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Research Article

Socio Economic Factors Influencing the Management of Agro-Ecosystem among Farmers in Kano State, Nigeria

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ABSTRACT

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The study analysed the socioeconomic factors influencing the management of ecosystems among farmers in Kano State. A multi-stage sampling method was used to select 110 respondents from 3 LGAs and 9 wards in the study area. Primary data were collected using questionnaires and subjected to descriptive and inferential. The result revealed that the average age was 43 years, 95.45% were married with a mean household size of 11 people, and informal Quranic education (40.90%) was the dominant level of education. All the respondents were crop producers with an average of 23 years of experience. The types of issues that damaged the environment were floods (59.09%) and erosion (50.0%). The result further revealed that the farmers practiced crop rotation and organic farming in order to restore the fertility of the land. Age and years of experience significantly influence the use of ecosystem restoration practices by farmers. In conclusion, farmers adopted many practices that influenced the socioeconomic characteristics of their environment in order to have maximum output. It is therefore recommended that stakeholders develop and implement extension programmes that focus on promoting ecosystem restoration.

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INTRODUCTION

An ecosystem (or ecological system) consists of all the organisms and the physical environment with which they interact

(Chapin *et al.*, 2011). An ecosystem can also be a biological community of interacting organisms and their physical environment. Ecosystems have historically been degraded,

damaged, or otherwise destroyed due to climate change and human activities that alter their structure or function. Numerous formerly-thriving species, such as plants and animals, have been classified as at-risk because of the damage done to these agro-ecosystems, which were once home to a wide variety of plants and animals. These ecosystems are under heightened stress due to reduced, inadequate habitats. Agricultural ecosystems comprise diverse climate zones, which are dynamic and intricate systems involving multiple factors such as temperature, precipitation, surrounding conditions that impact crop growth through direct or indirect interactions with local crop plants and animals, soil nutrients, and micro-biotic that promote plant growth (Poonam *et.al.*, 2021). Changes in any of the climatic parameters or conditions have an immediate effect on all parts of a specific agricultural ecosystem, affecting system dynamics and causing imbalances in the ecosystem (Poonam *et.al.* 2021).

Agricultural lands support human life by providing food, fiber, and other needed items, as well as habitat for biodiversity, economic opportunity, spiritual and cultural advantages (UNCCD, 2017). In Nigeria, at least about 70% of the population depends on the agricultural sector for their livelihoods, particularly poor and rural populations, and over 90 percent of our calories and protein originate from the land (FAO, 2021). Agricultural

Land degradation can lead to many issues like soil erosion, soil acidification, soil alkalisation, soil salination, soil water logging and destruction of the structure of soil which will directly affect the productivity and yields of crops (Barman et al., 2013). While degradation typically involves harm to soils (FAO and ITPS 2015), it can also result from the loss of wild species that provide pest

control and crop pollination (Dainese *et al.*, 2019). According to Právělie *et al.* (2021), at least one form of degradation affects about 80% of the world's arable land, such as soil erosion, aridity, a decline in vegetable production, soil salinization, loss of soil nutrients, etc.

Ecosystem restoration is the process of slowing and reversing degradation, resulting in increased ecosystem services and recovered biodiversity. It involves a broad range of practices, depending on local conditions and human preferences. Additionally, it is the process of assisting an ecosystem that has been injured, destroyed, or degraded in order to offer goods and services that human's value and to symbolise values that are thought to be inherent in the ecosystem (Martin, 2017). By restoring degraded ecosystems to their pre-damaged state, ecological restoration of farmland can contribute to the guarantee of sustainable agriculture. Sustainable land management and intensification, integrated production systems, regenerative agriculture, bio-innovations, and climate-smart and conservation farming practices are just some of the ways that agricultural land can be used to restore ecosystems (CPF 2021; FAO 2020). Furthermore, ecosystem restoration has been identified as one of the sustainable solutions to mitigate the effects of climate change on agriculture and other natural resources. However, despite the availability of restoration practices and different ecosystem restoration programmes initiated by governments and NGOs, the adoption of these practices among farmers remains low. This low adoption rate is mainly attributed to socio-economic factors that hinder their participation in restoration efforts. For instance, limited financial resources, a lack of technical knowledge, and a reluctance to take risks have constrained their potential to

embrace ecosystem restoration practices. Moreover, the socio-economic status of these farmers might limit their access to the necessary information, communication channels, and technological tools required to promote ecosystem restoration. Consequently, understanding the socio-economic factors influencing farmers' participation in ecosystem management is critical in designing effective policies and programmes aimed at encouraging and enhancing uptake of restoration practices. Finding these factors would help us understand the reasons, challenges, and chances for farmers to use ecosystem restoration methods. It would also help us come up with ways to make the problems caused by these factors less severe. Therefore, the objective of this study is to analyse the socio-economic factors influencing the management of agro ecosystems among farmers in Kano State, Nigeria. The specific objectives were to:

METHODOLOGY

Study Area

Kano is a state located in the northern region of Nigeria. It is located between latitude 10°30"-13°00" N, and longitude 70°30"-90°30"E. It is the most populous state in Nigeria, with a projected population of over 25 million people in 2022, and it covers an area of approximately 20,131 square kilometers. The State shares borders with the

West and Northwest by Katsina State, to the East and Northeast by Jigawa State; to the South by Bauchi State, and Southwest by Kaduna State. The landscape of Kano State is primarily characterized by savannah vegetation, with scattered trees and shrubs found in the savannah woodland. The climate of the study area is tropical dry, with a monomodal rainfall distribution of 600 mm on average per year, with the majority of rain falling between May and September. During the wet season, air humidity is high, while during the dry season, it is quite low. The average temperature is 29 °C, with a minimum temperature of 15°C occurring from November to February and a maximum temperature of 39 °C occurring from March to May (KNSG, 2019). The population of Kano State is a mix of different ethno linguistic groups. The majority of the population is Hausa, followed by Fulani, Yoruba, Igbo, Kanuri, and Tiv, among others. Agriculture is vital to the socioeconomic well-being of the people in the area, with crops such as onions, tomatoes, Irish potatoes, rice, maize, sorghum, and millet grown in large quantities. Animal husbandry is also a common occupation, with many households keeping cattle, goats, and sheep for domestic consumption and commercial purposes. Other occupations include local blacksmiths, weavers, dyers, trading, and local crafts.

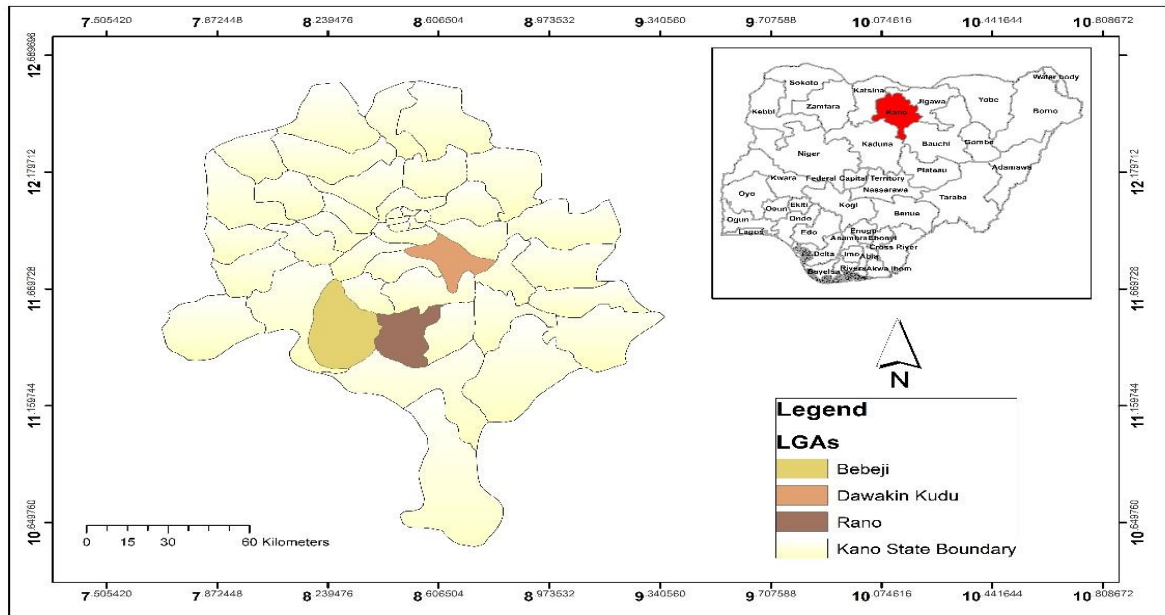


Figure 1: Kano State showing three Local Government Areas
 Source: Cartography Lab. Geography Department, Bayero University, Kano

Sampling Procedure and Sampling Size

According to NEMA (2022) Bebeji, Rano, and Dawakin Kudu were some of the LGAs in Kano that have suffered from the seasonal flood, land degradation, erosion, and drought. Therefore, these three LGAs were purposively selected based on the stated issues experienced in the area. The next stage involves the random selection of three (3)

wards from each LGA, giving a total of nine wards for the study. A list of the farmer groups was accessed, and 60% of the farmer groups were randomly selected from each ward, making a total of 22 farmer groups. Also, the last stage involved random sampling of 5 farmers from each of the selected farmer groups, resulting in a total of 110 farmers for the study.

Table 1: Summary of the sample size

LGA	Ward selected	No. of Farmers group	60% of Farmers group Selected	No. of Farmers
Bebeji	Bebeji,	5	3	15
	Kofa,	6	4	20
	Gwarmai	4	2	10
Rano	Rano,	5	3	15
	Madaci,	4	2	10
	Zurgu	3	2	10
Dawakinkudu	Yankatsari,	3	2	10
	Zogarawa,	3	2	10
	Dawaki,	4	2	10
Total	9	37	22	110

Source: KNARDA, 2022

Methods of Data Collection and Analysis

The method of data collection used was a well-structured questionnaire. The data collected was on the socio-economic characteristics of the farmers, factors influencing ecosystem restoration, and the coping strategies used to restore the ecosystem.

The collected data were subjected to both descriptive and inferential statistical tools. Descriptive statistics like frequency distribution, percentages, mean, minimum, maximum, etc. helped achieve objectives I and III. Regression analysis helped to achieve objective II.

Model Specification

$$Y = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + \beta_5 X_{i5} + \beta_6 X_{i6} + \mu \dots \dots \dots \text{equation (3)}$$

Where;

Y= ecosystem restoration

X₁= Age of the farmer (years)

X₂= Marital Status (no.)

X₃= Level of education (no.)

X₄= Household size (no.)

X₅= Farming experience (years)

X₆= Average annual income (Naira)

$$\beta = \frac{n \sum xy - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$\beta_0 = \frac{\sum y - b \sum x}{n}$$

μ = error term

RESULTS AND DISSCUSION

Socio-Economic Characteristics of the Respondents

The study's findings indicated that the average age of the participants was 43 years. The age range varied from a minimum of 20 years to a maximum of 65 years, as outlined in Table 2. This suggests that they are in productive age and capable to manage the ecosystem activities in order to achieve

optimal results. In contrast to older farmers who have been in the industry for an extended period and may resist changes in their farming methods, the majority of the participants was married (95.45%) and had an average household size of 11 individuals. This implies that they had familial responsibilities, and the larger household size was advantageous because it provided a labour force, influencing their decision to

engage in ecosystem restoration. The findings is in line with that of Gebremedhin *et al.* (2015) asserted that household with more members are more likely to adopt such practices due to the availability of labour for implementation.

Regarding educational background, informal education was prevalent among 40.90% of the participants, while 34.55% had primary education as their highest level of education. All respondents were involved in crop production, and their average age was 23 years. They had an average annual income of 413,864.86 naira, with a minimum income of 100,000 naira and a maximum of 1,500,000 naira, as shown in Table 2. This aligns with the findings of Bwema (2021), who observed that farmers with lower incomes are more inclined to adopt ecosystem management

practices because they have a pressing need to enhance their land's productivity and are more open to adopting any practices that can help manage their ecosystems.

The study also took into account the participants' interactions with development agents. Approximately 59.09% of the respondents had contact with various developmental agents, and this contact typically occurred on an annual basis (81.82%). This means that most of the interactions between the people who answered the survey and the people who were working on the project happened during the production season or in the lead-up to it, with the goal of incorporating practices that help restore ecosystems into their seasonal activities.

Table 2: Distribution of the Respondents According to their Socio-Economics Characteristics (n=370)

Variable	Frequency	Percentage
Age (Years)		
20 – 29	9	8.18
30 – 39	22	20.00
40 – 49	38	34.55
50 – 59	24	21.82
60 and above	17	15.45
Mean	43	
Minimum	20	
Maximum	65	
Std. Deviation	11.111	
Marital Status		
Single	5	4.55
Married	365	95.45
Household Size (No.)		
1-5	15	13.64
6-10	35	31.82
11_15	24	21.82
16_20	10	9.09
21 and above	26	23.64
Mean	11	

Minimum	2	
Maximum	30	
Std. Deviation	7.421	
Level of Educational		
Primary	38	34.55
Secondary	24	21.82
Tertiary	3	2.73
Informal education	45	40.90
Years of Experience (Years)		
1 – 5	5	4.55
6 – 10	10	9.09
15 – 20	9	8.18
21 – 25	19	17.27
Above 25	67	60.91
Mean	23	
Minimum	2	
Maximum	40	
Std. Deviation	9.560	
Average Annual Income (₦)		
100,000-500,000	65	59.09
600,000-1,000,000	35	31.82
1,100,000-1,500,000	10	9.09
Mean	413,864.86	
Minimum	100,000	
Maximum	1,500,000	
SD	283,927.90	
Contact With Dev't Agent		
Contact	65	59.09
No contact	45	40.91
Frequency of Contact		
Monthly	20	18.18
Yearly	90	81.82
Total	110	100

Source: Field Survey, 2023

Environmental Issues in the Study Area

The study reveals several critical environmental issues that are causing damage to the agroecosystem in the specific area under examination. A majority of the

respondents, approximately 59.09%, identify flooding as the most pressing issue affecting their land. Flooding can result in soil erosion, waterlogging, and crop damage, ultimately leading to reduced agricultural productivity

and the displacement of farming communities. Following flooding, erosion is the second most frequently cited problem, with 45.45% of respondents expressing concern (fig. 2). Erosion not only affects soil quality but can also lead to sedimentation in nearby water bodies, harming aquatic ecosystems.

Deforestation is another significant issue, expressed by approximately 40% of the interviewed farmers, that causes significant destruction to the agroecosystem in the study area. Additionally, the study points out that land degradation and soil depletion are also impacting the agroecosystem in the area. Land degradation, often resulting from

unsustainable land use practices, leads to the deterioration of land quality, while soil depletion involves the loss of essential nutrients, reducing agricultural productivity (fig. 2). Thus, the findings of the study highlight a complex set of environmental challenges threatening the health and resilience of the agroecosystem in the area. These challenges are interconnected, with one issue frequently exacerbating another. Addressing these problems will necessitate a comprehensive, multi-faceted approach that encompasses sustainable land management, flood mitigation strategies, afforestation efforts, and soil conservation practices

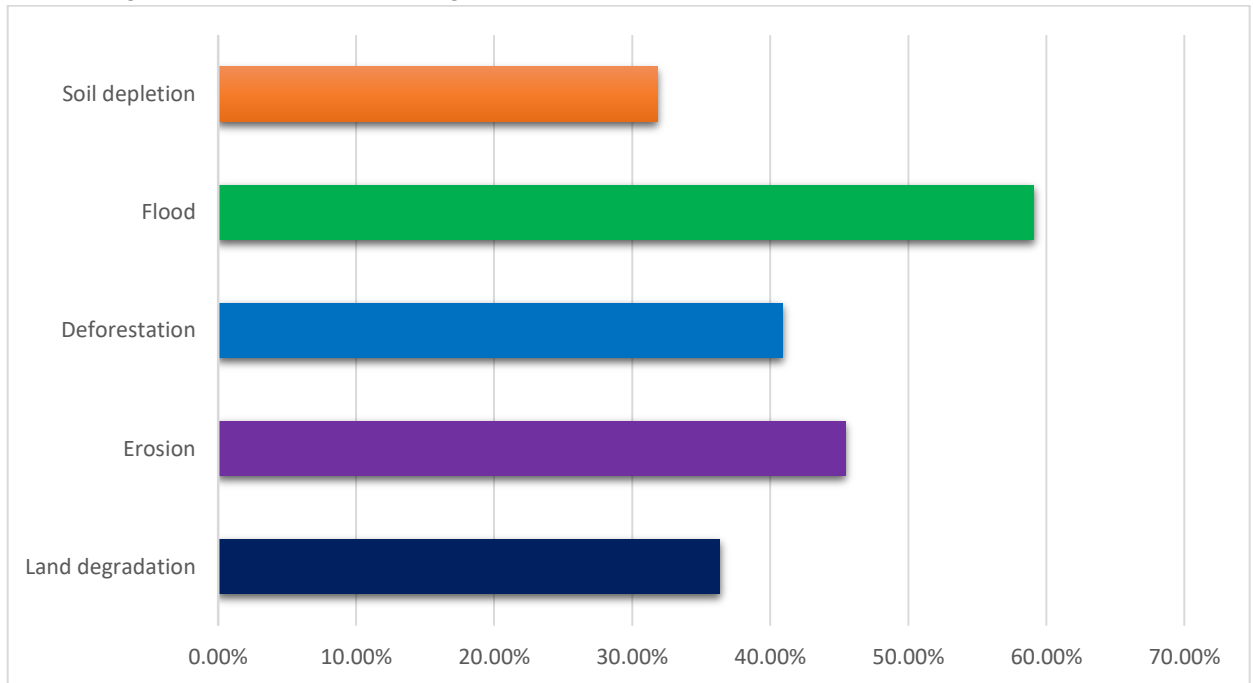


Figure 2: Environmental Issues in the study area

Ecosystem Management Practices Employed by the Farmers

The farmer’s practices to manage their ecosystem were an important aspect of this study. The results from Table 3 revealed that practicing crop rotation (59.09%) and organic farming (50.00%) were popular and important practices to manage the ecosystem

among the farmers in the study area. Following this came contour farming, no-till or minimal-tillage, and slope reorientation (22.73%). Other practices used by the farmers in the study area included tree planting and integrated production systems. This was similar to the study of Bello and Muhammad (2017), who examined the coping strategies

used by farmers in response to climate change in Kano State. It found that farmers in the area adopted various adaptive measures,

such as changing cropping patterns and planting drought-resistant crops.

***Table 3:** Distribution of Practices employed for Ecosystem Restoration

Variables	Frequency (<i>f</i>)	Percentage (%)
Contour farming	25	22.73
Tree planting	15	13.64
No till or minimum tillage	25	22.73
integrated production systems	10	9.09
Crop rotation	65	59.09
Reorientation of slopes	25	22.73
Organic Farming	55	50.00

Source: Field Survey, 2023

*Multiple responses

Socio-Economic Factors Influencing the Usage of Ecosystem Restoration Practices

Table 4 presents the results of the socio-economic factors that influence the adoption of ecosystem restoration practices. According to the findings, household age was found to be statistically significant in its influence on ecosystem restoration practices, with a negative coefficient of -0.007. This indicates that as age increases by one unit, ecosystem restoration practices tend to decrease by an estimated 0.007 units, holding other factors constant. The negative sign suggests that older individuals may be less likely to engage in these practices. On the other hand, marital status, education, household size, and average annual income did not show statistically significant associations with the use of ecosystem restoration practices. The p-values for these variables are greater than the typical significance level of 0.05, implying that changes in these factors do not have a strong impact on the dependent variable in this model.

Farming experience, with a coefficient estimate of 0.005, was found to be statistically significant at a significance level of 0.05. This suggests that individuals with

more farming experience are more likely to engage in ecosystem restoration practices, with a one-unit increase in farming experience associated with a 0.005-unit increase in ecosystem restoration activity.

The given numbers ($R = .448$, $R^2 = .201$, $F = 2.808$) show that the independent variables account for around 20.1% of the variation in putting ecosystem restoration practices into action. The F-value is statistically significant at the 0.05 level. The R value of .448 shows a moderately positive relationship between the independent variables and the dependent variable. This means that as the values of the independent variables rise (for example, age or farming experience), so does the likelihood of restoring ecosystems. The F-value of 2.808 and the significant P-value of .000 suggest that the overall model is statistically significant, indicating that at least some of the independent variables are significantly related to the dependent variable. The findings of this study coincide with a study conducted in Ethiopia that found that socioeconomic factors such as age, education level, landholding size, and off-farm income significantly influenced individuals' decisions

to participate in forest restoration programmes (Beyene *et al.*, 2019). These findings support the importance of

considering socioeconomic factors in designing effective ecosystem restoration initiatives.

Table 4: Socio-economic Characteristics Influence the ecosystem restoration practices

Variables	B	S.E	t-value	Sig.
Age (X ₁)	-.007	.002	-3.606	.001**
Marital status (X ₂)	.002	.113	.021	.983
Education (X ₃)	-.013	.011	-1.176	.244
Household size (X ₄)	.004	.003	1.326	.189
Farming Experience (X ₅)	.005	.002	2.397	.019**
Average annual income (X ₆)	4.734E-008	.000	.932	.355
Constant (X ₀)	1.139	.221	5.148	.000
R	.448			
R²value	.201			
R² adjusted	.129			
F-value	2.808			

Source: Source: Field Survey, 2023

IBM SPSS Statistics 20 (output).

Note **= Significant at 5% = 0.05% (P<0.05)

Note: **= significant at 5% = 0.05% (P<0.05).

CONCLUSION

Flood was the major environmental issue experienced by the farmers, socioeconomic characteristics, such as age and experience, influence a farmer's adoption of ecosystem management practices, also the farmers' most important practices to manage the ecosystem was the crop rotation and organic farming.

RECOMMENDATION

- Access to agricultural education and training programmes on agro-

ecosystem restoration should be increased.

- Provide farmers with accurate and timely information on climate change that can affect their ecosystems through various channels such as radio, television, and mobile phones. This can enable farmers to make informed decisions and take appropriate measures.

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