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Farming Practices and Biodiversity Degradation in Central Cross River State, Nigeria.

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Farming activities, tillage practices, harvest activities, post-harvest activities.

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Abstract

This study looked into the connection between Central Cross River State, Nigeria's farming practices and the decline of biodiversity. Two null hypotheses were developed and tested at the.05 level of significance in order to fulfil the objectives of this investigation. A review of related literature was conducted. The study used a correlational research design and selected 430 respondents for the sample using basic random sampling procedures and purposive sampling. Data for the study were gathered using a standardised questionnaire called the Farming Practices and Biodiversity Degradation Questionnaire (FPBDQ). A statistical tool called Pearson Product Moment correlation analysis was used to evaluate the data. The data analysis results showed that tillage techniques and biodiversity degradation in Central Cross River State were significantly correlated, however there was no significant correlation between harvest and postharvest activities and biodiversity degradation. Based on these results, it was suggested, among other things, that the government and other agricultural and environmental stakeholders support farming methods that reduce the loss of biodiversity, like zero-till land preparation. Modest crop management practices are necessary to prevent the loss of biodiversity.

Introduction and background

Farming activities, a cornerstone of rural economies, have significant environmental impacts, including biodiversity loss. Agriculture provides livelihoods and food security for many communities; however, its practices often come at the expense of environmental health. In Central Cross River State, Nigeria, the expansion of agricultural land and the intensification of farming practices have led to habitat destruction and a decline in species diversity. The conversion of forests to farmland reduces the available habitat for many species, resulting in the loss of both flora and fauna (Queiroz, Beilin, Folke & Lindborg, 2014).

This region, known for its rich biodiversity and dense tropical rainforests, faces severe ecological threats due to deforestation and unsustainable agricultural practices. The forests of Cross River State are home to numerous endemic and endangered species, including primates, birds, and a variety of plant species. However, the push for increased agricultural productivity has led to significant deforestation, which in turn exacerbates soil erosion, alters water cycles, and reduces carbon sequestration (Oljirra, 2019).

Unsustainable agricultural practices, such as slash-and-burn farming and the use of chemical fertilizers and pesticides, further degrade the environment by polluting water sources and soil, harming non-target species, and disrupting ecological balance. These practices not only threaten biodiversity but also undermine the long-term viability of agriculture itself by depleting the natural resources on which it depends (Baudron & Giller, 2014).

Understanding the relationship between farming activities and biodiversity loss is crucial for developing sustainable agricultural strategies that can balance human needs with environmental conservation. Integrating sustainable practices, such as agroforestry, organic farming, and conservation agriculture, can help mitigate the negative impacts of farming while promoting biodiversity. Policymakers, researchers, and local communities must collaborate to implement these strategies effectively, ensuring that agricultural development does not come at the cost of environmental degradation (Singh, 2009).

The phrase used to characterise the variety of life on Earth and the natural patterns it produces is called biodiversity. It is the outcome of human involvement, natural processes, and evolution (Verma, 2016). The diversity of species' genes, ecosystems' genes within species, and biosphere's ecosystems' genes all contribute to biodiversity. Many variables that vary across time and space interact to determine biodiversity rather than just one. Humans cannot exist without biodiversity, even though many may not understand how essential it is to them. Humans rely on species on a daily basis, the majority of which are completely unaware of this fact even if very few people are aware of it. Biodiversity offers humans food, water, oxygen, energy, waste detoxification, climate stabilisation, medicine, and other necessities.

Harvest and post-harvest operations, as well as land or soil preparation, are among the farming practices that this work takes into consideration when assessing biodiversity. Tillage practices, also known as land preparation operations, have an impact on biodiversity because they cause soil aggregation, pulverisation, surface sealing, resistance to infiltration and erosion, and degradation of soil structure. Activities related to harvesting and post-harvesting have also been blamed for the loss of biodiversity. The farmer must gather up all of his mature crops from the farm in order to harvest them. Activities carried out on crops to get them ready for the market, further processing, or storage are referred to as postharvest activities. Postharvest operations include cleaning crops, sun drying, shelling, fumigating, curing, sorting, grading, packing, and cooling. The biodiversity is impacted by each of these activities.

Statement of the problem

The Central Cross River State in Nigeria is renowned for its rich biodiversity, hosting a variety of endemic species and diverse ecosystems. However, this biodiversity is increasingly under threat due to escalating farming activities. Traditional and modern agricultural practices, including deforestation for farmland, use of chemical fertilizers and pesticides, and unsustainable land management, are contributing to habitat loss and ecosystem degradation. This situation raises significant environmental concerns, as the loss of biodiversity can lead to the disruption of ecological balance, reduction in ecosystem services, and decline in the overall health of the environment.

Despite the critical importance of preserving biodiversity for ecological stability and human well-being, there is a lack of comprehensive studies that quantify the impact of farming activities on biodiversity in this region. This study aims to fill this gap by examining the extent and nature of biodiversity degradation attributable to farming practices in Central Cross River State. The findings will provide valuable insights for policymakers, environmentalists, and the local community, enabling them to develop and implement strategies to mitigate the adverse effects of agriculture on biodiversity.

Purpose of the study

The main purpose of this study is to investigate farming activities and biodiversity degradation in Central Cross River State, Nigeria. Specifically, the study sought to

1. Investigate the effect of tillage practices and biodiversity degradation.
2. Examine the effect of harvest/postharvest activities on biodiversity degradation.

Research hypotheses

1. There is no significant relationship between tillage practices and biodiversity degradation.
2. There is no significant relationship between harvest/post-harvest practices and biodiversity degradation.

Literature review

Tillage practices and biodiversity loss

Sofiyuddin, Suyanto, Kadir, and Dewi (2021) evaluated land-clearing methods linked to a reduced risk of fire breakouts by contrasting the expenses related to different methods. After that, it examined intervention strategies involving farmers implementing these methods. These low-risk methods included controlled burning, the chemical removal of biomass with herbicides, zero-burning practices involving modern machinery and collaborations with government agencies/private firms, zero-burning procedures involving traditional machinery and farmer groups, and zero-burning activities employing contemporary machinery. According to the study, the costs of all four options are higher than those of using fire alone to clear land. It also demonstrated that, rather than concentrating just on specific land-clearing techniques, a more comprehensive approach to farming operations could help farmers reduce the financial consequences. The study's conclusions

The three methods of preparing soil in agriculture are manuring, levelling, and ploughing. Ploughing involves both loosening and digging the soil. During ploughing, the soil becomes looser, which improves aeration and makes it easier for roots to penetrate and breathe. The earth is levelled after ploughing to help with even distribution. Following levelling and ploughing, manure is employed in later phases of farming. Reintroducing nutrients to the soil through manuring promotes healthy crop growth (Palaniappan & Annadurai, 2018; Santhosh, Anusha & Anju, 2019). For the following reasons, it is essential to prepare the soil before sowing the seeds: 1. Weed control and soil loosening are two benefits of soil preparation. 2. The seeds must to be limited to

In a similar vein, Indoria, Rao, Sharma, and Reddy (2017) examined the contribution of conservation agriculture to enhancing soil physical health and related processes, noting that sustainable crop production and wise use of natural resources without compromising their quality depend on soil physical health remaining at its optimal level. The continuous use of intensive ploughing and crop residue removal from the field in conventional tillage practices for crop production has led to a decrease in water infiltration, a rise in surface crusting, compaction, and erosion, and ultimately a worsening of the physical health of the soil overall. Conservation agriculture has been suggested by numerous agricultural scientists globally in recent times as a means of mitigating the detrimental impact of traditional ploughing methods on the physical health of soil. Essentially, conservation agriculture is a blend of

In order to address the dual challenges of boosting agricultural productivity and maintaining soil quality in Ethiopia's highlands, Erkossa (2005) looked into alternative land preparation techniques in his doctoral dissertation, which he submitted to the University of Hohenheim on the topic of "Land preparation methods and soil quality of a vertisol area in the central highlands of Ethiopia." Three approaches are compared to the conventional Ridge and Furrow (RF) method: Broad Bed and Furrow (BBF), Green Manure (GM), and Reduced Tillage (RT).

A six-year period is used to analyse a variety of performance measures, such as crop output, economic profitability, soil erosion, and soil quality. In order to determine local soil functions and quality indicators, a participatory evaluation is also carried out at the watershed level. By emphasising the worldwide issue, the opening sets the scene.

Using a comparative methodology, the study assessed the effects of four different land preparation techniques on soil quality and productivity over a six-year period. Crop yield, financial profitability, soil erosion, and soil quality are examples of performance indicators. The identification of regional soil functions and quality concepts is done through participatory evaluation at the watershed level. According to study findings, GM's higher organic matter content and microbial activity result in decreased surface crust strength and increased aggregate stability. While moisture content and water-holding capacity are less susceptible to treatment, RT leads to decreased penetration resistance. Due to greater runoff, soil and nutrient losses somewhat increase with BBF and RT; however, BBF dramatically raises lentil grain yield by 59%, while RT produces the highest grain yields.

In interpreting the results, Erkossa (2005) highlights the trade-offs between various land preparation techniques with respect to soil quality, production, economic profitability, and soil protection. While GM is advised for soil quality and erosion prevention, BBF and RT are preferred due to their production and financial advantages. But GM has less of an economic benefit, and more research is needed to fully explore its potential uses. The study comes to the conclusion that various techniques for preparing land can boost output while preserving or improving the quality of the soil in vertisols. For overall performance, BBF and RT are preferred, however GM is advised to improve soil quality. These techniques' effectiveness is reliant on farmers' ability, willingness to invest, and access to outside incentives. Variations in the weather and institutional and regulatory issues are also important in their adoption.

Following his investigation into the connection between conservation and soil tillage, Rakesh (2022) discovered the following:

1. The physical state of the soil deteriorates when tillage operations are carried out beyond optimal conditions.
2. The surface soil granules are harmed by frequent or repeated tillage.
3. Tillage speeds up organic matter's oxidation.
4. Heavy machinery or instruments used in tillage result in hard pans (plough pans).
5. Increasing tillage causes the soil to become more drought-prone in non-plastic or less plastic soils, such as sandy and sandy loam soils.
6. Tilling the soil past the ideal moisture level results in poor soil physical condition in plastic soils (heavy soils, clay soils).
7. Water and wind erosion are exacerbated by frequent tillage.
8. The tilth is weakened by frequent and repeated tillage. The earth turns to powder.

In a similar line, Gao, Dang, Yu, Li, Liu, and Wang (2016) noted that tillage contributes to the spread of several diseases, parasites, and soil-borne pests. The effectiveness of tillage in

suppressing weeds within crop rows is limited. Destroys the structure and soil cover, increases soil erosion, leads to excessive moisture loss, messes with the life cycle of helpful soil organisms, and requires more effort to prepare the soil.

Harvest/postharvest activities on biodiversity loss

Gathering mature farm produce from the crop plant is known as harvesting. Using low-cost farming tools like hoes, sickles, daggers, or harvesters, manual harvesting is feasible. Reaping, stacking, handling, threshing, cleaning, and transporting are all part of rice paddy harvesting. These can be done one at a time with a combined harvester, or all at once. The four stages of harvesting include reaping, threshing, cleaning, and conveying. Utilising state-of-the-art technology during crop harvesting is essential as it minimises grain waste and improves grain quality and quantity. Reaping is the process of gathering grain or pulses with a sickle, scythe, or reaper (Abraham, Mathew, Sindhu, Pandey & Binod, 2016). Crop wastes can be used as a feedstock for bioenergy, which is one way to reduce greenhouse gas emissions. Crop residue harvesting done indiscriminately, however, can have a negative impact on plant growth, soil health, and other ecosystem services (Cherubin, Oliveira, Feigl, Pimentel, Lisboa, Gmach,... & Cerri (2018).

Activities carried out on crops to get them ready for the market or further processing are referred to as postharvest activities. Postharvest operations include cleaning crops, sun drying, shelling, fumigating, curing, sorting, grading, packing, and cooling. Microclimate has an impact on forest sites during agricultural harvest, particularly in clear-cut areas. Because of the deadly air and soil surface temperatures, frost-heaving, snow pressure, desiccation, and wind damage, these changes have the potential to significantly restrict the regeneration of forests. Postharvest management includes harvesting, handling, cooling, curing, ripening, packing, packaging, storing, shipping, wholesaling, retailing, and any other procedure the product goes through. In the postharvest industry, a high level of management is required to ensure quality because of how often vegetables can change hands (Rajapaksha, Gunathilake, Pathirana & Fernando 2021). Postharvest handling is the phase of crop production in agriculture that immediately follows harvest and includes cooling, cleaning, sorting, and packing. When a crop is removed from the ground or severed from its parent plant, it begins to deteriorate. Whether a crop is sold for fresh consumption or is used as an ingredient in a processed food product, its postharvest management has a substantial impact on its final quality.

Methodology

This study utilized a correlational research design and was conducted in the central region of Cross River State, Nigeria. The Ejagham ethnic group predominantly inhabits this central area, which includes local government areas such as Boki, Ikom, Etung, Obubra, Abi, and Yakurr. Cross River State is situated in the tropical rainfall belt, experiencing seasonal and occasionally heavy rainfall. The state generally enjoys a humid tropical climate with annual rainfall between 1300-3000mm and average temperatures around 30°C, except on the Obudu Plateau, where

the climate is sub-temperate, with temperatures ranging from 15°C to 23°C. The vegetation in Cross River State varies from mangrove swamps and rainforests to derived savannah and montane parkland. The state's geology is diverse, as are its mineral resource potentials. Cultivated food crops include rice, corn (maize), yams and cassava. The State also engages in coastal deep-sea fishing and prawn harvesting. The state capital and main seaport of Calabar is the exporter of palm oil and kernels, lumber, cocoa and rubber. Cement, palm oil, asbestos pipes and roofing sheets, and baking flour are produced by industries. The main waterway used for inland transportation is the river. The majority of Cross Riverians are farmers who rely mostly on subsistence farming to survive; just a small portion of them work in business.

The target population for this study comprises all 8,902 farmers registered with the Cross River State Agricultural Development Programme in the Ikom Education Zone as of 2022 (Cross River State Agricultural Development Programme, 2023). Stratified and proportionate sampling techniques were employed to select the study sample. Farmers were categorized according to Local Government Areas (LGAs) and wards. From each LGA and each ward within the LGAs, 5 percent of the farmers were sampled. For sample distribution, since the registers included farmers' addresses, the serial numbers from the registers were written on pieces of paper, rolled into balls, and placed in a bucket. A research assistant randomly drew pieces of paper with replacement until the required number for each LGA was reached. Using the addresses, the researchers and their assistants distributed the questionnaires to the farmers. For the study, 430 farmers were chosen as a sample. Three University of Calabar measurement and evaluation specialists face-and content-validated the structured questionnaire used to collect the data. The Cronbach alpha reliability method was employed to determine the instruments' level of dependability. The reliability coefficient estimations obtained from the findings were between.83 and.89. This demonstrated that the device consistently measured the things that were expected of it. The analysis of the data for the study was done using the Pearson Product Moment Correlation.

Results

Ho:1

There is no significant relationship between tillage practices and biodiversity degradation. Here, tillage practices are the independent variable while biodiversity destruction is the dependent variable. The Pearson product moment correlation was used to assess the respondents' scores on tillage methods and biodiversity degradation in order to test the hypothesis. Table 1 displays the analysis's findings.

TABLE 1: Pearson product moment correlation analysis of the relationship between tillage practices and biodiversity degradation N=430

Variables	Mean	SD	Cal- value	Sig.
Tillage practices	22.35	1.18		
			.709**	.000
Biodiversity degradation	90.06	5.32		

**Significant at 0.05, df=428

The result of the analysis presented on Table 3 reveals that, the calculated r-value of .709 is greater than the critical r-value of .098 at the 0.05 level of significance with 428 degrees of freedom and a significant p-value of 0.000.
Therefore, the null hypothesis was rejected. This means that there is a strong positive significant relationship between tillage practices and biodiversity degradation. This implies that an increase in tillage practices leads to a corresponding increase in biodiversity degradation.

Ho: 2
There is no significant relationship between harvest/post-harvest activities and biodiversity loss. Here, harvest and post-harvest practices are the independent variable and biodiversity degradation is the dependent variable. The hypothesis was tested by obtaining and analysing respondents' scores on harvest/post-harvest practices and biodiversity degradation through the use of Pearson product moment correlation analysis. The analysis's findings are displayed in Table 2.

TABLE 2: Pearson product moment correlation analysis of the relationship between Harvest/post-harvest practices and biodiversity degradation N=430

Variables	Mean	SD	Cal-value	Sig.
Harvest/post-harvest practices	19.73	1.21		
			.044	.367
Biodiversity loss	90.06	5.32		

Not Significant at 0.05 level, df =428.

The result of the analysis presented on table 7 shows that, the calculated r-value of .044 is less than the critical r-value of .098 at the 0.05 level of significance with 428 degrees of freedom and a significant value of .367. Therefore, the null hypothesis was not rejected. This means that there was no significant relationship between Harvest/post-harvest activities and biodiversity loss. This implies that harvest/post-harvest activities have no relationship with biodiversity loss in Ikom Education zone.

Discussion

The examination of hypothesis one's findings showed a strong, positive, and significant correlation between tillage practices and the decline of biodiversity. The null hypothesis was thus disproved. This result is consistent with the findings of Gao et al. (2016), who found that tillage facilitates the spread of several diseases, parasites, and soil-borne pests. The effectiveness of tillage in suppressing weeds within crop rows is limited. Destroys the structure and soil cover, increases soil erosion, leads to excessive moisture loss, messes with the life cycle of helpful soil organisms, and requires more effort to prepare the soil. The results are consistent with those of Schneider et al. (2017), who enumerated the detrimental impacts of soil tillage on the ecosystem, such as soil erosion, the breakdown of the soil into smaller particles due to ploughing, and the lowering of quality.The examination of hypothesis three yielded findings indicating that the null hypothesis was not refuted. This indicates that there was no discernible link between harvesting and post-harvest practices and the decline in biodiversity. This suggests that there is no connection between harvest and post-harvest activities and the decline in biodiversity in the study area.

The results are consistent with Rajapaksha et al.'s (2021) findings that the microclimate impacts forest sites during crop harvest, particularly in clear-cut forests. Because of the deadly air and soil surface temperatures, frost-heaving, snow press, desiccation, and wind damage, these changes have the potential to significantly restrict the regeneration of forests. Postharvest management includes harvesting, handling, cooling, curing, ripening, packing, packaging, storing, shipping, wholesaling, retailing, and any other procedure the product goes through. Vegetables in the postharvest business can change hands a lot, therefore maintaining quality requires a high level of supervision. The results corroborate those of Cherubin et al. (2018), who suggested that one possible tactic to reduce greenhouse gas (GHG) emissions is to use crop residues as a fuel for bioenergy.

Implication of the findings

1. There is a strong positive significant correlation between biodiversity degradation and tillage practices. This suggests that the research area's biodiversity is significantly lost as a result of land preparation activities or tillage practices.
2. The conclusion of hypothesis two shows that there was no meaningful connection between harvest and post-harvest activities and the decline in biodiversity. This suggests that there is no discernible loss of biodiversity in the study region as a result of harvest and post-harvest activities.

Conclusions and recommendations

The essence of this study was to investigate the relationship between farming practices and biodiversity degradation central Cross River State, Nigeria. Findings obtained from the analysis of data and testing of hypothesis revealed that, there is a strong positive significant relationship between tillage practices and biodiversity degradation. And there was no significant relationship between Harvest/post-harvest practices and biodiversity degradation.

It was concluded that farming practices have a significant relationship with biodiversity degradation. It was recommended among others that Government and other agricultural and environmental stake holders should encourage the practice of zero till land preparation activities to reduce biodiversity loss. Harvest/postharvest activities should be done with environmental sustainably in mind to avoid biodiversity loss.

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