads", members of VFMC to gain top leadership support, sensitization and education workshop to explain the importance of tree planting, involving farmers in the selection of the priority tree species to be planted, providing daily financial incentives to planters to support food, transport and subsistence, among others. Recommendations included providing more financial incentives for participation in the ecosystem restoration activities, increased and continuous sensitization and education activities, developing tree planting schedule for the entire season, create and train a network of tree management groups in each village, provide farmers with the needed tree planting tools/materials, locate nurseries closer to tree planting sites, regular follow-up visits to project sites by the implementing organization, amongst others.

Table 2: Principal component analysis results showing constitutive items and respective means, standard deviations, and Cronbach alpha values of the dimensions of volunteers' challenges (N = 99).

Dimensions of challenges and constitutive items	**Mean**	**Standard deviation**	**Cronbach alpha (α)**
Management	51.50	48.95	0.89
Lack of tree planting tools/materials such as spades, diggers, cutlasses, rain boots, rain coats, etc.; "we sometimes dug soil with our bare hands"			
Lack of regular follow-up of the nursery management, tree planting and management process by the organization; " we feel abandoned"			
Lack of timely information about tree planting activities; "I hardly get informed about planting activities in good time"			
Late planting of trees in September through October when the dry season is already near/there leading to the dying of trees			
Most trees are destroyed/killed by cattle, competitive vegetation, pesticides spray and/or man-made fires			
Provision of poor quality (bad) seeds and immature seedlings for nursing and planting			
Insufficient provision of preferred fruit trees, especially avocado, which takes short time to mature and provide quicker financial return			
Financial	23.90	28.39	0.874
Insufficient financial incentives for food and transport during potting of seedlings in nurseries and planting of trees			
Misappropriation of nursery management and tree planting financial incentives by field technicians, lead planters and project field staff			
Psychological	14.4	15.98	0.799
I fear that in the future the government will take the community land that we have planted the trees, and will not benefit from my labour			
I fear that lead planters or the implementing organization will seize my farmland if they plant "their" trees in there			
Uprooting of trees planted in water catchments and along village boundaries by disgruntled villagers who oppose the project			
Geographical location	17.30	16.64	0.751
The mountain and steep hill slopes present physical fitness challenges, and make tree planting difficult and tiring			
Long distances between nurseries and planting sites requires that I carry heavy polybags on my back for hours			
Excessive rainfall events poses poor weather conditions during the tree planting raining season			
Knowledge management	7.10	5.71	0.506
The implementing organisations resist our local ideas of increasing tree planting spacing in farmlands			
The implementing organisations refuse our idea of planting two seedlings of raffia in a single hole in water catchments to maximise tree survival			

Table 3: Principal component analysis results showing constitutive items and respective means, standard deviations, and Cronbach alpha values of the dimensions of non-volunteers' barriers (N = 21).

Dimensions of barriers and constitutive items	Mean	Standard deviation	Cronbach alpha (α)
Economic	6.20	6.32	0.780
The daily financial incentive that I hear that the organisation pays is not enough to motivate me to go to the bushes to plant trees for them			
I prefer to plant my market garden crops (potatoes, cabagges, tomatoes, maize, carrots, leeks, etc.) and get quick and plenty of money than occupying my land with trees			
I prefer to go for my farm work (e.g. to spray my potatoes) than planting trees that I am not sure I will benefit from in the future			
Information (asymmetry)	3.40	3.98	0.736
I never have any information on the days the tree planting activities are taking place to participate; I sometimes only hear when it has past			
I sometimes get the information about tree planting very late when I already have other important different things to do			
Psychological	7.20	7.25	0.858
I fear that the organisation or government may seize my land after planting their trees (most farmers don't have legal titles over their land)			
I know that the organisation has eaten the big project money and has only come here to fool us with small finances to show proof that they have executed the project to the "Whiteman" (foreign funders)			
I have bad experiences with previous organisations implementing similar projects here in this village			
I do not want to waste my time and energy to plant trees that may not survive and I may not live to benefit from			
Personal	6.10	5.40	0.686
I am willing to plant trees but I do not have/own a piece of land to plant trees			
I am usually very busy with the many festivities in my locality during my free days; "I don't have time to plant trees"			
I will not have enough land to plant my food crops if I plant trees; "tree planting will deprive me of my agricultural land to feed my family"			

Discussion

1-Ecosystem restoration involvement and commitment

The environment has often been ranked as the most important drive of participation in conservation and environmental volunteering (Bruyere and Rappe 2007; Bramston et al. 2011). However, sustaining the urban conservation volunteering frequency, commitment and retention is motivated by personal and social factors within the Seattle-Tacoma metro area in Washington State, USA (Asah and Blahna 2012; Asah et al. 2013). This suggest that the environment is not a significant predictor of volunteers' duration of involvement in environmental volunteering (Ryan et al. 2001; Asah and Blahna 2012). In Cameroon's Western Highlands, farmers' involvement and participation in the ecosystem restoration volunteering was initially driven by their goals to protect their environment, particularly restoring their degraded watersheds, since water scarcity is acute in the villages, particularly in the dry season. However, the frequency of volunteer involvement and commitment in the ecosystem restoration activities was motivated by personal economic and community benefits. These was mainly constructed as benefiting from the meagre financial incentives provided to planters for participating in daily tree planting activities linked to the poverty and miserable livelihoods of the peasant farmers, and the desire of giving back to the future generation tree species that are fast disappearing.

Management, financial, psychological geographical location challenges were significant predictors of farmers desire to continue volunteering, greatly affecting the project success. Economic, information, personal and psychological barriers significantly hindered farmers' participation and involvement in the ecosystem restoration volunteering (Table 4). Inadequate financial resources is one of the many prevailing challenges to ecosystem restoration and biodiversity conservation initiatives in developing countries, in addition to time and labour constraints (Executive Secretariat of the Convention on Biological Diversity, 2007; Cabin et al., 2010; Geist and Galatowitsch, 1999), education and sensitisation campaign and condition of road infrastructure (Le et al. 2014). The highly degraded earth road conditions and ongoing Anglophone separatist conflict is causing significant constraints to household income and economic resilience, information dissemination following frequent internet and mobile phone network blackouts, and psychological stress to poor rural dwellers in Cameroon's Southwest and Northwest English speaking regions since 2017.

Table 4: Predicting volunteer motivations and challenges and barriers on the frequency of volunteer involvement and commitment or non-participation (N = 120).

Category	**Influence on volunteer involvement and commitment or non-participation**					
Motivations	*r*	R^2	*β*	*Std. error*	*t*	*Sig.*
Environment	0.997	0.994	0.815	0.444	1.834	0.000
Economic	0.995	0.990	0.910	0.541	1.682	0.000
Community	0.984	0.969	1.086	0.638	1.701	0.000
Social	0.023	0.001	6.333	3.245	1.952	0.950
Challenges						
Management	0.998	0.996	7.778	1.312	5.930	0.001
Financial	0.989	0.979	1.926	0.848	2.271	0.000
Psychological	0.953	0.907	1.490	1.104	1.350	0.002
Geographical location	0.899	0.808	1.290	3.397	0.380	0.049
Knowledge management	0.855	0.730	0.709	1.166	0.608	0.010
Barriers						
Economic	0.991	0.981	-0.064	0.210	-0.303	0.000
Information	0.981	0.962	0.134	0.193	0.695	0.000
Psychological	0.981	0.963	-0.118	0.251	-0.472	0.000
Personal	0.992	0.984	-0.299	0.316	-0.944	0.000

Conclusions

In Cameroon's Western Highlands, community volunteering in ecosystem restoration and conservation activities was initially driven by the farmers' desire to protect and restore the environment; however, personal economic and community motives proved to be crucial in sustaining volunteer involvement, commitment and retention. Committing and retaining the ecosystem restoration volunteers was mainly limited by management, financial, psychological and geographical location challenges, which greatly undermined the success of the project. Non-participation and -involvement of some farmers in the ecosystem restoration activities was motivated by economic, information, psychological and personal barriers. Thus, understanding human behavior is crucial to the success and sustainability of ecosystem restoration and conservation initiatives, particularly in Sub-Saharan African countries, where political willingness, management efficiency and effectiveness, economic incentives, and individual factual and action knowledge and interest on ecosystem restoration and conservation are notably limited. These local knowledge from community volunteers is useful to inform policy and practice and improve the success and sustainability of volunteer-dependent community-led ecosystem restoration initiatives in Cameroon.

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