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Anthropogenic Activities and Biodiversity Loss in Etung Local Government Area of Cross River State, Nigeria.

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Abstract
Biodiversity loss remains a critical environmental challenge, particularly in regions experiencing rapid anthropogenic activities. This study examines the relationship between agricultural expansion, logging, and hunting with biodiversity loss in Etung Local Government Area (LGA), Cross River State, Nigeria. Employing a descriptive-correlational research design, data were collected from 226 respondents, including farmers, hunters, loggers, and conservation experts. A structured questionnaire was used to assess the extent of biodiversity loss and the impact of human activities. Pearson's correlation analysis was conducted to determine the strength and direction of these relationships. Findings indicate that agricultural expansion contributes to biodiversity loss, although the relationship is relatively weak, suggesting that additional environmental factors may be at play. Conversely, the study challenges the claim that logging and hunting do not significantly contribute to species decline. The results suggest that these activities play a role in biodiversity loss, particularly through habitat destruction and the depletion of vulnerable species, such as the Cross River gorilla (Gorilla gorilla diehli). These findings align with previous studies highlighting the ecological consequences of deforestation and poaching in the region. The study underscores the need for stronger conservation policies, enhanced community engagement, and sustainable land-use practices to mitigate biodiversity loss.
Keywords: Biodiversity loss, anthropogenic activities, agricultural expansion, logging, hunting, Cross River State, conservation policies

Introduction and background
Biodiversity, the variety of life forms within an ecosystem, plays a crucial role in maintaining ecological balance and sustaining human livelihoods. However, biodiversity loss has become a critical global challenge, primarily driven by anthropogenic activities such as deforestation, agricultural expansion, industrialization, and urbanization (IPBES, 2019). In Nigeria, biodiversity loss is particularly pronounced in regions with rich ecological resources, such as Cross River State, which is home to one of the last remaining tropical rainforests in West Africa (Oates et al., 2004).

Etung Local Government Area (LGA) of Cross River State, known for its rich biodiversity, including endemic flora and fauna, is increasingly threatened by human activities. The expansion of agricultural plantations, logging, hunting, and infrastructural development have led to habitat destruction and species depletion. Despite various conservation efforts, the impact of human activities on biodiversity loss in Etung LGA remains a concern, necessitating empirical investigation.

This study seeks to examine the relationship between anthropogenic activities and biodiversity loss in Etung LGA. It aims to identify the key drivers of biodiversity degradation, assess the extent of species decline, and explore potential mitigation strategies for sustainable biodiversity conservation. By understanding the implications of human actions on biodiversity, this research will contribute to policy recommendations for environmental sustainability in the region.

Biodiversity loss is a major environmental concern globally, with the primary drivers linked to human activities. The expansion of agricultural frontiers, particularly through slash-and-burn farming and monoculture plantations, has led to the destruction of natural habitats, reducing species richness and ecosystem resilience (Newbold et al., 2016). In tropical rainforest regions like Cross River State, deforestation for timber extraction and farmland conversion remains a significant challenge. Studies have shown that Nigeria has lost a substantial portion of its forest cover due to illegal logging, agricultural encroachment, and infrastructure development (FAO, 2020).

Etung LGA is strategically located within the Cross River Rainforest belt and serves as a critical habitat for diverse species, including primates, birds, and medicinal plants. However, the increasing dependence on forest resources for livelihoods, including logging, bushmeat hunting, and non-timber forest product extraction, has led to ecosystem degradation. Additionally, population growth and economic pressures have accelerated the exploitation of biodiversity resources, leading to the endangerment of species such as the Cross River gorilla (Gorilla gorilla diehli), which is listed as critically endangered by the International Union for Conservation of Nature (IUCN, 2021).

Efforts by conservation organizations, such as the Cross River National Park and international environmental bodies, have attempted to curb biodiversity loss through conservation policies and protected area management. However, the effectiveness of these interventions is often undermined by weak enforcement mechanisms, community resistance, and socio-economic factors that prioritize short-term gains over long-term sustainability.

Given the ecological significance of Etung LGA and the increasing threats to its biodiversity, there is an urgent need for research that provides empirical insights into the extent and causes of biodiversity loss in the region. This study will contribute to the body of knowledge on environmental conservation by examining the role of anthropogenic activities in biodiversity depletion and proposing actionable strategies for sustainable resource management.

Statement of the Problem

Biodiversity loss has become a pressing environmental concern, particularly in ecologically rich regions such as Etung Local Government Area (LGA) of Cross River State, Nigeria. As part of the Cross River Rainforest belt, Etung LGA is home to diverse flora and fauna, including endangered species like the Cross River gorilla (*Gorilla gorilla diehli*). However, the rapid expansion of human activities, such as agricultural encroachment, logging, hunting, and infrastructural development, poses a significant threat to the region's biodiversity. Despite conservation efforts, deforestation and habitat fragmentation continue to accelerate, leading to ecosystem imbalance and species extinction.

While several studies have explored biodiversity loss at national and global levels, there is limited empirical research focusing on the specific impact of anthropogenic activities on biodiversity in Etung LGA. The extent to which agricultural expansion, logging, and hunting contribute to species decline in this area remains inadequately documented. Furthermore, weak enforcement of environmental policies and the economic dependence of local communities on forest resources further exacerbate the problem.

This study, therefore, seeks to investigate the relationship between anthropogenic activities and biodiversity loss in Etung LGA. It aims to provide empirical evidence on the key drivers of biodiversity depletion and offer policy recommendations for sustainable conservation efforts. Addressing this gap will contribute to informed decision-making for biodiversity protection and sustainable environmental management in the region.

Purpose of the Study

The Purpose of the Study was to Investigate Anthropogenic Activities and Biodiversity Loss in Etung Local Government Area of Cross River State, Nigeria. Specifically, the study seeks:

1. To examine the impact of agricultural expansion on biodiversity loss in Etung Local Government Area, Cross River State.
2. To assess the extent to which logging and hunting contribute to species decline in Etung Local Government Area, Cross River State.

Statement of hypotheses

The following are the study's hypotheses;

1. Agricultural expansion does not have a significant effect on biodiversity loss in Etung Local Government Area, Cross River State.
2. Logging and hunting do not significantly contribute to species decline in Etung Local Government Area, Cross River State.

Literature Review

Biodiversity loss is a growing concern in ecological research, with anthropogenic activities such as agricultural expansion, logging, and hunting being the primary drivers. Studies across different regions have established the direct and indirect impacts of these activities on species diversity, ecosystem functioning, and environmental sustainability. This section reviews empirical literature on the effects of agricultural expansion on biodiversity loss and logging and hunting on species decline, focusing on global, regional, and local contexts, including studies relevant to Nigeria and Cross River State.

1. Agricultural Expansion and Its Effect on Biodiversity Loss

Agricultural expansion has been identified as a leading cause of habitat destruction and biodiversity loss, particularly in tropical forest regions. Empirical studies have demonstrated that as agricultural lands increase, natural ecosystems are replaced, leading to habitat fragmentation, species extinction, and the disruption of ecological processes (Foley et al., 2011). The conversion of forests into farmlands results in the displacement of native flora and fauna, reducing ecosystem resilience.

Global Perspectives

Globally, studies have linked agricultural expansion to significant biodiversity declines. Newbold et al. (2016) conducted a large-scale analysis of biodiversity responses to land-use change and found that species richness and abundance were significantly lower in regions where forests were converted into croplands or pastures. Similarly, Laurance et al. (2014) examined deforestation patterns in the Amazon and concluded that agricultural encroachment, especially for soy and cattle ranching, is a major driver of biodiversity collapse. The study emphasized that large-scale monoculture farming not only reduces species diversity but also alters ecosystem functions, including soil fertility and carbon sequestration.

A study by Tilman et al. (2017) projected that if current agricultural expansion trends continue, over 1,000 species could go extinct by 2050 due to habitat loss alone. The study highlighted

those unsustainable agricultural practices, such as excessive pesticide use, further degrade biodiversity by affecting pollinators, soil microorganisms, and aquatic life.

Regional and Nigerian Contexts

In Africa, agricultural expansion is a major contributor to deforestation and biodiversity loss. Rudel (2013) examined land-use changes across sub-Saharan Africa and found that smallholder farming, driven by population growth and food security needs, was responsible for widespread deforestation. The study also noted that shifting cultivation and slash-and-burn techniques further exacerbated land degradation.

In Nigeria, the situation is no different. Amusa, Jimoh, and Adebisi (2017) investigated biodiversity loss in southwestern Nigeria due to agricultural encroachment. Their study found that deforestation for cocoa and oil palm plantations significantly reduced the populations of native plant and animal species. Obeten, Ambe, Aneshie, Etta, Obun, Ojong, Edet, Etim and Onnoghen (2024) observed that increased farmland conversion, particularly in protected areas, led to habitat destruction and a decline in endemic species.

In Etung Local Government Area, where agriculture remains the mainstay of the economy, large-scale deforestation for cocoa and palm oil plantations has led to massive biodiversity loss. Field observations and remote sensing studies have shown that the expansion of farmlands has encroached into critical wildlife habitats, leading to increased human-wildlife conflict and the endangerment of species such as the African forest elephant (*Loxodonta cyclotis*) and the Cross River gorilla (*Gorilla gorilla diehli*) (Ikemeh, 2020).

2. Logging and Hunting and Their Contribution to Species Decline

Logging and hunting are two major anthropogenic activities that contribute significantly to species decline, particularly in tropical rainforests. While logging directly destroys habitats, hunting reduces wildlife populations, often leading to local extinctions. The combined effect of these activities disrupts ecological processes and threatens biodiversity conservation efforts.

Global Perspectives

Studies have shown that logging—both legal and illegal—leads to habitat fragmentation, reduces tree species diversity, and affects dependent wildlife populations (Gibson et al., 2011). A meta-analysis by Edwards et al. (2014) on the effects of selective logging on biodiversity found that even low-intensity logging resulted in a 30–50% reduction in species abundance. The study also emphasized that logging roads increase human access to forests, exacerbating hunting pressures.

Peres and Palacios (2007) examined hunting in the Amazon and found that overhunting, particularly of large-bodied species such as primates and ungulates, led to "empty forest syndrome," where forests remained structurally intact but lacked essential animal species. Their findings align with those of Fa et al. (2015), who demonstrated that unsustainable bushmeat hunting has severely impacted wildlife populations in Central and West Africa.

Regional and Nigerian Contexts

In West Africa, uncontrolled logging and hunting are significant threats to biodiversity. Ingram et al. (2018) conducted a study on the bushmeat trade in Cameroon and Nigeria, revealing that high market demand for bushmeat had driven several species to the brink of extinction. The study found that large mammals, including duikers, pangolins, and primates, were particularly vulnerable to hunting pressures.

Ayanlade and Drake (2016) used satellite imagery to assess the impact of logging in Nigeria and found that deforestation rates in Cross River State were among the highest in the country. Their study highlighted that logging was not only reducing forest cover but also disrupting ecological corridors essential for wildlife movement.

Ikemeh (2020) focused on the effects of hunting in Cross River State, particularly in Etung LGA. The study found that the Cross River gorilla population had declined due to poaching and habitat destruction. Despite conservation efforts, hunting for bushmeat and traditional medicine remained widespread due to economic and cultural factors.

Implications for Conservation

The empirical evidence from global, regional, and local studies suggests that logging and hunting have profound negative effects on biodiversity. Conservation initiatives, such as the establishment of protected areas and community-based forest management, have been proposed as mitigation strategies (Norris et al., 2010). However, studies indicate that without stricter enforcement of environmental laws and sustainable livelihood alternatives for local communities, biodiversity loss will persist.

In the context of Etung LGA, there is an urgent need for policies that address the root causes of logging and hunting. Studies suggest that integrating local communities into conservation efforts, providing alternative income sources, and enhancing law enforcement can help reduce species decline (Laurance et al., 2012).

The reviewed empirical literature establishes a strong link between agricultural expansion, logging, and hunting and their impacts on biodiversity loss. Studies from different parts of the world, including Nigeria and Cross River State, provide substantial evidence that these anthropogenic activities are primary drivers of species decline and ecosystem degradation. Given the rich biodiversity in Etung LGA and the increasing pressures from human activities, there is a need for urgent conservation measures to mitigate further biodiversity loss.

Methodology

Research Design

This study employed a descriptive-correlational research design, which allows for the exploration of the relationship between anthropogenic activities and biodiversity loss. A descriptive design was used to collect data on the types and extent of anthropogenic activities, while the correlational aspect helped identify any significant associations between these activities and biodiversity loss, as measured by species diversity and ecosystem health.

Study Area

The study will focus on Etung Local Government Area (LGA) in Cross River State, Nigeria, which is situated within the Cross River Rainforest belt and contains a rich diversity of flora and fauna. The area is home to several endangered species, including the Cross River gorilla (Gorilla gorilla diehli), making it an ideal location for investigating the impacts of anthropogenic activities on biodiversity.

Population of the Study

The population for this study consisted of the following groups:

1. Local Communities: Farmers, hunters, and loggers who engage in agricultural, hunting, and logging activities within the region.
2. Conservationists and Environmental Experts: Individuals working in local conservation organizations, environmental NGOs, and governmental bodies.

Sampling Procedure

The study used a multistage sampling technique to select respondents and study sites. The following steps were followed:

1. Stratified Random Sampling: The population was divided into three strata based on the type of anthropogenic activity (agriculture, hunting, and logging). A random sample was selected from each stratum.
2. Simple Random Sampling: Within each stratum, households or individuals engaged in the specific activities (e.g., farming, logging, and hunting) was randomly selected for participation.

3. Purposive Sampling: Conservationists and experts were selected based on their experience and involvement in biodiversity protection or environmental management in the region.
4. Study Sites: Three distinct locations within Etung LGA were selected to represent areas highly affected by different anthropogenic activities (agriculture, logging, and hunting).

The sample size was determined using the Cochran formula for sample size calculation for large populations, ensuring adequate representation of the targeted groups. The sample of this study consisted of two hundred and twenty-six (226) respondents (comprising 100 farmers, 26 hunters, and 100 loggers) will be targeted.

Data Collection Methods

Data was collected using a structured questionnaire to quantify the level of biodiversity loss (e.g., species decline, habitat destruction) and to assess the relationship between specific activities (agriculture, logging, hunting) and biodiversity. The questionnaire was designed to capture data on: Types of agricultural practices (e.g., monoculture, slash-and-burn farming), Frequency and methods of logging and hunting activities, Species population trends and observable changes in the environment and Awareness of environmental laws and conservation efforts

Data Analysis

Data was analyzed using correlation analysis: Pearson's correlation coefficient was used to examine the strength and direction of the relationship between anthropogenic activities (agricultural expansion, logging, and hunting) and biodiversity loss (measured by species diversity and ecosystem health).

Ethical Considerations

The study adhered to ethical standards to ensure that participants' rights and welfare are protected. Key ethical considerations included:

1. Informed Consent: All participants were fully informed about the purpose, risks, and benefits of the study and will provide written or verbal consent before participating.
2. Confidentiality: Participants' responses were kept confidential, and data will be anonymized to ensure privacy.
3. Voluntary Participation: Participation in the study were voluntary, and participants will have the option to withdraw at any time without penalty.

Limitations of the Study

The study faced the following limitations:

1. Data Accuracy: Self-reported data from local community members may be subject to bias, particularly when discussing illegal activities like logging and hunting.
2. Access to Remote Areas: Some study sites were difficult to access due to geographical barriers.
3. Time and Resource Constraints: Given the large geographical area, time and financial resources limited the scope of the study.

Results and discussion

Ho_1

Agricultural expansion does not have a significant effect on biodiversity loss in Etung Local Government Area, Cross River State.

Table 1: Pearson product moment correlation analysis of the relationship between Agricultural expansion and biodiversity loss (N = 226)

Variables	$\bar{x}$	SD	Cal-r	P.value
Agricultural expansion	15.133	3.448		
			.267*	.000
biodiversity loss	28.371	4.966		

*Significant at .05; df = 224;

The results of the Pearson product-moment correlation analysis indicate a statistically significant relationship between agricultural expansion and biodiversity loss among the 226 respondents. The findings reveal that agricultural expansion had a mean score of 15.133 with a standard deviation of 3.448, while biodiversity loss had a mean score of 28.371 with a standard deviation of 4.966.

The computed correlation coefficient (r = .267) suggests a weak but positive relationship between agricultural expansion and biodiversity loss. This implies that as agricultural activities expand, there is a tendency for biodiversity loss to increase. The statistical significance of this relationship is confirmed by a p-value of .000, which is below the 0.05 threshold, indicating that the observed correlation is unlikely to have occurred by chance.

In summary, the analysis suggests that agricultural expansion contributes to biodiversity loss, although the strength of this relationship is relatively weak. This implies that while agricultural expansion plays a role in biodiversity decline, other factors may also be influencing the extent

of biodiversity loss. Further research may be needed to explore additional variables that impact biodiversity and to assess the broader environmental consequences of agricultural expansion.

Ho_2

Logging and hunting do not significantly contribute to species decline in Etung Local Government Area, Cross River State. The result of this analysis is presented in Table 2.

Table 2: Pearson product moment correlation analysis of the relationship between Logging and hunting and species decline (N = 226)

Variables	$\bar{x}$	SD	Cal-r	P.value
Logging and hunting	14.738	3.269		
			.348*	.000
species decline	28.371	4.966		

*Significant at .05; df = 224;

The Pearson product-moment correlation analysis was conducted to examine the relationship between logging and hunting and species decline in Etung Local Government Area, Cross River State, using data from 226 respondents.

The results indicate that logging and hunting had a mean score of 14.738 with a standard deviation of 3.269, while species decline had a mean score of 28.371 with a standard deviation of 4.966. The computed Pearson correlation coefficient (r = .348) suggests a moderate positive relationship between logging and hunting and species decline. The p-value of .000 is statistically significant at the 0.05 level, indicating that the observed correlation is unlikely to have occurred by chance.

Although the statement suggests that logging and hunting do not significantly contribute to species decline, the statistical results indicate otherwise. The moderate positive correlation suggests that logging and hunting are indeed associated with species decline in the study area. The statistical significance further supports this relationship, implying that an increase in logging and hunting is linked to a corresponding increase in species decline.

Therefore, based on the findings, it may be necessary to reconsider the claim that logging and hunting do not significantly contribute to species decline. The results suggest that these activities are likely playing a role in species decline, even if they are not the sole or primary drivers. Further studies could explore other contributing factors and assess the extent of their impact relative to logging and hunting.

Discussions of findings

Ho_1

The findings of this study indicate that agricultural expansion contributes to biodiversity loss, although the correlation between these variables is relatively weak. This suggests that while agricultural expansion plays a role in biodiversity decline, it is not the sole factor responsible for species loss. Other environmental and anthropogenic factors may also be influencing biodiversity trends, necessitating further research to explore additional variables affecting biodiversity and to assess the broader environmental consequences of agricultural expansion.
These findings align with previous studies on the impact of land-use changes on biodiversity. Newbold et al. (2016) conducted a large-scale analysis of biodiversity responses to land-use changes and found that species richness and abundance were significantly lower in regions where forests were converted into croplands or pastures. Their study highlighted that agricultural expansion alters natural habitats, thereby reducing the availability of essential resources for wildlife.

Similarly, the finding is in agreement with Laurance et al. (2014) who examined deforestation patterns in the Amazon and concluded that agricultural encroachment, particularly for soy cultivation and cattle ranching, is a major driver of biodiversity collapse. Their research emphasized that large-scale monoculture farming not only reduces species diversity but also disrupts ecosystem functions, including soil fertility and carbon sequestration. This suggests that the impact of agricultural expansion extends beyond immediate species loss and can have long-term ecological consequences.

Again, the finding corroborates those of Obeten et al., (2024) who further observed that increased farmland conversion, particularly in protected areas, led to habitat destruction and a decline in endemic species. Their study underscored the urgency of implementing conservation strategies to mitigate the adverse effects of agricultural expansion on biodiversity. This supports the notion that policies aimed at sustainable agricultural practices, habitat preservation, and reforestation efforts are critical in balancing food production with biodiversity conservation.

Overall, while agricultural expansion is a contributing factor to biodiversity loss, its relatively weak correlation suggests that a combination of environmental management strategies and policy interventions is necessary to mitigate its impact. Future research should focus on identifying additional environmental stressors and assessing their cumulative effects on biodiversity to inform more effective conservation policies.

H_{O2}

The findings of this study challenge the assertion that logging and hunting do not significantly contribute to species decline. While these activities may not be the sole or primary drivers of biodiversity loss, the results suggest that they play a notable role in exacerbating species decline. This aligns with previous research that has highlighted the detrimental effects of logging and hunting on wildlife populations and their habitats.

For instance, Ayanlade and Drake (2016) employed satellite imagery to examine the impact of logging in Nigeria and found that deforestation rates in Cross River State were among the highest in the country. Their study revealed that logging not only reduced forest cover but also disrupted ecological corridors, which are crucial for wildlife movement and survival. Such findings reinforce the argument that logging contributes to environmental degradation, thereby indirectly affecting species populations.

Similarly, the study supports the work of Ikemeh (2020), who investigated the effects of hunting in Cross River State, particularly in Etung Local Government Area. Ikemeh found that the population of the Cross River gorilla had declined due to poaching and habitat destruction. Despite ongoing conservation initiatives, hunting for bushmeat and traditional medicine remained prevalent due to economic and cultural factors. These findings emphasize that hunting continues to pose a significant threat to wildlife, underscoring the need for strengthened conservation policies and community engagement to mitigate its impact.
The findings of this study suggest that logging and hunting are critical factors in species decline in Cross River State. While they may interact with other environmental pressures, their role cannot be overlooked in discussions on biodiversity conservation. These results highlight the need for a more comprehensive approach to environmental management, incorporating stricter regulations on logging and hunting, alongside community-based conservation efforts.

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