WebLog Journal of Environmental Sciences

Research Article
Published: 24 Oct, 2026

Motivations and Challenges of Sustaining Forest Ecosystem Services Through Community Forest Stewardship in Fako Division Southwest Region Cameroon



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Abstract

The Ecosystem Services (ES) approach promotes the integration of local communities into natural resource management to enhance both livelihood and conservation outcomes. However, despite its importance, Community Forest Stewardship (CFS) which is a vital component of conservation has not been given adequate attention for the past 3 decades. The article is focused on how CFS has helped in sustaining forest ecosystem services through their motivations and challenges that will guide putting in place suitable adaptation plans and policy recommendations to ensure the continuous flow of ES. The study adopted a mixed research design methodology. Relevant data was obtained from 160 respondents selected randomly and also from community stewards within the Etinde and Bakingili Community Forest (CF) through questionnaires, interviews and Focus group discussions. The study made use of the Kruskal Wallis H test and Mann Whitney test to rank the importance of the constitutive items within the 4 categories of ES. The principal component analysis and scree plot were used to categorize constitutive items identified by respondents under different categories of motivations and challenges. and Fisher's test statistics to analyse the 16 capacity indicators. Results show that supporting ecosystem services and regulating ecosystem services were significantly identified (with 113 and 102 mean counts respectively) and constructed than cultural and provisioning ecosystem services (54 and 83 mean count respectively). More so, socio-economic variables - level of education, income range and household size influenced the perception and valuing of provisioning ES, cultural ES and regulating ES. Community forest stewards are more motivated by the community and economic dimensions of motivations although the environment still remain salient. Challenges, capacity and actions of community forest stewardship organisations were identified. As such, there is the need of training, sensitization, and community education on the different categories of Es and how they can be sustainably managed to achieve both conservation and livelihood development objectives of community forestry.

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Received Date: *07 Oct 2026*

Accepted Date: *22 Oct 2026*

Published Date: *24 Oct 2026*

Citation:

Patience UA, Atembehnkeng FK, Yengeh MJC. Motivations and Challenges of Sustaining Forest Ecosystem Services Through Community Forest Stewardship in Fako Division Southwest Region Cameroon. WebLog J Environ Sci. wjets.2026. j2402. https://doi.org/10.5281/zenodo.23878933

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Introduction

Tropical rainforest ecosystems are blessed with diverse and endemic natural resources that provide various ecosystem services of importance to human well-being. These forest ecosystem services include provisioning, regulating, cultural and supporting service categories that are benefits people obtain directly or indirectly [1]. However, deforestation and forest degradation has been prevailing at alarming rates within the tropical rainforest ecosystems of Africa from 2010-2020 mainly due to agricultural expansion of food and cash crops [2]. The increasing loss of forest is causing significant alterations in the provision of ecosystem services thereby affecting the resilience and sustainability of social ecological systems [3, 4].

Globally, forests cover approximately 31% of the Earth's land surface, about 4 billion hectares and rank among the most productive terrestrial ecosystems. They support the livelihoods of nearly 1.6 billion people who depend on them for timber, food, fuel, employment, and shelter [5, 6]. Furthermore, about 75% of the rural poor rely directly on forest resources [7]. Historically, most forest resources have remained under public ownership, with roughly 76% controlled by governments [5, 6]. However, recent decades have seen increasing policy shifts toward decentralised governance and community-based forest management, whereby governments devolve resource management authority to local communities through the establishment of community forests [8, 9].

In Cameroon, community forestry emerged following the 1994 Forestry Law, which defines a community forest as part of the non-permanent forest estate not exceeding 5,000 hectares and

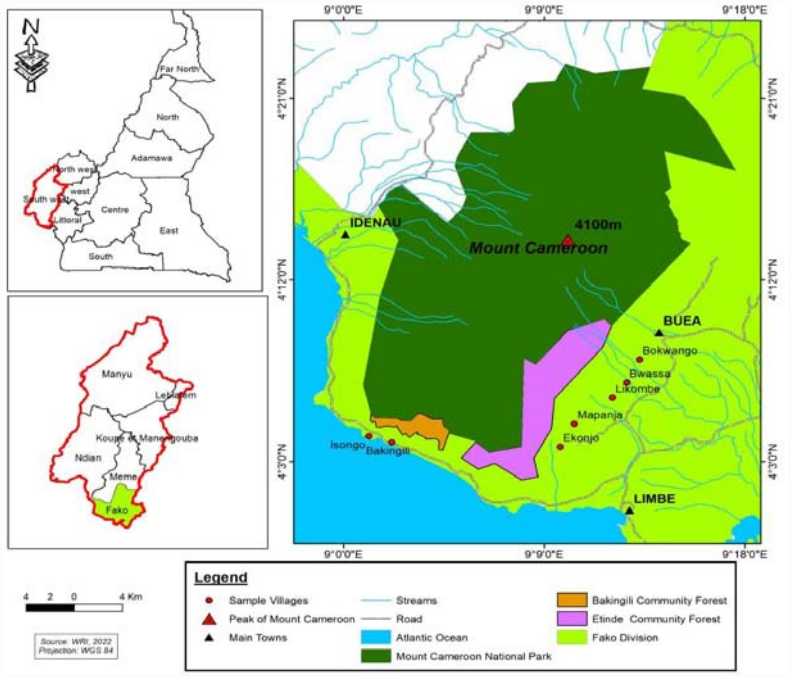


Figure 1: Location of the study area (Bakingili and Etinde community forests).

managed under an agreement between village communities and the forestry administration (Article 3(11), Decree No. 95/531/PM of 23 August 1995). These forests are managed by local communities with technical support from state authorities. Currently, approximately 300 community forests covering about 990,000 hectares have been allocated nationwide, with more than 200 additional applications pending (about 600,000 hectares). This governance framework has increased community participation in forest conservation, albeit with varying levels of motivation, institutional capacity, and effectiveness.

Local communities contribute to forest conservation through organised stewardship initiatives. Environmental stewardship broadly refers to actions undertaken by individuals, groups, or networks to protect, care for, or responsibly use environmental resources in pursuit of social and ecological outcomes across diverse socio-ecological contexts [10]. Community stewardship represents a localized expression of this broader concept and plays a critical role in sustaining ecosystem services at the landscape level. Motivation is central to stewardship behaviour and encompasses both intrinsic drivers and extrinsic incentives that influence actions aimed at fulfilling needs, goals, and aspirations [10, 11].

Understanding context-specific motivations, capacities, and challenges faced by local conservation actors is essential for strengthening governance interventions and ensuring sustainable ecosystem service provision [10, 12]. However, empirical assessments of how these factors influence the sustainability of forest ecosystem services remain limited in the Fako Division of Cameroon. It is in the light of this that the study seeks to: investigate local knowledge of different forest ecosystem services offered by the community forest, examine the motivations of continual engagement of community forest stewardship organisations to sustain forest ecosystem services despite existing challenges and assess the capacity and actions of community forest management organisations in sustaining ecosystem services.

Materials and Methods

Study area

Cameroon is a key member state of Central Africa and is a major stakeholder in the advancement of the sustainable management of the rainforest-rich Congo Basin. Fako Division is located between Latitude $40^0$28'30" and $40^0$54'26" North of the equator and longitude $80^0$57'10" and $90^0$30'49" East of the Greenwich Meridian. Administratively, Fako Division is bounded to the West by the Atlantic Ocean, to the East by Meme Division, to the North by Ndian Division and to the South by the Wouri division (Figure 1).

The two CFs considered in this study are, the Bakingili community forest (BCF), and Etinde Community Forest (ECF), located in the West Coast and Buea sub-Divisions, respectively within Fako Division in the Southwest region of Cameroon. The Etinde community forest cuts across both the Buea sub-division and the West coast sub-division. The study covered the following villages: Mapaja, Bawassa, Bokwango, Likoko- Mimbia, and Likombe in the southeast and northern cluster in Buea sub-division and the two villages of Bakingili and Isongo within the Bakingili CF in the West Coast sub-division (Figure 1).

Both community forests were created in 2001 to buffer the Mount Cameroon National Park by providing conservation and livelihood development opportunities to designated local communities. They operate under an approved Simple and Management Plan (SMP) since 2002. Both community forests were chosen because of their relative accessibility to urban areas and their conservation and development importance as buffer zones of the Mount Cameroon national park.

Data collection

Relevant data for the study was obtained from both primary and secondary sources. Primary data was obtained through the administration of questionnaires, interviews and focus group discussions. A total of 160 local people in seven villages were asked

about their awareness and knowledge of the different forest ecosystem services, using structured closed-ended questionnaire in a simple random sampling technique to understand local perceptions of forest ecosystem services.

The semi-structured open-ended questionnaire used in this study contained questions on motivations, challenges, capacity and actions of the local community forest management organisations over the past 20 years. Individual members of the Bakingili (9 members) and Etinde (10 members) community forest management organisations were asked about their stewardship motivations, challenges, capacity and actions so far in maintaining the sustainable provision of forest ecosystem services over the past 20 years using semi-structured open-ended questions in a purposeful sampling technique.

Four key members of the Bakingili and five from Etinde community forest management organisations participated in two separate focus group interview sessions to harmonise and reach a consensus on individual opinions about their local organisation's stewardship motivations, challenges, capacity and actions in maintaining the sustainable provision of forest ecosystem services over the past 20 years. The participants in the focus groups were selected by the community forest management officers based on their duration in office, experience, availability, accessibility and involvement in conservation activities.

Secondary data was obtained from community forest reports, journal articles, past projects and the google search engine.

Analysis of the benefits of ecosystem services

The benefits identified by the members of the community forest management organizations and the local population as ecosystem services were analyzed and presented as a framework for community knowledge and identification of ecosystem services in community conservation stewardship in the form of a table. This will help inform policy makers on conservation and environmental sustainability. It will also help inform them on how local communities view and identify the benefits they get from community forest as ecosystem services and how the ecosystem services can be sustainably managed to increase community forest contributions to joint conservation and development in Cameroon.

Statistical analysis

Data on local awareness and knowledge of the different forest ES were analysed using the Kruskal Wallis H-test (2 samples) to obtain mean ranks of the most used important and valued forest ecosystem services. Also, the K related sample test (test for several related samples by Friedman and Kendall's W) was used to give the ranks of the different elements/items of each category of ES (provisioning, cultural, regulating and supporting). The reliability test of each dimension items or factors was examined using the Cronbach reliability test statistics in a scale dimension of 0.60 and above to be reliable. A linear regression analysis was performed to confirm the predictive importance of the items or factors in each motivation and challenge dimension based on their R2 and significance values level. All the above statistics were completed using SPSS version 20.0 and trial version of XLSTAT.

The influence of the local population's socio-economic characteristics on the perceptions of forest ecosystem services was analysed using Fisher's test statistics. Stewardship motivations and challenges data were sorted into different dimensions and analysed using the Principal Component Analysis (PCA) statistical test with oblique (direct oblimin) rotation. The eigen values (≥1), commonalities and the leveling point of the scree plots (scree test) of the PCA were used to identify the most important motivations and challenges based on their significant values.

Data on the different dimensions and attributes of local conservation stewardship capacity were analysed using the Fisher's test statistics on the expected "YESES" and observed "YESES" and "NOS".

Results

Local knowledge and perceptions of forest ecosystem services

To investigate local knowledge of forest Ecosystem Services (ES) provided by the community forests, respondents were asked to identify and describe the benefits derived from the forests in Bakingili and Etinde. The findings reveal variation in both the breadth and type of services recognised across the two sites.

In the Bakingili community forest, seven ecosystem service items were identified across three categories - provisioning, regulating, and cultural services - whereas in the Etinde community forest, eleven items were identified across provisioning, regulating, and supporting services. No supporting services were reported in Bakingili, and no cultural services were identified in Etinde. Community forest managers in Bakingili recognised three provisioning items, one cultural item, and three regulating services. In contrast, respondents in Etinde identified five provisioning services, five regulating services, and one supporting service. These identifications were based on the experiential understanding of community forest managers rather than formal exposure to the detailed ecosystem service classification framework proposed by [1]. This indicates that local ecological knowledge shapes service recognition through lived interaction with forest resources rather than theoretical categorisation.

Provisioning services recognised in Bakingili centred on subsistence and income-related uses, including timber extraction for housing and furniture, harvesting bark of *Prunus africana* for medicinal and commercial purposes, and collection of Non-Timber Forest Products (NTFPs) such as gongo leaves, bush pepper, and njansang. Cultural services were limited to the role of the forest in attracting visitors and researchers. Regulating services were perceived in relation to local climate conditions, including temperature moderation and rainfall patterns. In Etinde, provisioning services were more diversified and included timber and fuelwood extraction, harvesting of medicinal plants and wild foods, employment opportunities, income from *Prunus africana*, and trade in kola products. Regulating services were associated with climate regulation, water resource protection, air quality, rainfall maintenance, and carbon storage. The only supporting service identified related to soil stabilisation and erosion control (Table 1).

Valuation of Constitutive Ecosystem Service Items

Beyond identification, respondents evaluated the importance of specific service components. The most valued provisioning services included; food, fuelwood, medicinal plants, and handicraft materials (Figure 2). This highlights the strong livelihood dependence on forest resources, reinforcing the role of community forests as socio-economic safety nets.

For cultural services, valued components included cultural identity, traditional knowledge transmission, aesthetic appreciation,

Table 1: Identified ecosystem services by the community stewards in both Bakingili and Etinde community forests.

Bakingili CF	
Category	**Description of items**
Provisioning ES	-We exploit timber for the construction of our houses and furniture
	- Harvesting the bark of *Prunus africana* for sale and for medicinal purposes
	-We harvest NTFPs such as “Gongo leaves’, “Bush pepper” and “Njansang”
Cultural ES	-The community forest exposes our village to visitors and researchers.
Regulating ES	-Climate moderation as it sued to be when the CDC controlled much of the land
	-It brings about more rainfall
	-Moderation of the temperature of our community
Supporting ES	None was identified
Etinde CF	
Provisioning ES	-Exploitation of timber products such as timber, firewood, honey, leaves, and medicinal plants.
	-Harvesting of non-timber products like vegetables. flowers, bush pepper, bush meat, bush mango
	-Provision of temporary employment for household income.
	-Money gotten from *Prunus africana* exploitation only.
	-Bitter kola and red kola harvesting for sale and home consumption.
Cultural ES	None was identified
Regulating ES	Regulation of climate change
	-Water sources are intact.
	-It provides fresh air to our community.
	-It helps us to have good cold temperatures and abundant rainfall.
	-It serves as a good source of carbon storage.
Supporting ES	-It holds the soil in place thereby preventing soil erosion.

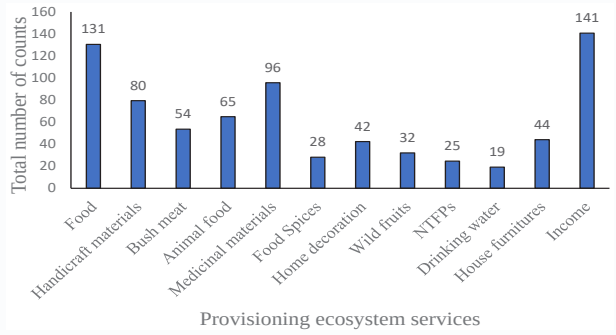


Figure 2: Total number of counts for identified provisioning ecosystem services.

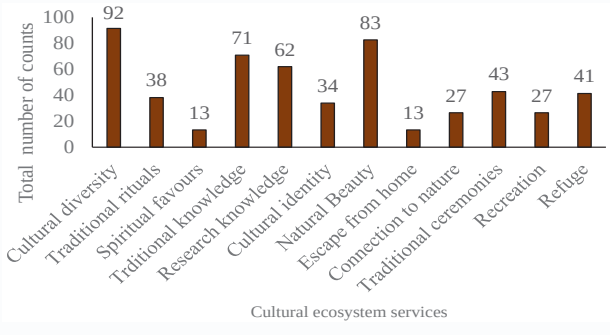


Figure 3: Total number of counts for identified cultural ecosystem service.

and educational activities (Figure 3). Although cultural services were less frequently identified in Etinde, their importance where recognised reflects the symbolic and educational relevance of forest landscapes.

Regulating services perceived as most valuable include air quality improvement, temperature moderation, water quality protection, and mitigation of soil erosion, landslides, and flooding (Figure 4). These perceptions demonstrate an awareness of ecosystem functions linked to environmental stability and hazard reduction, suggesting experiential recognition of ecological resilience benefits.

Supporting services valued by respondents were soil formation, oxygen production, nutrient cycling, and hydrological cycling (Figure 4). While these services were less frequently articulated, their identification indicates some understanding of foundational ecological processes necessary for sustaining other ecosystem services (Figure 5).

Variation in Ecosystem Service (ES) identification between the two community forests indicates that socio-ecological context strongly shapes local knowledge construction and valuation of forest benefits. The absence of supporting services in Bakingili and cultural services in Etinde likely reflects differences in livelihood priorities, conservation exposure, and environmental interaction rather than a true lack of these services.

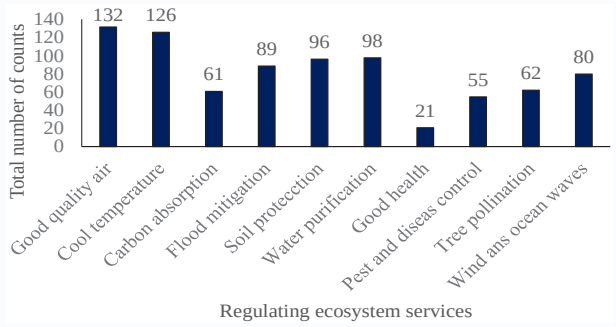


Figure 4: Total number of counts for identified regulating ecosystem services.

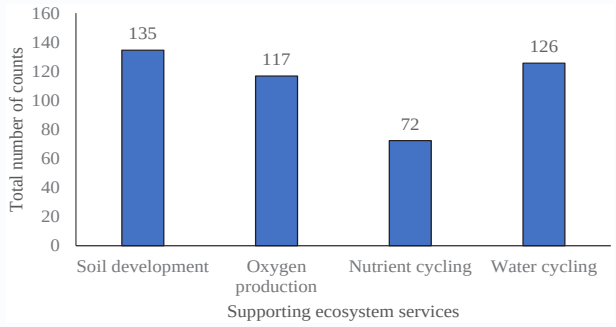


Figure 5: Total number of counts for identified supporting ecosystem services.

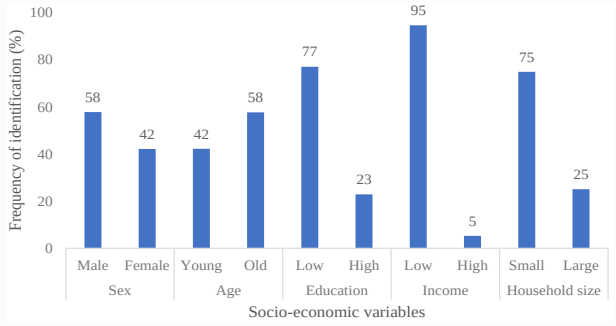


Figure 6: Identification of provisioning ecosystem services based on socio-economic variables.

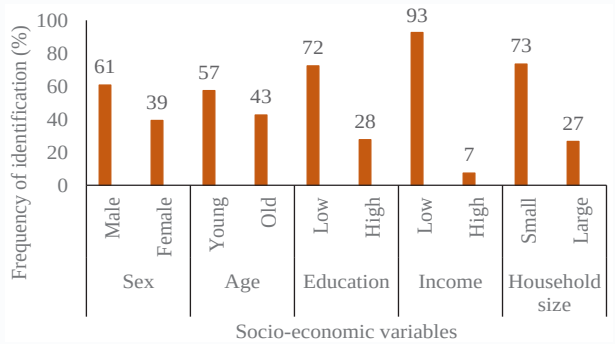


Figure 7: Identification of cultural ecosystem services based on socio-economic variables.

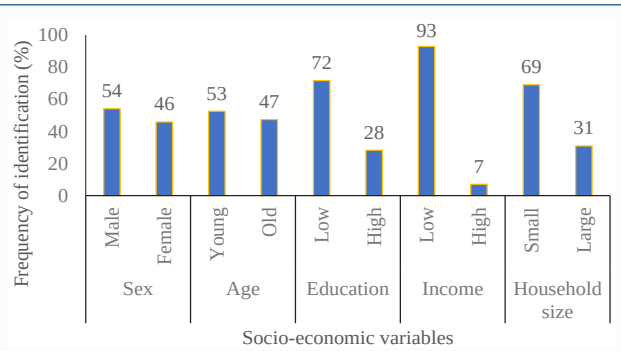


Figure 8: Identified regulating ecosystem services based on socio-economic variables.

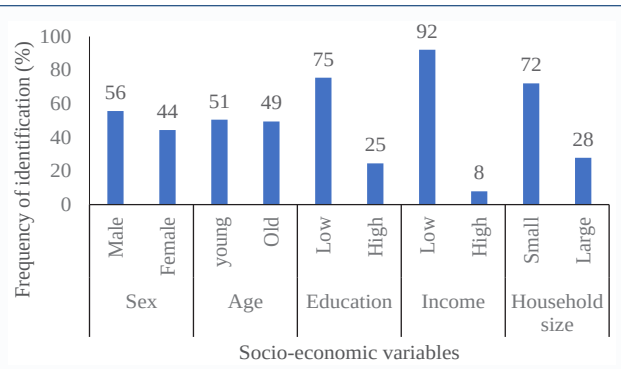


Figure 9: Identified supporting ecosystem services and socio-economic variables.

Identification of ecosystem services based on socio-economic variables

Male respondents (58%) identified and perceived provisioning ES more than females (42%). Old respondents (58%) identified and perceived provisioning ES more than the young (42%). Respondents with low level of education (77%) identified and perceived provisioning ES more than those with high level of education (23%). Respondents with low-income range (95%) identified and perceived provisioning ES more than respondents with high income range (5%). Also, respondents with small household size (75%) identified and perceived provisioning ES more than respondents with large household size (25%) as seen in Figure 6.

In Figure 7, male respondents (61%) identified and perceived cultural ES more than females (39%). Young respondents (57%) identified and perceived cultural ES more than old respondents (43%). Respondents with low level of education (72%) identified and perceived cultural ES more than those with high level of education (28%). In addition, respondents with low-income range (93%) identified and perceived different items of cultural ES more than the respondents with high income range (7%). More so, respondents with small household size identified and perceive cultural ES more than respondents with large household size (27%).

In Figure 8, it is evident that male respondents (54%) recognized and perceived regulating ecosystem services (ES) more frequently than their female counterparts (46%). Additionally, younger respondents (53%) demonstrated a greater identification and perception of regulating ES compared to older respondents (47%). Furthermore, individuals with a lower level of education (72%) were more likely to identify and perceive regulating ES than those with a higher level of education (28%). Similarly, respondents within the low-income

Table 2: Relationship between identified ecosystem service categories and socio-economic variables using Fisher's test statistics.

	Ecosystem services categories			
Socio-economic variables	**Provisioning ecosystem services**	**Cultural ecosystem services**	**Regulating ecosystem services**	**Supporting ecosystem services**
Sex	0.109	0.002**	0.039*	0.125
Age	0.344	0.227	0.344	0.625
Level of education	0.001**	0.0005**	0.002**	0.125
Income	0.002**	0.0005**	0.002**	0.125
Household size	0.001**	0.0005**	0.002**	0.125

**, *P*<0.01 (Highly significant); *, *P*<0.05 (significant)

Table 3: Motivations items identified by community stewards in sustaining the community forest/Results of Principal component analysis showing of motivations dimensions community stewardship (N = 19).

Dimension of motivations and constitutive items	Mean	Standard Deviation	Cronbach alpha (α)
Environment	8.1429	11.55319	0.816
To restore and regenerate the forest land			
To protect the environment from climate change			
To protect our forest to improve soil fertility			
To restore the forest by planting economic timber trees such as Cedrelas.			
Economic	9.0000	11.28421	0.926
To harvest and process Cedrela for timber/wood products in the future for commercial purposes.			
To receive conservation bonus and use the money for village development such as buying and renting of chairs and canopies.			
To receive training on sustainable non-tree income generation activities.			
To generate income from the collection and sale of non-timber forest products (NTFPs).			
To generate income from timber exploitation.			
Community	7.8571	12.06135	0.965
To be part of the strong community development spirit			
To reclaim our land from the Cameroon Development Cooperation (CDC).			
To protect and save the forest for the future generation.			
Social	1	1.46385	0.889
To participate in multipurpose nursery of fruit trees.			
To enable our children to receive scholarship awards for forest education from forest project donors.			

bracket (93%) showed a significantly higher identification and perception of regulating ES than those in the high-income bracket (7%). Lastly, respondents from smaller households (69%) identified and perceived regulating ecosystem services more than those from larger households (31%).

The data presented in Figure 9 indicates that a greater proportion of male respondents, at 56%, recognized and understood Supporting Ecosystem Services (SES) compared to their female counterparts, who accounted for 44%. Furthermore, young respondents demonstrated a higher identification and perception of SES, with 51% compared to 49% among older respondents. Additionally, individuals with lower educational attainment showed a significant inclination towards recognizing and perceiving SES, with 75% of this group doing so, in contrast to only 25% of those with higher education levels. Moreover, respondents belonging to the lower income bracket exhibited a pronounced awareness of SES, with 92% identifying and perceiving these services, while only 8% of those in the higher income range did the same. Lastly, individuals from smaller households also displayed a stronger recognition of SES, with 72% identifying and perceiving these services, compared to 28% of respondents from larger households.

Relationship between identified ecosystem service categories and socio-economic variables

The relationship between identified ecosystem service categories and socio-economic variables using Fisher's test statistics is summarized on Table 2. The analysis evaluates the strength of associations between four ecosystem service categories - provisioning, cultural, regulating, and supporting - and socio-economic variables (sex, age, education level, income, and household size). Results revealed that the variables of education, income, and household size show highly significant relationships with provisioning, cultural, and regulating ecosystem services. However, they do not have a significant relationship with supporting ecosystem services. Sex was significantly related to cultural and regulating ecosystem services and showed no significant relationship with provisioning or supporting ecosystem services. Age does not show significant relationships with any ecosystem service category.

Motivations of community stewardship to sustain forest ecosystem services

Community forest stewards identified multiple motivations for sustaining forest ecosystem services, which were grouped into

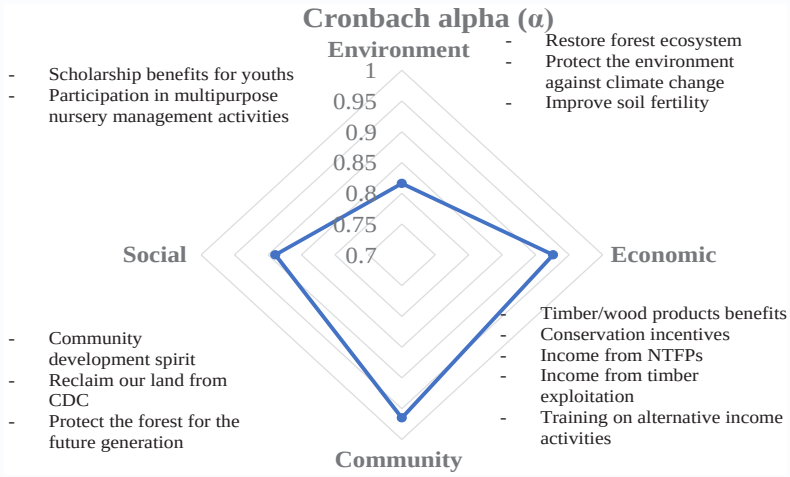


Figure 10: Dimensions and constitutive items of motivation of community conservation stewardship, based results of principal component analysis test statistics.

four principal dimensions: environmental, economic, community, and social. These motivations reflect the multidimensional drivers shaping local engagement in forest stewardship within the Bakingili and Etinde community forests.

Seven constitutive items were classified under environmental motivations, largely centred on protecting and restoring ecological integrity. Stewards expressed commitment to regenerating degraded forest land, mitigating climate change impacts, improving soil fertility, and promoting reforestation through the planting of economically valuable timber species such as Cedrela. Economic motivations comprised eight identified items and were primarily linked to livelihood improvement and income diversification. These included anticipated revenue from timber harvesting, exploitation of Non-Timber Forest Products (NTFPs), participation in conservation incentive schemes, and access to training on alternative income-generating activities. Community-oriented motivations encompassed five items reflecting collective identity and land stewardship, including strengthening community development solidarity, reclaiming historically controlled lands, and safeguarding forest resources for future generations. Social motivations were least represented, with two items focusing on participation in nursery initiatives and educational opportunities for youth through scholarship programmes.

Overall, community stewards identified environmental and economic motivations more frequently than community and social motivations (Table 3), indicating that ecological responsibility and livelihood considerations are the dominant drivers of stewardship engagement.

Test of hypothesis on community forest stewardship motivations in sustaining forest ecosystem services

The hypothesis that community forest management members are significantly driven by economic and community motives was tested using Principal Component Analysis (PCA) and reliability assessment through Cronbach's alpha. All motivational dimensions demonstrated acceptable internal consistency, with alpha values exceeding the threshold of 0.70, indicating reliable grouping of constitutive items.

The economic and community dimensions showed particularly strong reliability ($\alpha = 0.926$ and $\alpha = 0.965$ respectively), suggesting that these motivations were most strongly identified among community stewards. Environmental and social dimensions also demonstrated good reliability ($\alpha = 0.816$ and $\alpha = 0.889$), indicating meaningful but comparatively secondary influence. These results supported the rejection of the null hypothesis and acceptance of the alternative hypothesis that stewardship motivations are significantly driven by economic and community considerations (Table 3).

Dimensions and constitutive items of motivation of community conservation stewardship

Figure 10 presents the reliability and relative strength of the four motivational dimensions of community conservation stewardship as measured by Cronbach's alpha coefficients. The radar plot indicates that all dimensions exceeded the acceptable reliability threshold ($\alpha \geq 0.70$), confirming strong internal consistency among the constitutive items defining each motivational category. Overall, the results suggest that effective community forest management strategies should prioritize economic incentives and community cohesion while simultaneously fostering environmental awareness and social development.

Challenges faced by forest management organisation in sustaining ecosystem services

Community-based Forest management agencies face many obstacles in the maintenance of ecosystem services of the forest. Challenges are grouped into six community related challenges (including illegal expansion of farmland and forest logging), two economic challenges, four social challenges and three management/ administration related challenges (Table 4). In general, challenges related to the community aspect were more recognized by the forest steward managers, indicating the criticality of the community challenges in derailing the process of community forest management and sustainability of the ecosystem services.

Four types of challenges related to the Community Forest (CF) management have been found through the analysis, where the first one is the challenge of the community encroachment (M = 5.42, SD = 5.71, $\alpha = 0.850$). Community encroachment consists of illegal expansion of farmland, forest logging, poor agricultural practices, deforestation and slash-and-burn bush fires. It poses the highest threat to the CF and constitutes a good scale of the challenge. Next in

Table 4: Principal component analysis showing of challenges dimensions of community forest stewardship (N = 19).

Dimensions of challenges and constitutive items	Mean	Standard Deviation	Cronbach alpha (*α*)
Community encroachment	5.4286	5.71131	0.850
Illegal farmland expansion into the CF.			
Illegal timber exploitation			
Poor farming methods inside CF			
Increase in deforestation			
Illegal burning of farms and slash and burn farming (bushfires in the forest by farmers).			
Economic	2.5714	4.72077	0.997
Lack of adequate equipment materials for usage			
Lack of financial resources to undertake surveillance patrols, tree planting, inventory activities, etc.			
Social conflicts	5.1429	9.08164	0.995
Conflict between CDC and the communities following CDC expansion into the CF even after delimitation of the CF.			
Elephants encroachment into farmlands which are the livelihood of committee members.			
Management/Administrative	2.7143	3.40168	0.512
Complicity of regional and local Government authorities and local elites, which exacerbates the difficulties in controlling illegal users			
Selling of parts of the CF by government authorities and local elites.			
Lack of overnight forest monitoring facilities such as standard camping lodge, sleeping bags/mats, tents, rainboots/coats, etc.			

order comes social conflict (M = 5.14, SD = 9.08, $\alpha = 0.995$), including conflict between CDC expansion and the problem of encroachment by elephants on farmlands. Lastly, there are the management/administration related challenges (M = 2.71, SD = 3.40, $\alpha = 0.512$) and the economic challenges (M = 2.57, SD = 4.72, $\alpha = 0.997$). While economic and social conflict challenges are highly reliable scales ($\alpha > 0.95$), the management dimension does not reach the reliability threshold ($\alpha = 0.512 < 0.70$). Therefore, the items in this scale (complicity and sale of the CF *versus* monitoring logistics challenge) do not measure one single construct and thus, the management challenge can be considered as two separate factors. High standard deviations in all dimensions indicate the polarization of perceptions of the stakeholders.

Discussion

Local knowledge and perceptions of forest ecosystem services

The prominence of provisioning services mirrors patterns observed in many tropical forest-dependent communities, where immediate subsistence and income need drive perceptions of ecosystem value toward tangible and marketable outputs such as food, fuelwood, and medicinal resources [1, 13]. Nonetheless, recognition of regulating services such as climate moderation and water regulation suggests an expanding awareness of indirect ecological functions that support community resilience [3]. Limited identification of cultural services in Etinde may reflect under-recognition linked to weaker engagement with tourism or research networks, while the identification of supporting services there may indicate greater environmental interaction or exposure to ecological sensitisation programmes. These findings highlight that experiential knowledge, while valuable, often lacks alignment with formal ES frameworks, underscoring the importance of capacity-building and environmental education initiatives [10, 12]. Strengthening participatory learning that integrates scientific classifications with local ecological knowledge could enhance stewardship decision-making, improve conservation outcomes, and support the long-term sustainability of community forestry systems.

Identification and construction of ecosystem services in relation to socio-economic variables

The findings highlight that socio-economic factors of education, income, and household size are crucial determinants for understanding the perception and utilization of certain ecosystem services. Conversely, age appears to have minimal influence, and the relationship of sex is context-dependent. Supporting ecosystem services seem less influenced by socio-economic variables compared to the other categories. Studies carried out by [14] and [15] are in line with the findings that, sex, level of education and occupation have significant influence on ES identification and construction. In contrast, [16] found that household size had less influence on the identification and construction of ES.

Community stewardship motivations and challenges

The findings of this study indicate that community forest stewards in Bakingili and Etinde are primarily motivated by economic and community considerations, with environmental and social motivations playing secondary roles. Economic motivations such as income generation from timber and non-timber forest products, participation in conservation incentives, and training for alternative livelihoods reflect the centrality of forests in supporting rural livelihoods, consistent with previous studies in tropical forest communities [13, 15]. These results align with [16], who found that local people are largely driven by economic incentives when engaging in forest stewardship activities.

Community-oriented motivations, including collective land management, reclaiming land rights, and protecting resources for future generations, underscore the importance of social cohesion and collective identity in sustaining forest management initiatives [10, 12]. This suggests that forest stewardship is not solely an individual economic endeavor but also a social practice that reinforces community solidarity and intergenerational equity.

Environmental motivations such as forest regeneration, climate moderation, and soil fertility improvement - though secondary in frequency, indicate an awareness among stewards of the ecological functions forests provide. Similar patterns have been observed in other studies of local ecological knowledge, where stewardship is often driven first by tangible livelihood benefits, but environmental concerns emerge through experiential interaction with the ecosystem [1, 4]. Social motivations, including educational opportunities for youth and participation in tree nurseries, were the least frequently reported but highlight the long-term developmental and capacity-building role of community forests.

The statistically significant Cronbach alpha values for all motivation dimensions confirm the reliability of these categories and the coherence of constituent items. The dominance of economic and community motivations corroborates the hypothesis that livelihood and collective goals are key drivers of forest stewardship, which echoes findings from socio-ecological systems research showing that local incentives, both material and social, strongly influence participation in conservation programs [17, 18]. Integrating local motivations with formal conservation objectives can enhance stewardship effectiveness, improve ecosystem service sustainability, and strengthen the resilience of socio-ecological systems [10, 12].

The study revealed that economic/financial challenges were the most constraining factor towards sustainability in conservation by community stewards, followed by social conflicts and community encroachment. On the other hand, management/administrative were the least constraint towards sustainable management of the CF for sustainable FES provision. Other scholars also revealed financial and time constraint as well as labour limitations as major challenges towards stewardship actions in conservation practices in developing countries [19, 20].

In Cameroon, [21] stated that financial/management issues were the main factor in undermining community participation in ecosystem restoration projects such as tree planting in the Mt. Bamboutus landscape. In addition, [22] pointed out the lack of education resulting in human capital being inadequately educated and sensitised as the main challenge towards community participation in conservation projects through ecosystem restoration in the Philippines.

Conclusion

The community conservation stewardship has risen within the past three decades in both developed and developing nations owing to decreasing support towards forest landscape restoration and conservation. The current research was carried out to examine the awareness of Forest Ecosystem Services (FES) supplied by Community Forests (CF), as well as motivations and challenges, The results indicate that Supporting and Regulating Services (SES and RES) were easily identified and constructed by the locals compared to the Cultural and Provisioning Services (CES and PES). Local communities fail to understand that medicinal plants, roots, fiber, food and meat are provisioning services, while libation and prayers are cultural services; hence, there is a need to educate and sensitize the locals regarding the services and importance of the conservation of CFs.

It was also established that the main motivation of CF stewards is community and economic, even though environmental is still important. The community motivation comes from the willingness to pass on forest resources to future generations. On the other hand, economic motivation emanates from the need to secure household livelihoods in times of poverty. Sustainable management of CFs is limited by social conflict, economic constraints and encroachment by the community, and therefore stakeholder action is urgently needed. Also, there is inadequate capacity in CFMOs since they do not have an annual budget, office, equipment and training on natural resource management. There is need to enhance capacity and actions of CFMOs along with taking advantage of their motivations and economic development projects in the community for sustainable management of CFs.

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