Effect of Forest Degradation on the Livelihoods and Biodiversity in Boki Local Government Area of Cross River State, Nigeria

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Abstract
This study examined the effects of forest degradation on livelihoods and biodiversity in Boki Local Government Area of Cross River State, Nigeria. The study focused on the use of forest resources by local residents, the contribution of these resources to household livelihoods, and the environmental changes associated with forest degradation. A descriptive survey design was adopted, and data were collected from 300 respondents using structured questionnaires. The collected data were analysed using descriptive statistics and the chi-square test to examine the relationship between forest degradation and livelihoods. The findings revealed that forest resources were important to residents' daily needs and sources of income. Fruits were the most commonly reported forest product, accounting for 89 respondents (29.7%), followed by vegetables and timber, each reported by 81 respondents (27.0%). The income findings also showed that forest resources contributed to household earnings, with 31% of respondents earning between ₦41,000 and ₦60,000 monthly from forest-related activities. The chi-square result indicated a statistically significant relationship between forest degradation and livelihoods ($\chi^2 = 209.436$, $df = 30$, $p < 0.001$). Regarding environmental changes, 268 respondents (89.6%) rated biodiversity loss as high, while changes in rainfall patterns, reduced soil fertility, drying of streams and rivers, and land degradation were also reported. The study concluded that forest degradation is an important environmental and socioeconomic concern in Boki Local Government Area because local livelihoods depend partly on forest resources, while biodiversity and other environmental conditions are affected by forest loss. The study recommends stronger forest protection, tree planting and restoration of degraded areas, promotion of alternative livelihood activities, and greater participation of local communities in forest conservation. Sustainable harvesting practices and continued monitoring of forest conditions are also necessary to protect biodiversity and support the long-term livelihoods of residents.

Keywords: *Forest Degradation, Livelihoods, Biodiversity, Forest Resources*

1. Introduction

Forest degradation refers to a decline in the condition, structure, productivity and ecological functioning of forests. Unlike deforestation, which converts forest to another land use or involves long-term loss of forest cover, degradation can happen while the forest is still classified as forest. It reduces the capacity of forests to deliver ecosystem services such as carbon storage, biodiversity conservation, soil protection and livelihood resources (FAO, 2020). The main causes include

unsustainable logging, overexploitation of forest resources, road construction, mining, shifting cultivation and other land-use activities (FAO, 2020).

Globally, forest loss and degradation remain major environmental challenges because of their effects on biodiversity, climate regulation and human livelihoods. The FAO (2020) reported that forests covered approximately 4.06 billion hectares globally, about one-third of the world's land area. Yet approximately 420 million hectares of forest had been lost through deforestation since 1990. Although the global rate of net forest loss declined over the period, Africa recorded the highest annual rate of net forest loss between 2010 and 2020, estimated at about 3.9 million hectares per year (FAO, 2020). Forest degradation is also harder to detect and quantify than deforestation because it can occur without an immediate change from forest to another land-cover class (FAO, 2020). Agricultural expansion, logging and other forms of resource extraction are among the major drivers of forest loss in tropical regions. Curtis et al. (2018), using global spatial data on forest loss between 2001 and 2015, identified commodity-driven agriculture, forestry, shifting agriculture and wildfire as the main drivers of tropical forest loss. More recent assessments continue to identify agricultural expansion as a direct driver of deforestation, while timber extraction and mining also contribute to forest loss and degradation (Derebe et al., 2023). The expansion of agricultural frontiers matters because forests are frequently cleared or modified to create land for crop production and other economic activities.

African forests face similar pressures. Forest loss varies across regions, with agricultural expansion, shifting cultivation, timber extraction and infrastructure development contributing to changes in forest cover. In the Upper Guinean Forest region of West Africa, for example, logging and shifting agriculture have been identified as major contributors to forest loss, while cocoa and oil-palm cultivation have also driven the conversion of natural forest to agricultural land (Curtis et al., 2018). The loss and degradation of African forests affect biodiversity, carbon storage, soil resources and the livelihoods of communities that depend on forest products.

In Nigeria, forest degradation and deforestation are persistent concerns. Gbadebo et al. (2022) observed that unsustainable forest management practices and increasing human pressure on forest resources contribute to forest degradation, biodiversity loss and disruption of ecological processes. The country's forest resources face pressure from agricultural activities, timber exploitation and other forms of land-use change, which reduce the ability of forests to provide environmental services and socioeconomic benefits.

Boki Local Government Area (LGA) in Cross River State is a relevant case for examining these processes because of its extensive rainforest, biodiversity and dependence on forest-related livelihoods. The area is part of the wider Cross River rainforest landscape, which contains habitats and species of conservation significance. The Okwangwo landscape, within the Cross River National Park, supports tropical moist forest and species including the Cross River gorilla, forest elephant, chimpanzee and drill (UNESCO, 2020). Because of this ecological significance, changes in forest condition have direct consequences for biodiversity conservation and resource management. Historically, forests in Boki have provided communities with timber, non-timber forest products, agricultural land and other resources. Forest-dependent communities obtain food, medicinal plants, fruits and other materials from the forest, while agriculture remains a major livelihood activity. Recent research confirms the importance of cocoa production to small-scale farmers in Boki LGA, with farm resources, labour, planting materials and capital influencing cocoa production (Oniah et al., 2024). The presence of commercially valuable rainforest tree species within cocoa plantations also points to the close relationship between agricultural production and the remaining forest resources of Boki (Offiong et al., 2025).

Forest degradation in Boki is tied to increasing pressure on land and forest resources. Agricultural expansion, particularly cocoa production, can involve the modification or clearing of forest vegetation, while timber extraction and other forest-resource activities may alter forest structure and composition. A recent study in Boki and other cocoa-producing areas of Cross River State identified numerous commercially valuable rainforest tree species within cocoa plantations, indicating that cocoa landscapes can retain substantial tree resources while also reflecting changes from natural forest conditions (Offiong et al., 2025). Recent research on forest-resource utilisation in Boki has also emphasised the importance of community participation in protecting remaining forest resources (Kujoh et al., 2025). Reports of growing concern about forest loss in Cross River State reflect these pressures. The Cross-River State Government raised concerns in 2024 about activities contributing to forest depletion and called for sustainable environmental practices and greater cooperation among stakeholders in protecting the state's forest resources (Cross River State Government, 2024). This concern is relevant to Boki because of the LGA's location within one of Nigeria's most significant rainforest and biodiversity landscapes.

The consequences of forest degradation and deforestation go beyond the reduction of tree cover. Loss and deterioration of forest vegetation can affect biodiversity, soil quality, water regulation, carbon storage and the availability of forest products. For communities whose livelihoods depend on agriculture and forest resources, continued forest degradation can also affect food security and household income. Evidence from Boki indicates that communities depend on forest products for food and livelihood, while agricultural production, especially cocoa farming, is a major component of the local economy (Oniah et al., 2024; UNESCO, 2020).

The future management of Boki's forest environment requires greater attention to conservation, sustainable agriculture, agroforestry, community participation and effective forest management. Recent research in Boki has identified agroforestry and afforestation as possible approaches for improving sustainable forest-resource management in the LGA (Agomobi & Ambe, 2025). These approaches can maintain tree cover while supporting agricultural production and reducing pressure on natural forests. However, despite the recognized importance of forests for sustaining ecological balance, supporting biodiversity and providing sources of livelihoods, the specific effects of deforestation on Boki's local environment and communities have not been extensively studied. The primary problem this research will address is the need to understand the comprehensive (environmental, socioeconomic, cultural and policy/management) impacts of deforestation in Boki Local Government Area. Understanding the changes in forest cover and their consequences on ecosystem services is critical for assessing the broader environmental implications.

2. Material and Methods

2.1 Study Area

Boki Local Government Area (LGA) is in Cross River State, Nigeria, in the southern part of the country within the South-South geopolitical zone. It is bordered by Ikom and Etung Local Government Areas within Cross River State and shares an international boundary with the Republic of Cameroon to the east. The LGA sits approximately between latitude 6.25° N and longitude 9.03° E, placing it within the tropical rainforest belt of southeastern Nigeria. Its location and climate produce the dense forest vegetation and ecological diversity the area is known for (Cross River State Government, 2025; UNESCO, 2020). Figure 1.

Boki LGA was created on 28 August 1991. The area is known for agricultural and forest-based economic activities, particularly cocoa, coffee, timber and palm products. Cocoa production matters to rural livelihoods here, where small-scale farmers depend on land, labour, farm inputs

and other resources (Oniah et al., 2024). Research has also found commercially valuable rainforest tree species within cocoa plantations in Cross River State, showing that agricultural production and forest resources remain closely linked in practice (Offiong et al., 2025).

Like other local government areas, Boki has cultural traditions and social practices that distinguish its communities. Traditional dressing, festivals, communal activities and social gatherings shape the cultural identity of the people. Major cultural activities include the Boki New Yam Festival, Irruan cultural activities, Edien Festival, Borum Festival and cassava-related celebrations, with music and traditional performances accompanying these occasions. These practices, passed down across generations, form the social context within which agricultural and natural-resource activities take place (Boki Local Government Council, 2025). The people of Boki maintain a social lifestyle built around inter-village cultural activities, age-grade meetings, burial ceremonies, communal farming and other forms of interaction. Traditional markets such as Okundi, Ntamarte, Kakwagom and Wula serve as centres for exchanging agricultural produce, forest products and other goods, supporting local economic activity (Cross River State Government, 2025). Agriculture remains the backbone of the local economy, and cocoa is a major livelihood for small-scale farmers. Oniah et al. (2024) reported that the use of farm resources is closely associated with cocoa production among small-scale farmers in Boki LGA.

The forest vegetation of Boki provides habitats for wildlife and gives the area its ecological significance. The Okwangwo Division of Cross River National Park is part of the wider forest landscape of Boki and the Nigeria–Cameroon rainforest region, supporting tropical moist forest and diverse plant and animal species, including the Cross River gorilla, forest elephant, chimpanzee and drill. Okwangwo stands out for its relatively intact forest ecosystems and the presence of species of high conservation importance (UNESCO, 2020). The forest also supplies timber and non-timber products medicinal plants, fruits, rattan and other materials that surrounding communities rely on, while performing ecological functions such as soil protection and maintenance of water resources (UNESCO, 2020).

But agricultural activity and forest-resource use are placing growing pressure on the natural vegetation. The presence of commercially valuable rainforest tree species within cocoa plantations shows how forest and agricultural land use are shifting in relation to each other (Offiong et al., 2025). Boki's position within the wider Cross River rainforest and the Nigeria–Cameroon transboundary landscape adds to its ecological relevance: the area contains forest habitats that support biological diversity and threatened wildlife, with Okwangwo in particular recognised for its biodiversity value (UNESCO, 2020). The mix of natural forest, agricultural land and human settlements means that changes in land use carry real environmental and socioeconomic consequences.

These features make Boki LGA a fitting setting for assessing the extent of land degradation resulting from deforestation. The LGA combines extensive forest resources, biodiversity conservation areas, agricultural production and communities whose livelihoods depend on land and forest resources. Cocoa production, forest-product use and the presence of valuable rainforest species all illustrate how closely human activities and the natural environment are connected here (Oniah et al., 2024; Offiong et al., 2025; UNESCO, 2020). Changes in forest cover and their effects on vegetation, soil, biodiversity, water resources and agricultural land make Boki a relevant area for investigating land degradation associated with deforestation.

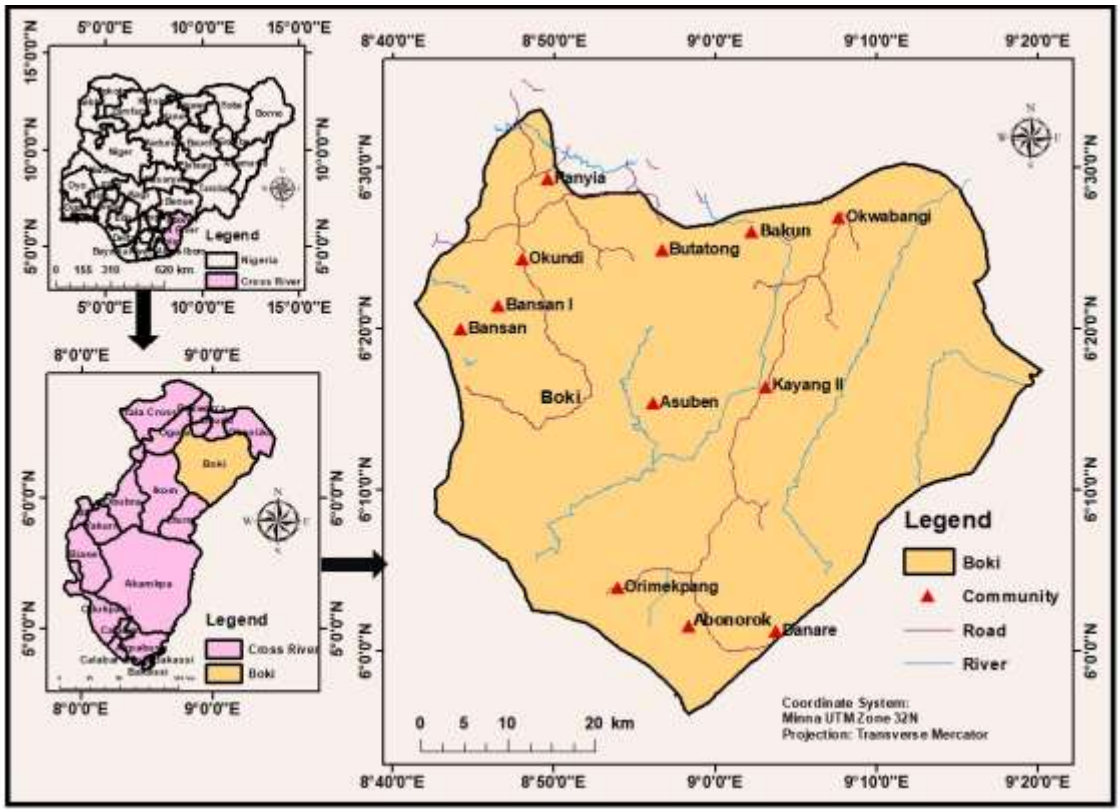


Figure 1: Map of Cross River State showing the Study Area

2.2 Methodology

Research Design

The study adopted a descriptive survey research design to examine the effects of forest degradation on livelihoods and biodiversity in Boki Local Government Area of Cross River State, Nigeria. This design was considered appropriate because it enabled the researcher to obtain information directly from residents concerning their dependence on forest resources, the income derived from forest products, and the environmental changes associated with forest degradation. The design also provided an opportunity to assess respondents' experiences and observations regarding changes in biodiversity, soil fertility, rainfall patterns, soil erosion, and the availability of streams and rivers within the study area. The study employed a quantitative approach, using structured questionnaires to collect data from respondents. The questionnaire gathered information on the types of forest products utilized, including fruits, vegetables, timber, honey, rope, and medicinal plants, as well as the average monthly income derived from forest resources. It also obtained respondents' assessments of environmental changes attributed to forest degradation, using a five-point rating scale ranging from very high to not at all. A total of 300 respondents participated in the survey, while 294 valid cases were used for the chi-square analysis of the relationship between forest degradation and livelihoods. Data collected were analysed using descriptive and inferential statistical techniques. Frequencies and percentages were used to summarize respondents' utilization of forest products, monthly income levels, and assessments of environmental changes. The chi-square test of independence was employed to examine the statistical relationship between forest degradation and livelihoods, with the level of significance set at 0.05. The findings provided an empirical basis for understanding the socioeconomic and environmental implications of forest

degradation in Boki Local Government Area and for identifying the need for sustainable forest resource management and biodiversity conservation.

3. Results and Discussion

Effect of Forest degradation on Livelihoods

The results presented in Table 4.1 show that forest resources constitute an important source of livelihood for residents of Boki Local Government Area. Among the forest products utilized by the respondents, fruits recorded the highest frequency of utilization with 89 respondents (29.7%), followed by vegetables and timber, each accounting for 81 respondents (27.0%). Medicinal plants were utilized by 31 respondents (10.3%), while honey and rope accounted for 12 respondents (4.0%) and 6 respondents (2.0%), respectively. These findings indicate that the livelihoods of many households are closely linked to the availability of forest resources, particularly edible products, timber, and medicinal plants. Consequently, continued forest degradation threatens household food security, income generation, healthcare, and the supply of raw materials that many rural communities depend upon for their daily survival. Similar findings have been reported by the Food and Agriculture Organization (FAO, 2024), which noted that millions of rural households in developing countries rely on forests for food, fuel, medicine, and income, making forest degradation a direct threat to sustainable livelihoods. The dominance of fruits, vegetables, timber, and medicinal plants among the utilized forest products further suggests that degradation of forest ecosystems could have widespread socioeconomic consequences in the study area. As forest cover declines, the availability of these products is expected to decrease, compelling households to travel longer distances, incur higher costs, or seek alternative livelihood sources. Reduced access to timber may also affect local construction and wood-based enterprises, while the decline in medicinal plants could undermine traditional healthcare practices that remain important in many rural communities. The relatively low utilization of honey and rope does not diminish their economic importance, as they provide supplementary income for a segment of the population. These findings are consistent with the United Nations Environment Programme (UNEP, 2024), which emphasized that forest degradation reduces the availability of ecosystem goods and services that support rural livelihoods. Likewise, recent studies by Oranu et al. (2022) and Adelesi et al. (2024) found that increasing forest degradation in southern Nigeria has significantly affected the availability of non-timber forest products, reduced household incomes, and weakened the resilience of forest-dependent communities. Together, these findings underscore the need for sustainable forest management and conservation measures to protect both the ecological integrity of forests and the livelihoods of communities that depend on them.

. **Table 4.1: Utilization of Forest Resources by the Respondents**

Forest Products	Frequency	Percentage
Vegetables	81	27
Fruits	89	29.7
Honey	12	4
Timber	81	27
Rope	6	2.0
Medicinal plants	31	10.3
Total	**300**	**100**

Source: Field Survey (2025)

Similarly, Figure 4.1 shows the average monthly income derived from the forest products by the respondents. There were variations in the level of income they derive from the forest resources from between 0 to N20,000 to above N100,000. The result shows that about 31% of the respondents earned between N41,000 to N60,000 while about 29% generated between N61,000 to N80,000 with less than 5% that generated above N100,000. These results show that on the average, the inhabitants of Boki LGA who depend on the forest for their livelihoods can generate a monthly average income that is equivalent to national minimum wage of N75,000.

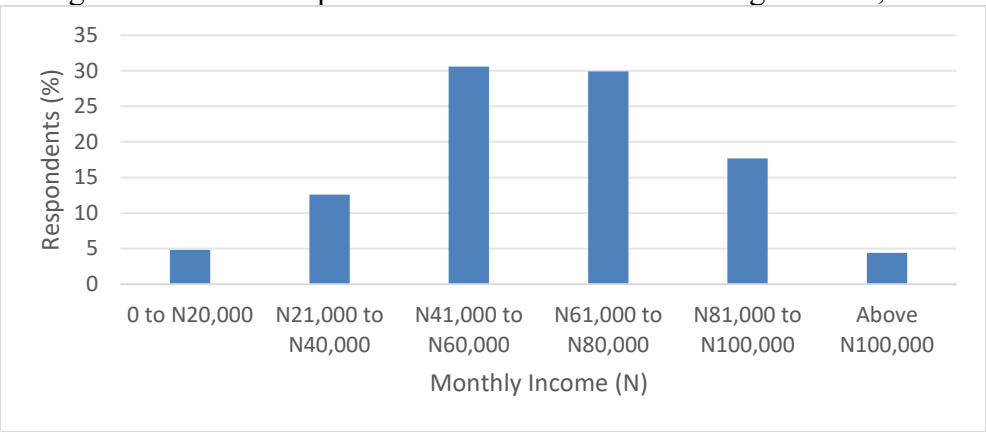


Figure 4.1: Average monthly income derived from the forest by the respondents
Source: Field Survey (2025)

Chi-square result of the effect of forest degradation on livelihoods

Table 4.2 show that forest degradation is significantly associated with the livelihoods of residents in Boki Local Government Area, Cross River State. The Pearson chi-square value of 209.436, with 30 degrees of freedom and a p-value of less than 0.001, indicates a statistically significant relationship between forest degradation and the livelihoods of the respondents. The likelihood ratio of 182.206, which is also significant at $p < 0.001$, further supports this finding. This result reflects the important role forests play in the daily lives of people in Boki, where many households depend on forest products such as fruits, vegetables, timber, honey and medicinal plants for food, income and other domestic needs. When these resources become scarce because of forest degradation, households may find it more difficult to meet their daily needs and maintain their sources of income. This finding agrees with the Food and Agriculture Organization (FAO, 2024), which highlighted the contribution of forests to rural livelihoods, food security and household income. Similarly, the United Nations Environment Programme (UNEP, 2024) emphasized that environmental degradation threatens the natural resources on which many rural communities depend. These findings demonstrate that forest degradation in Boki is not only an environmental problem but also a concern for the economic well-being of households whose livelihoods depend on the continued availability of forest resources.

Although the Pearson chi-square result indicates a significant relationship, the Linear-by-Linear Association produced a value of 1.080 and a p-value of 0.299, showing that a statistically significant linear trend was not established. This means that the relationship should not be interpreted as proof that increasing forest degradation always leads to a corresponding increase in livelihood effects in a consistent direction. Nevertheless, the overall result highlights the close connection between forest resources and the livelihood activities of the respondents. Research on forest-dependent communities in Cross River State has also highlighted the importance of forest

resources to local livelihoods and the need to address pressures arising from unsustainable resource use. Recent research on forest conservation in the state has further drawn attention to the importance of sustainable resource management and community participation in protecting forest ecosystems. For residents of Boki, protecting the forest is therefore important not only for conserving plants and wildlife but also for sustaining the resources that support household income and everyday living. Encouraging tree planting, agroforestry, controlled harvesting of forest products and alternative income-generating activities would help reduce pressure on forests while allowing local people to continue benefiting from the resources around them.

Table 4.2: Chi-square result of the effect of forest degradation on livelihoods of the respondents

	Value	Df	Asymptotic Significance (2-sided):	p-value
Pearson Chi-Square	209.436[a]	30	.000	
Likelihood Ratio	182.206	30	.000	
Linear-by-Linear Association	1.080	1	.299	
N of Valid Cases	294			

Source: Field Survey (2025)

The Effect of Forest Degradation on Biodiversity in the Study Area

The results presented in Table 4.3 show that biodiversity loss was the most noticeable environmental change associated with forest degradation in Boki Local Government Area, Cross River State. A total of 268 (89.6%) respondents rated biodiversity loss as high, 12 (4.0%) rated it very high, while 14 (4.7%) considered it moderate. This finding indicates that most respondents had observed a considerable decline in the variety of plants and animals within their environment. Forest degradation through logging, agricultural expansion, fuelwood collection and other human activities can destroy natural habitats, reduce food sources for wildlife and threaten the survival of different species. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2024), changes in land use and habitat destruction remain important drivers of biodiversity loss worldwide. Similarly, the Food and Agriculture Organization (FAO, 2024) emphasized the role of forests in conserving biodiversity and maintaining ecological balance. In Boki, the high proportion of respondents who reported biodiversity loss raises concerns about the continued availability of forest plants, wildlife and other resources that support local livelihoods. Although the findings reflect respondents' observations rather than direct measurements of changes in species populations, they provide important evidence of local concern about the ecological consequences of forest degradation.

Table 4.3: Respondents' response to environmental changes attributed to forest degradation activities

Activity	Rating	Frequency	Percentage
Biodiversity loss	Very high	12	4.0
	High	268	89.6
	Moderate	14	4.7
	Low	0	0.0
	Not at all	0	0.0
Loss of soil fertility	Very high	0	0.0
	High	1	0.3
	Moderate	211	70.6
	Low	82	27.4
	Not at all	0	0.0
Soil erosion	Very high	0	0.0
	High	0	0.0
	Moderate	47	15.7
	Low	247	82.6
	Not at all	0	0.0
Changes in rainfall pattern	Very high	0	0.0
	High	56	18.7
	Moderate	208	69.6
	Low	30	10.0
	Not at all	0	0.0
Drying of streams/rivers	Very high	0	0.0
	High	51	17.1
	Moderate	170	56.9
	Low	73	24.4
	Not at all	0	0.0
Land degradation	Very high	0	0.0
	High	3	1.0
	Moderate	185	61.9
	Low	104	34.8
	Not at all	2	0.7

Source: Field Survey (2025)

The results further show that respondents observed changes in soil fertility, rainfall patterns, water availability and land conditions, although the severity of these changes varied. Loss of soil fertility was rated moderate by 211 (70.6%) respondents, while 82 (27.4%) rated it low. Similarly, 247 (82.6%) respondents rated soil erosion as low, compared with 47 (15.7%) who considered it moderate. Changes in rainfall patterns were rated moderate by 208 (69.6%) respondents and high by 56 (18.7%). Regarding the drying of streams and rivers, 170 (56.9%) respondents reported a moderate effect, while 51 (17.1%) rated it high. Land degradation was also rated moderate by 185 (61.9%) respondents, while 104 (34.8%) considered it low. These findings indicate that, alongside biodiversity loss, residents are concerned about changes in the natural environment that may affect

farming, water supply and other livelihood activities. Research by Akwaji et al. (2024) on forest tree species diversity and distribution in Cross River State highlights the importance of environmental conditions in sustaining forest diversity. Similarly, Itu et al. (2025) examined forest degradation associated with timber exploitation in Cross River State and emphasized the need for stronger forest protection and community-based conservation. These findings reinforce the importance of tree planting, sustainable farming, controlled timber harvesting and community participation in forest conservation in Boki LGA.

Overall, the findings suggest that forest degradation poses a considerable environmental concern in Boki, particularly in relation to biodiversity loss, changes in rainfall patterns and the availability of water resources. The fact that 268 (89.6%) respondents rated biodiversity loss as high, compared with 208 (69.6%) who reported moderate changes in rainfall patterns and 170 (56.9%) who reported moderate drying of streams and rivers, indicates that biodiversity loss was the most widely recognized environmental effect. However, these percentages represent respondents' assessments and should not be interpreted as direct measurements of ecological change or proof that forest degradation alone caused all the observed changes. The findings nevertheless agree with the broader environmental concerns discussed by the United Nations Environment Programme (UNEP, 2024) regarding the consequences of ecosystem degradation for biodiversity and the services that nature provides to human communities. Therefore, effective forest management in Boki should focus on protecting remaining forest areas, restoring degraded land, reducing unsustainable tree felling and encouraging local communities to participate in conservation activities. These measures would help preserve plant and animal habitats while maintaining the soil, water and forest resources required for the well-being of present and future generations.

The results show that degradation activities have varied degree of effects on the environmental elements as illustrated in Figure 4.2. These results show that biodiversity loss is the most significant environmental impact of forest degradation with 89.6% High rating, indicating that plants and animal lives are heavily affected. On the other hand, loss of soil fertility (0.3%), soil erosion (0.0%) and land forest degradation (1.0%) are relatively minimal in this perspective which is suggestive of either under reporting or that these effects are less recognized in the area. However, change in rainfall pattern (18.7%) and drying of streams/rivers (17.1%) are also notable; highlighting that forest degradation may be disrupting the local water cycles.

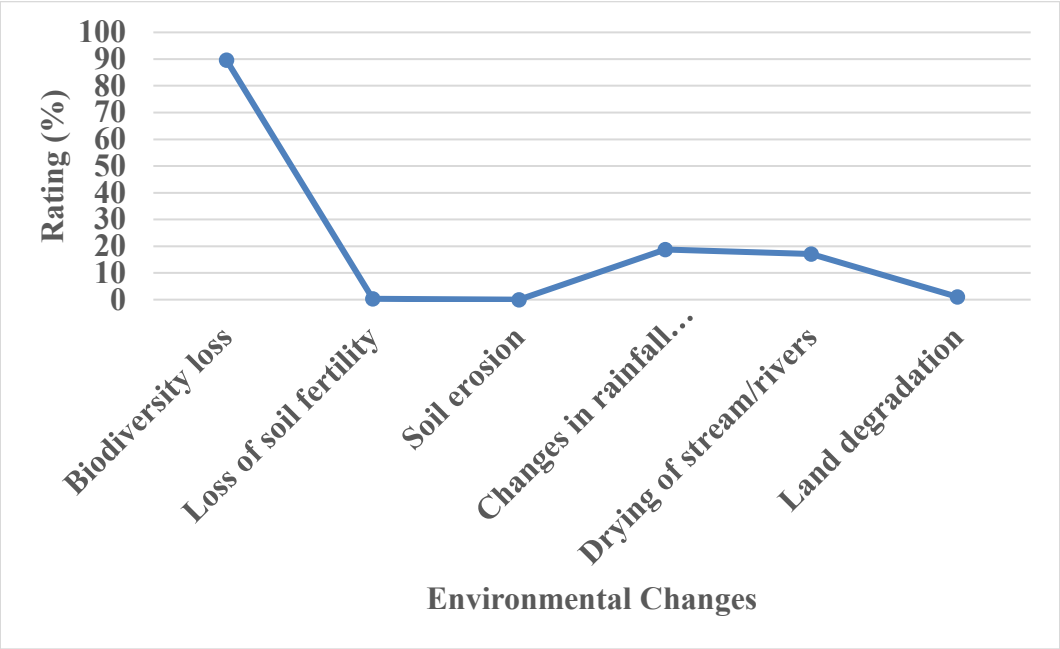


Figure 4.2: Environmental Changes Attributed to Forest Degradation Activities
Source: Researcher Analysis; 2025

4 Conclusion

The study examined the effects of forest degradation on livelihoods and biodiversity in Boki Local Government Area of Cross River State, Nigeria. The findings showed that forest resources provide important sources of food, income and other household needs. Fruits, vegetables and timber were the most commonly used products, highlighting the importance of forests to the livelihoods of local residents. The analysis also revealed a significant relationship between forest degradation and livelihoods ($\chi^2 = 209.436$, $p < 0.001$).

The study further found that biodiversity loss was the most widely reported environmental effect, with 268 (89.6%) respondents rating it as high. Other reported effects included changes in rainfall patterns, reduced soil fertility, drying of streams and rivers, and land degradation. The study therefore concludes that protecting forests and restoring degraded areas are essential for conserving biodiversity and sustaining the livelihoods of communities in Boki LGA.

5. Recommendations

i. Strengthen forest protection: The government and forestry authorities should monitor forest activities and control illegal logging and unsustainable tree felling.

ii. Promote alternative livelihoods: Residents should be encouraged to engage in beekeeping, agroforestry, fruit cultivation and the sustainable processing of forest products to reduce pressure on forests.

iii. Encourage tree planting: Communities and government agencies should plant trees and restore degraded forest areas to support biodiversity and improve environmental conditions.

iv. Involve local communities: Traditional leaders, farmers, women and young people should participate in forest conservation decisions and environmental awareness programmes.

v. Promote sustainable forest use: Residents should be educated on responsible harvesting practices, while further studies should assess changes in forest cover and biodiversity over time.

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