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Assessment of Forestry Extension Service Delivery among Rural Farmers Living around Awi Forest Reserve in Cross River State, Nigeria

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ABSTRACT: This study assessed forestry extension service delivery among rural farmers living around the Awi Forest Reserve in Cross River State, Nigeria. A total of 214 respondents were selected using a multistage sampling technique. Data were collected through structured questionnaires and analyzed using descriptive statistics and a 5-point Likert scale. The results showed that the average age of respondents was 39 years, with 61% being male and 85% married. Most respondents (53%) had primary education, and 57% operated on small farm sizes of 1-2 hectares. Farmers expressed satisfaction with campaigns against forest fires (mean = 3.58), forest management practices (mean = 3.35), and information on forestry laws (mean = 3.34). However, dissatisfaction was recorded for training on agroforestry (mean = 2.77), seedling distribution (mean = 1.75), and budding and grafting (mean = 1.54). Major constraints to effective service delivery included inadequate extension agents (mean = 4.0), poor supervision (mean = 3.53), and insufficient funding (mean = 3.48). The findings highlight the urgent need to address these challenges to enhance sustainable forest management and conservation efforts in the study area.

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Forests are indispensable to human existence, offering a multitude of benefits that are crucial for sustainable development (Sackey, 2007). They are vital to human survival and well-being, particularly in developing countries, where approximately 1 billion impoverished individuals rely on forests for part of their livelihoods. Additionally, about 350 million people living in or near forests depend heavily on them for their security and sustenance (World Bank, 2006). Forests contribute significantly to economic development, food security, rural livelihoods, and climate regulation. They are integral to the water cycle, carbon sequestration, biodiversity preservation, and serve as a genetic reservoir and food source. Moreover, forests play a critical role in stimulating rainfall, preventing soil erosion, and managing water flow (Vihi *et al*., 2020).

Despite these vital functions, forests face significant threats from deforestation, degradation, and fragmentation (Olagunju, 2015). Deforestation refers to the conversion of forested areas into non-forest land, while forest degradation involves the reduction of forest density or structure. Fragmentation occurs when continuous forest landscapes are divided into

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smaller, isolated patches due to non-forest land uses. Over time, forested areas have steadily declined as they are cleared for agriculture, industrial use, housing, and infrastructure development, including roads, railways, and hydroelectric projects.Forests are also being transformed into permanent settlements, hindering their ability to regenerate. In some cases, these lands become wastelands within a few years due to repeated cultivation. Communities residing near forests contribute to this decline by harvesting fuelwood. Additionally, excessive grazing by livestock damages young shoots and seedlings, impeding regeneration. Historically, lower population levels allowed forests to meet demands without significant degradation. However, the rapid population growth has drastically depleted forest resources (Pujari, 2015).

Nigeria has periodically developed and reviewed forest policies, but their success has been limited, particularly in enforcing forestry laws. As the challenges of sustainable forest management in the tropics, including Nigeria, continue to evolve, forestry education at all levels is increasingly recommended. Vihi *et al*. (2020) emphasize that effective forest conservation is only possible when extension agents demonstrate to local communities that sustainable forest use can provide them with viable livelihoods. Raising awareness among local populations about the importance of forests and involving them in protective measures through forestry extension programs is the most effective way to safeguard forests and their biodiversity. Forestry extension programs are tailored to address the needs of small-scale farmers, focusing on agroforestry technology, small-scale wood processing techniques, biodiversity conservation, and introducing innovative concepts in forest management (Onumadu *et al*., 2001). Achieving this requires a proactive approach to forestry extension (Agbogidi and Ofuoku, 2009). Forestry extension involves the systematic exchange of ideas, knowledge, and techniques, fostering mutual changes in attitudes, behaviors, practices, and values aimed at improved forest and tree management. It is a critical tool for expanding forest resources, conserving existing forest ecosystems, and promoting sustainable development. The primary objective of forestry extension is to equip stakeholders with the necessary education, skills, and technical knowledge to adopt practices that support forestry development at all levels. An aggressive forestry extension approach is essential to realize sustainable forest management (SFM), the overarching goal of forestry initiatives. Through effective forestry extension, communities can understand that sustainably managed forests provide greater and more enduring benefits (Ogunwale *et al*., 2006). Forestry extension plays a vital role in forest protection and conservation, given the indispensable contribution of forests to the environment and human survival. To achieve sustainable forest management and curb the alarming loss of genetic diversity, it is crucial to disseminate current and emerging scientific knowledge about biodiversity and promote innovative conservation concepts and technologies.

Nigeria has employed a multi-dimensional approach to tackle the unregulated exploitation of forest resources and desertification. Issues such as deforestation, infrastructural expansion, fuelwood harvesting, uncontrolled forest fires, and overgrazing are widely recognized as key contributors to the decline in forest reserves. According to Odediran *et al*. (2013), global deforestation poses a significant threat to environmental sustainability, with Nigeria experiencing particularly severe consequences. Deforestation affects the environment, economy, and citizens, placing all at risk. Africa has the second highest rate of tropical deforestation globally (Alao, 2005), with Nigeria's timber reserves depleting rapidly, creating a widening gap between demand and supply. Alao (2005) suggests that educating forest users on the impacts of forest degradation and encouraging widespread tree planting are critical solutions. Deforestation in Nigeria occurs at an alarming rate of 3.5-3.7% annually, translating to the loss of 350,000-400,000 hectares of forestland per year (UN-REDD, 2013). Between 1990 and 2005, while the world lost 3.3% of its forests, Nigeria accounted for 21% of the global total (Ladipo, 2010). This rapid deforestation drives annual increases in flood disasters, global warming, ozone layer depletion, land degradation, and soil erosion (Chomini *et al*., 2013; Farinola *et al*., 2013). A strong link exists between rural agricultural communities and forest use. Farmers often rely on diverse forest products, such as timber, fuelwood, fruits, and medicines. However, poaching and illegal timber harvesting remain rampant, with traders sourcing resources from local communities. Many rural residents prioritize maximizing short-term financial gains from forest harvesting, often exceeding natural regeneration rates and threatening the sustainability of forest resources. Similar issues are evident in Plateau State, where habitat destruction, hunting, and tree felling have disrupted ecological balance. Human activities, including uncontrolled logging, bush burning, and charcoal production, have severely depleted forest resources.To address these challenges, the government has initiated several forest management programs (FAO, 2003). These include the reservation policy introduced during the colonial era, industrial plantations established from 1978, and land use and vegetation (LUV) surveys conducted

between 1975 and 1978. Additional programs include rural forestry development policies from 1981, the 1990-2005 perspective plan, and the 1997 Nigerian Forest Action Programme (NFAP), also known as the Tropical Forest Action Programme (TFEAP). Following the civil war, efforts to increase agricultural production led to the establishment of the World Bank-assisted Agricultural Development Programme (ADP) in 1975. This program, through collaboration between federal and state governments, created a unified, inclusive extension delivery system. The ADPs, now operational in all 36 states and the Federal Capital Territory, employ the Unified Agricultural Extension System (UAES) based on the Training and Visit (T and V) model. This system emphasizes frequent, regular visits by well-informed village extension workers to deliver technical messages and link farmers' challenges to research solutions.

Despite various policies and programs implemented by the government, indiscriminate tree felling by farmers using poor agronomic practices remains prevalent. This contributes significantly to deforestation, desertification, land degradation, greenhouse gas emissions, climate change, and biodiversity loss. One major factor driving this decline in forest resources is the lack of effective forestry extension service delivery. Udo *et al*. (2009) highlighted that many individuals engage in illegal forest activities due to ignorance, lack of alternative livelihoods, and the lucrative nature of such acts, which often go unpunished due to insufficient societal ethics and weak penalties for offenders. Government policies and programs have had limited success in reversing the precarious state of forest resources, largely because effective extension service delivery was not incorporated as a core objective. The successful implementation of these initiatives depends significantly on effective extension services and the farmers who are expected to adopt these policies. Preliminary findings indicate that forestry extension service delivery, critical for educating and sensitizing local communities on sustainable forest management practices and forestry policies, is inadequate. To reverse this negative trend, forestry extension must be prioritized. Effective forestry extension has the potential to enlighten forest-dependent communities about the environmental dangers of their activities, thereby encouraging compliance with forestry laws and regulations. Strengthening research and education in forest and environmental protection is essential to equip the public and rural inhabitants with the knowledge and tools necessary for sustainable survival. Forestry extension plays a pivotal role in forest protection and conservation, given the undeniable importance of forests and ecosystems to human survival. Communicating current and emerging scientific information on biodiversity, along with new conservation concepts and technologies, is critical for achieving sustainable forest management and curbing the alarming loss of genetic diversity. However, there is a significant lack of extensive research evaluating forestry extension service delivery among rural farmers in Nigeria, particularly in Plateau State. Hence, the objective of this paper is to assess forestry extension service delivery among rural farmers living around the Awi Forest Reserve in Cross River State, Nigeria.

MATERIALS AND METHODS

The Study Area: The study area is Awi Forest Reserve, located in Akamkpa Local Government Area of Cross River State, Nigeria. Awi Forest Reserve is part of the Cross River rainforest ecosystem, rich in biodiversity and known for its economic and ecological significance. The rural farmers living around this reserve engage in various agricultural and forestry-related activities, including subsistence farming, cash crop production, and the exploitation of forest resources. The reserve is threatened by deforestation, unsustainable agricultural practices, and climate change, making the role of forestry extension services critical. The target population comprises all rural farmers living in communities around Awi Forest Reserve who interact with forestry extension services. These include men and women actively engaged in agricultural and forestry-related activities, such as timber harvesting, non-timber forest product collection, and agroforestry practices.

Sampling Techniques: The study employs a multistage sampling technique to select respondents: In the first stage, Awi forest reserve was purposively selected due to the fact that it is part of the Cross River rainforest ecosystem, known for its rich biodiversity, including rare and endangered species of flora and fauna. Its conservation and sustainable management are crucial for maintaining ecological balance, which underscores the relevance of forestry extension services in the area. In the second stage, five communities closest to the forest reserve were purposively selected due to their direct dependence on the forest for their livelihoods. Finally, a sampling frame was developed for each of the selected communities and using proportional allocation, 10% of the sample frame from each of the districts was drawn to obtain 214 respondents for the study.

Methods of Data collection and Analysis: Data for this study were generated from primary sources. Primary data were generated using well-structured questionnaire and interview techniques. Data collected were analysed using descriptive statistics and five point likert type rating scale. Descriptive statistics such as frequencies, percentages and mean were used to analyze the socio-economic characteristics of the respondents, examine rural farmers access to forestry extension services and identify the forestry extension services delivered to rural farmers in the study area while five point likert scale was used to examine the perception of farmers on the effectiveness of forestry extension service delivery in the study area and the perceived constraints to forestry extension service delivery in the study area.

Likert Scale: The level of satisfaction with forestry extension service delivery in the study area and the perceived constraints to forestry extension service delivery in the study area were analysed using the 5-point likert scale respectively. The response categories included: Very Satisfied, Satisfied, Neutral, Dissatisfied, and Very Dissatisfied. Responses of Very Satisfied and Satisfied were considered positive perceptions of the forestry extension services provided, while Dissatisfied and Very Dissatisfied were categorized as negative perceptions. Neutral responses indicated a lack of knowledge or opinion. A mean score of 3.0 was used as the threshold to determine satisfaction or dissatisfaction with each service indicator. The calculation was based on the sum of the scale values (1+2+3+4+5 = 15), divided by the number of response categories (5), yielding a mean score of 3.0. Scores equal to or greater than 3.0 were classified as satisfied, while scores below 3.0 were categorized as dissatisfied.Similarly, farmers' perceptions of constraints to forestry extension service delivery were evaluated using a 5-point rating scale: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1). A mid-point of 3.0 was also established for this analysis. Any mean score of 3.0 or above was considered indicative of a constraint to forestry extension service delivery, whereas scores below 3.0 suggested otherwise.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents: The findings in Table 1 show that the average age of farmers in the study area is 39 years, indicating a predominantly young and energetic population. Younger individuals are often more open to adopting and transferring new technologies, which enhances the sustainability of interventions (Vihi *et al*., 2020).

In terms of gender, 61% of respondents were male, while 39% were female. This suggests that male-headed households dominate farming activities, likely due to socio-cultural norms in the region that provide men with greater access to productive resources such as land.

The majority of respondents (85%) were married, with only 15% being single. This highlights the role of marital status in agricultural production, as married individuals often utilize family members as a labor force, which is critical given the high labor demands of farming. This finding aligns with studies by Obasi *et al*. (2012) and Orisakwe *et al*. (2011), which observed similar trends among agroforestry farmers in Nigeria.

Educational attainment among respondents revealed that 53% had primary education, 24% had no formal education, 17% had secondary education, and 6% had tertiary education. This indicates that most respondents possess some level of education, a factor that facilitates awareness and adoption of innovations. Education has been shown to enhance farm productivity and improve the ability to evaluate and implement new technologies (Henri-Ukoha *et al*., 2011).The average farm size among respondents was 2.5 hectares, suggesting that most are smallholder farmers operating on fragmented plots of land. This fragmentation, common in traditional societies where land is inherited, limits access to larger, contiguous farming areas.Household size data indicate that 47% of respondents had 6-10 members, while 26% had 11-15 members, with an average household size of 11 people. This implies a reliance on family labor for agricultural activities, which is essential for resource-constrained small-scale farmers. This observation supports the findings of Orisakwe and Agomuo (2011), who noted that larger households provide labor advantages for farming.

Agriculture was the primary source of income for 87% of respondents, while 6% relied on salaried jobs, 5% on trading, and 2% on other non-farm activities. This underscores the importance of agriculture as a livelihood strategy in the area. Forestry extension can further enhance community resilience by promoting agroforestry and increasing agricultural productivity.

Regarding land tenure, 93% of respondents acquired their land through inheritance, while only 7% rented farmland. This indicates that land ownership is not a major issue in the area, as the dominance of inherited land facilitates communal forestry activities.

The mean annual income of respondents was ₦82,742, reflecting a relatively strong financial base for agricultural investments. This income level suggests that farmers are well-positioned to engage in more productive agricultural ventures if supported by effective extension services.

Table 1: Distribution of respondents based on their socio-economic characteristics (N=214)

Variable	Frequency	Percentage	Mean
Age (years)			
21-30	25	12.0	
31-40	107	50.0	
41-50	58	27.0	
50 above	24	11.0	39
Sex			
Male	130	61.0	
Female	84	39.0	
Marital status			
Single	31	15.0	
Married	183	85.0	
Educational level			
Primary	113	53.0	
Secondary	37	17.0	
Tertiary	13	6.0	
Non formal education	51	24.0	
Household size			
1-5	39	18.0	
6-10	101	47.0	
11-15	55	26.0	
16-20	19	9.0	10
Size of farm land			
1.0-2.0	123	57.0	
3.0-4.0	79	37.0	
Above 4.0	12	6.0	2.5
Sources of income			
Salary	12	6.0	
Agriculture	186	87.0	
Business/trading	11	5.0	
Others (specify)	5	2.0	
Land tenure			
Rent	16	7.0	
Inheritance	198	93.0	
Annual income			
1000-50000	76	36.0	
51000-100000	69	32.0	
101000-150000	42	20.0	
151000-200000	16	7.0	
>200000	11	5.0	82742

Source: Field survey, 2024

Frequency of Extension Contact: The data in Table 2 reveals that a significant proportion of respondents had minimal contact with extension agents, with 38% reporting no contact and 58% having contact only 1-3 times. This low level of interaction indicates that forestry extension services may not be adequately reaching their target audience. The absence of respondents reporting more frequent contacts (4-6 or 7-9 times) suggests a lack of sustained engagement, which is critical for effective forestry conservation awareness and practices. The implication of this finding is that limited extension contact likely hampers the dissemination of critical information on sustainable forestry practices, conservation techniques, and the importance of forest ecosystems. Without consistent engagement, farmers and forest-dependent communities may lack the knowledge or motivation to adopt practices that mitigate deforestation, promote reforestation, and protect biodiversity. To address this, it is essential to strengthen forestry extension programs by increasing the frequency and quality of contact between extension agents and community members. This could involve employing more extension staff, utilizing ICT tools for remote engagement, and fostering participatory approaches that prioritize community involvement. Improving extension contact is vital to achieving long-term forestry conservation goals and ensuring the sustainability of forest resources for future generations.

Table 2: Distribution of Respondents according to Number of Extension contact

Extension contact	Frequency	Percentage
No contact	81	38.0
1-3 times	124	58.0
4-6 times	9	4.0
7-9 times	0	0.0
Total	**214**	**100**

Forestry Extension Services received by the Farmers: Data in Table 3 show the distribution of respondents according to types of forestry extension services available to them. The result in Table 5 below shows that 42% of respondents received information on forestry laws. 28% of the respondents received awareness campaign on dangers of bush burning, 17.5% received horticultural seedlings from extension agents, 18.3% were given practical teachings on method/result demonstration, 14.2% received training on improved forest management practices while 12.2% received training on raising of seedlings.

Table 3: Distribution of Respondents According to Forestry Extension Services Received (Note: only 113 respondents accessed extension services)

Variable	*Frequency	%
Information on forestry laws		
Training on improved forest management practices		
Training on agroforestry		
Training on raising of seedlings		
Campaign on dangers of bush burning		
Training on budding/grafting		
Distribution of horticultural seedlings		
Organization of method/result demonstration		

*Multiple responses

Table 4 Mean Rating of Farmers Satisfaction with Forestry Extension Service Delivery

Forestry extension service	VS(5)	S (4)	U(3)	VD(2)	D(1)	Sum	Mean
Information on forestry law	255	322	27	76	33	713	3.34*
Forest management practices	295	288	36	62	36	717	3.35*
Training on agroforestry	330	156	21	46	40	593	2.77
Campaign against forest fire	305	352	33	48	30	768	3.58*
Training on raising of seedlings	30	84	36	72	139	361	1.68
Training on budding and grafting	0	0	18	210	103	331	1.54
Distribution of horticultural seedlings	60	46	6	174	90	376	1.75
Method/result demonstration	55	108	27	144	95	429	2.00

VS= Very satisfied, S= Satisfied, U=Undecided, VD= Very Dissatisfied & D= Dissatisfied

Table 5 Mean Rating of Perceived Constraints to Forestry Extension Service Delivery (N=214)

Perceive constraints	SA(5)	A(4)	U(3)	SD(2)	D(1)	Sum	Mean
Inadequate number of extension agents	430	364	33	30	11	868	4.0*
Lack of in-service training of personnel	140	100	27	136	84	487	2.27
Lack of funding of extension activities	295	344	18	50	38	745	3.48*
Lack of subject matter specialist	55	60	75	96	115	401	1.87
Lack of commitment of field agents	105	112	69	72	106	464	2.16
Inadequate supervision of field agents	340	300	21	62	33	756	3.53*

SA=Strongly Agree, **A**=Agree, **N**= Neutral, **SD**=Strongly Disagree, **D**=Disagree

Note: *= Agree

Farmers Level of Satisfaction with Forestry Extension Service Delivery: The results in Table 4 present farmers' satisfaction levels with various forestry extension service delivery indicators, using a mean of 3.0 as the cutoff point to determine satisfaction or dissatisfaction. Indicators with a mean score above 3.0 indicate satisfaction, while those below 3.0 reflect dissatisfaction. The results reveal varying levels of farmers' satisfaction with forestry extension service delivery. Farmers expressed high satisfaction with the campaign against forest fires, which had the highest mean score of 3.58. Similarly, satisfaction was reported for support on forest management practices (mean = 3.35) and the dissemination of information on forestry laws (mean = 3.34), indicating that these areas of service delivery were well-received. In contrast, moderate dissatisfaction was observed for training on agroforestry, which had a mean score of 2.77, falling below the satisfaction cutoff. This indicates that while some farmers appreciated the efforts in this area, the training was insufficient for others. Farmers expressed low satisfaction with method/result demonstrations (mean = 2.00), training on raising seedlings (mean = 1.68), and the distribution of horticultural seedlings (mean = 1.75). These scores suggest significant dissatisfaction, pointing to gaps in practical and material support provided to farmers. The lowest level of satisfaction was recorded for training on budding and grafting, with a mean score of 1.54. This highlights a severe gap in specialized training, which is crucial for improving farmers' skills in advanced forestry and agroforestry techniques. While farmers are satisfied with services related to forest fire prevention, forest management, and legal awareness, they are largely dissatisfied with training and practical demonstrations. Addressing these areas of dissatisfaction is essential to enhance the impact of forestry extension services and improve farmer engagement in sustainable forestry practices.

Perceived Constraints to Forestry Extension Service Delivery : Farmers perception of the constraint to extension service delivery was measured using a 5-point rating scale of: Strongly Agree (SD) = 4; Agree = 3; Disagree = 2; and Strongly Disagree = 1. The results in Table 5 reveal that the inadequate number of extension agents emerged as the highest-rated constraint with a mean score of 4.0. This indicates strong agreement among respondents that the limited availability of extension personnel significantly hinders forestry extension service delivery.

Following closely is the inadequate supervision of field agents, with a mean score of 3.53, highlighting the lack of proper oversight as a major challenge that affects the performance and effectiveness of forestry extension activities. The third most significant constraint is the lack of funding for extension activities, which received a mean score of 3.48. Respondents agreed that insufficient funding limits the scope of operations, including training, logistics, and outreach to forestry-dependent communities.

In contrast, the lack of commitment among field agents was perceived as a relatively minor constraint, with a mean score of 2.16, suggesting that the extension personnel are generally viewed as dedicated. Similarly, the lack of in-service training for personnel, with a mean score of 2.27, was not seen as a major issue, implying that training opportunities for forestry extension staff might be reasonably available.

The lowest-rated constraint was the lack of subject matter specialists, with a mean score of 1.87. This result reflects a consensus among respondents that the availability of technical expertise is not a critical limitation in the delivery of forestry extension services.

The findings underscore the need to address the top-rated constraints; inadequate number of extension agents, inadequate supervision, and funding shortages to enhance the effectiveness of forestry extension service delivery. By prioritizing these areas, the capacity to promote sustainable forestry practices and conservation efforts can be significantly improved.

Conclusion: The study reveals significant gaps in the delivery of forestry extension services around the Awi Forest Reserve. While farmers were satisfied with some services, such as forest fire campaigns and forestry law dissemination, dissatisfaction was notable in critical areas, including training on agroforestry, budding, and grafting, as well as seedling distribution. Additionally, the limited interaction between extension agents and farmers further constrained the effectiveness of these services. The main challenges identified include inadequate staffing, poor supervision, and insufficient funding, which hinder sustainable forestry practices and conservation efforts in the region. To ensure the sustainability of the forest reserve and the livelihoods of the surrounding communities, urgent measures are required to improve the scope and delivery of forestry extension services.

Declaration of Conflict of Interest *:* The authors declare no conflict of interest.

Data Availability: Data are available upon request from the first author or corresponding author or any of the other authors

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