The Impact of Land Degradation on the Socioeconomic Livelihoods of Small-Scale Farmers in Ethiope East Local Government Area, Delta State, Nigeria

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Abstract
The study focused on the effects of land degradation on the income of small-scale farmers in Ethiope East Local Government Area of Delta State, Nigeria. The specific objectives of the study were to analyze the effects of socio-economic characteristics on land degradation in the study area; **and** examine the **e**ffects of land degradation on the income of small-scale farmers in the study area**.** A multistage sampling technique was used to select one hundred and twenty (120) small-scale farmer respondents that were used for the study. Descriptive statistics and multiple linear regression analysis were employed for the analysis of the objectives. The mean age of the respondents was 45 years. The result reveals that majority of respondents are female (75.8%) and males (24.2%). Majority of the respondents are married (70%) followed by the single (16.7%) and the rest are widowed (8%) and divorced (8%). The mean household size was seven persons, with 40% having secondary education. The mean farming experience was 3 years with an average of 1-3 Ha of farmland. The main source of farmland was hired land. The major source of farm labour for the respondent was hired labour. Majority of the respondents did not belong to cooperative society. Majority of the farmers had problem of accessibility to credit and extension visitation. The main causes of land degradation were cattle grazing and deforestation underscoring the role of water management and forest cover in maintaining land productivity. The multiple regression analysis indicates that education (5%), household size (5%), and farming experience (1%) significantly influence land degradation. It was observed that farmers who were more educated; with larger households or more farming experience were likely to adopt practices that reduce land degradation. The land degradation variables affected the level of small-scale farmer's income. Factors such as cattle grazing, fire disasters, soil nutrient loss significantly affect income positively at 5% and 1% significant level respectively, while others like erosion, soil dredging, etc show a weaker, non-significant relationship. The researchers recommended the consolidation of programs to boost poverty alleviation and encourage livelihood diversification into off-farm and non-farm activities to supplement agricultural income.

Introduction:

Land degradation is one of the world's most pressing environmental problems and it will worsen without rapid remedial action. Destruction of land (land degradation) has been identified to have a detrimental effect on food production (Edoja, Aye, Abu and Ater, 2021; Tsue, 2015). Land degradation is the deterioration or loss of the productive capacity of the soils for present and future, caused by multiple forces, including extreme weather conditions, human activities that pollute or degrade the quality of soils, and land utility (W.H.O, 2020). It is a global challenge that affects agricultural productivity, livelihoods, and the production and provision of other ecosystem goods and services. It is induced or aggravated by human activities such as soil erosion, soil contamination, deforestation, and inappropriate agricultural practices. This process negatively affects food production, water sources, and can lead to the spread of infectious diseases as populations migrate (Badapalli, Kottala, Madiga&Golla, 2022). Hence, It is a significant concern in the 21st century, affecting various aspects of the environment and human well-being (NIH, 2017).

Degradation of land occurs when natural and man-made factors reduce the productivity of the land and its capacity to deliver services (Edoja et al., 2021). Famine among smallholder farmers results from the aforementioned variables that impact soil quality and the land's capacity to produce. Global soil deterioration and changes in land cover are caused by both deliberate and inadvertent human activity as well as natural processes (Pasquale Borrelli, David, Larissa, Emanuele, Cristiano, Christine, Katrina, Sirio, Brigitta, Vito, Vincenzo, Krist, Luca andPanos 2017). The environment of the natural world found to be changing due to human activity (Ronald, 2020). Ayalneh (2003) asserts that the primary and fundamental factors contributing to the extent and gravity of the land degradation issue include variations in relief, ecosystem, rainfall, land use, land cover, and soil types. Nyol (2019) in his estimation establish globally that, land degradation lowers agricultural land production by about 75%. Little has been done, according to Isreal et al. (2020), to minimize the adverse effect of degraded land on agriculture, which leads to reduced agricultural yields.

More so, Global environmental issues have gotten worse as a result of increased strain on land brought on by the world's rapidly expanding population. According to Oladimeji (2020), land degradation is a multifaceted and worldwide issue that is impacted by institutional, cultural, ecological, technological, and socioeconomic elements. According to Henry et al. (2018), land is defined as a physical entity or the terrestrial portion of the biosphere that consists of natural resources, including abiotic and biota resources, as well as the ecological processes, topography, and infrastructure and human settlements that are part of that system. Agenda 21 and the Special Report on Climate Change and Land (SRCCL) support this definition. Together with agriculture, these elements offer a range of services necessary for the upkeep of life-supporting systems and the environment's potential for productivity.

While the development of agriculture underpinned the advancement of civilizations, farming practices led to the conversion of forests and grasslands to farmland and the heavy reliance on domesticated annual grasses for our

food production meant that soils started to deteriorate through seasonal mechanical disturbances (Ellis, 2019), culminating into land degradation (Oladimeji, 2020).The UN convention to combat desertification (CCD), of which Nigeria is a cosigner, recognizes land degradation as a global development and environmentalissue.

The consequences of land degradation extend far beyond the biophysical environment, penetrating deeply into the economic livelihoods of rural farming households and threatening the sustainability of agricultural income in affected communities. Nkonya, Mirzabaev and von Braun (2016) estimate that land degradation costs the global economy approximately US$300 billion annually in lost agricultural productivity, with the burden disproportionately borne by smallholder farming populations in Sub-Saharan Africa who depend almost exclusively on land-based income for household sustenance and survival. In Nigeria's Niger Delta region specifically, Edoja et al. (2021) establish that land degradation — manifested through soil nutrient depletion, erosion, and vegetation loss — significantly reduces crop yields, diminishes the productive lifespan of arable land, and forces farmers into poverty-deepening cycles of income decline and livelihood vulnerability. The economic livelihood dimension of land degradation is further compounded by the structural marginalisation of smallholder farmers from credit markets, extension services, and cooperative support networks, which collectively constrain their adaptive capacity and leave them with limited resources to invest in soil restoration or income diversification (Wollburg, Bentze, Lu, Udry and Gollin, 2024). Barbier and Hochard (2018) affirm that rural households occupying degraded lands are significantly more likely to experience chronic poverty, food insecurity, and involuntary livelihood diversification into low-return off-farm and non-farm activities — not as a choice-driven strategy but as a survival response to declining farm income. This nexus between land degradation and economic livelihood impoverishment is particularly acute in communities characterised by high dependence on subsistence agriculture, limited institutional support, and exposure to multiple concurrent degradation pressures — conditions that are emblematic of the smallholder farming context in Ethiope East Local Government Area of Delta State.

Delta State is plagued bythe challenge of land degradation (Edoja et al., 2021). Ethiope East Local Council Area in Delta State is no exception. arable crop farmers in Ethiope East Local Government Area of Delta State, Nigeria, heavily rely on agriculture for their income. Farmers in the area are of the opinion that land degradation does affect agricultural activities (Akinanagbe and Umukoro, 2011) Hence, researchers quest to findout if socio-economic characteristics have consequencesfor land degradation and land degradation has effects on the jncome ofsmall scale farmers due to the paucity of empirical research focused on Ethiope East Local Government Area. The objectives of the study were:1) identify the socio-economic characteristics of small scale farmers in the study area;2) ascertain the factors driving land degradation in Ethiope East Local Government Area of Delta State; 3) analyze the effects of socio-economic characteristics on land degradation in the study area.; and **4) e**xamine the e**ffects of** land degradation on theincome of small-scale farmers in Ethiope East Local Government Area of Delta State**.**The research proposes the following hypothesis:H_{01}:socio-economic characteristics of the small-scale farmers do not have any effect on land degradation in the study area. H_{02}: land degradation does not have any effect on income of small-scale farmers in Ethiope East Local Government Area of Delta State.

Methodology

Study Area

The research was done in Ethiope East local government area of Delta State. It is located in the center of the state, and bordered by Ughelli North LGA to the north, Ughelli South LGA to the east, Ethiope West LGA to the south, and Uvwie LGA to the west. The headquarters of Ethiope East LGA is located in the town of Isiokolo. Ethiope East LGA has a population of about 250,000 people. The majority of the populations are Urhobo people, but there are also significant populations of Igbo, Yoruba, and Itsekiri people. The main language spoken in Ethiope East is Urhobo, but Pidgin and English are also widely spoken; her economy is based on agriculture (fishing, cropping and palm oil production and intensive and extensive livestock farming), civil service and oil exploration. The main crops grown in the area are cassava, yams, and plantains. Fish, poultry, goat rearing, pig farming and cattle rearing are also an important source of food and income for many people in Ethiope East.

Ethiope East LGA covers a total area of 380 square kilometres and has the Ethiope River flowing through the area. The average temperature of the area is 25 degrees centigrade while the humidity level of the LGA averages 82 percent. Ethiope East LGA witnesses two major seasons - rainy and the dry seasons. The coordinates of Ethiope East: coordinates Latitude: 5.63314, Longitude: 6.02819 5° 37′ 59″ North, 6° 1′ 41″ East, a land area 38,000 hectares i.e. 380.00 km² (146.72 sq mi), with an Altitude of 6 m (20 ft). The vegetation goes from mangrove thick forest to blended rain forest and meadows. The inhabitants are mostly native farmers. Because of rainfall for a significant part of the year (8-9 months) and human activity, the soil is permeable and moist with temperature between 28-32°C. Ethiope East LGA has three major Kingdoms: Agbon Kingdom, Abraka Kingdom and Umiagwa Kingdom. It is comprised of the following communities, Okpara Inland, Kokori, Eku, Oviorie, Ovu, Okurekpo, Abraka, Igun, okpara Water Side, Ekpan, Ovwere, oria, Urhuovie, Ovwere, Ekrebo, Okorogba, Otumara (Orho r'Ufuoma), Okorobi, Ajanomi, Erho-Abraka, Urhuoka, Umeghe, Okoroke, Urhodo, Oko-onomarho and Oko-edafe.

Sampling procedure

All small-scale farmers in the area constituted the population for this study. Multi-stage sampling procedure was used in selecting respondents from the L.G.A. The first stage involved a purposive selection of 10

communities affected by land degradation in the study area. The second stage involves random selection of 12 arable crop from each of the ten communities, making 120 respondents.

To qualify for inclusion in the study, small-scale farmers were required to meet the following criteria: (i) ownership or active cultivation of a farm plot not exceeding 5 hectares; (ii) residence in the selected community for a minimum of five years prior to the study; (iii) active engagement in farming as a primary or secondary source of livelihood at the time of data collection; (iv) willingness to participate and ability to provide informed consent; and (v) direct experience with land degradation on or around their farmland. Farmers who did not meet any of these criteria were excluded and replaced through re-sampling within the same community. The list of small-scale farmers in the L.G.A. was supplied by the Council office of the State Ministry of Agriculture and Natural Resources.

3.3 Method of data collection

The data generated from primary data source. The data were collectedusing guided interview via the administration of questionnaire by the researcher.

3.4 Measurement of variables

Information on the socio-economic characteristics of the respondents which were examined included sex, age, marital status, farming experience, educational level, farm yield, farm income and household size. To assess the causes of land degradation in the study area, respondents were provided with a list of possible causes of land degradation to tick from, on a 4-point Likert scale (4 = very serious, 3 = serious, 2 = not serious and 1 = not very serious). The values on the Likert scale was sum to obtain 10, which was divided by 4 to obtain a mean score of 2.5. Then any mean score equal or higher than 2.5 was perceive as a possible cause of land degradation in the area. The study formulated two null hypotheses that were tested using the **Multiple Linear Regression (MLR)** analytical framework, which served as the primary inferential tool for both Objective 2 and Objective 5 of the study. **3.5 Method of data analysis**

Frequencies, percentages, means, and Likert scale analysis were used to profile socio-economic characteristics and assess the causes of land degradation and its perceived drivers (Objectives 1 and 4). Multiple linear regression was employed to examine (a) the effects of socio-economic characteristics on land degradation (Objective 2), and (b) the effects of land degradation on farmer income (Objective 5). The income model is specified as:

3.6 Model specification

Multiple Linear Regression Model

Multiple Linear regression models was employ to achieve objectives 2 and 5. The model is specified as follows:

To analyze the effects of socio-economic characteristics on land degradation in the study area, a Multiple Linear Regression (MLR) model was employed, consistent with the analytical framework adopted by the study (Oghoje, 2024). The model is formally expressed as:

$$\mathbf{Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon}$$

Where:

Y = Land degradation (dependent variable)
$\mathbf{X_1}$ = Age
$\mathbf{X_2}$ = Sex
$\mathbf{X_3}$ = Marital status
$\mathbf{X_4}$ = Educational level
$\mathbf{X_5}$ = Source of farm labour
$\mathbf{X_6}$ = Size of farmland
$\mathbf{X_7}$ = Access to finance/credit
$\mathbf{X_8}$ = Household size
$\mathbf{X_9}$ = Farming experience
$\mathbf{X_{10}}$ = Membership in cooperative society
$\boldsymbol{\beta_0}$ = Constant/intercept
$\boldsymbol{\beta_1}$–$\boldsymbol{\beta_{10}}$ = Estimated regression parameters
$\boldsymbol{\varepsilon}$ = Stochastic error term

To examine the effects of land degradation on farmers' income, a Multiple Linear Regression (MLR) model was employed, with farmers' income as the dependent variable and thirteen land degradation indicators as the independent variables. The model is formally expressed as:

$$\mathbf{Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \varepsilon}$$

Where:

Y = Farmers' income (₦)
$\mathbf{X_1}$ = Cattle grazing
$\mathbf{X_2}$ = Fire disaster
$\mathbf{X_3}$ = Oil exploration
$\mathbf{X_4}$ = Urbanisation
$\mathbf{X_5}$ = Soil nutrient loss
$\mathbf{X_6}$ = Land pollution
$\mathbf{X_7}$ = Erosion
$\mathbf{X_8}$ = Flooding
$\mathbf{X_9}$ = Sand dredging
$\mathbf{X_{10}}$ = Deforestation
$\mathbf{X_{11}}$ = Heavy rainfall
$\mathbf{X_{12}}$ = Industrialisation
$\mathbf{X_{13}}$ = Acid rain
$\boldsymbol{\beta_0}$ = Constant/intercept
$\boldsymbol{\beta_1}$–$\boldsymbol{\beta_{13}}$ = Estimated regression parameters
$\boldsymbol{\varepsilon}$ = Stochastic error term

Results and Discussion

Socio – economic characteristics of Small-scale farmers in Ethiope East L.G.A.

The Table 4.1 provides a detailed overview of the socio-economic and institutional characteristics of the arable crop farmers surveyed in the study area.

Age Distribution: The majority of farmers fall within the age range of 31-45 years (40.8%), followed by those aged 46-60 years (35.0%) with mean age of --. This indicates that the farming population is relatively middle aged, with a significant portion in their prime working age, which could suggest a workforce capable of handling physically demanding agricultural tasks.

Gender: The finding that the farming population in the study area is predominantly female (75.8%), with males constituting only 24.2%, reflects a well-documented pattern of gender-differentiated participation in smallholder agriculture across Nigeria and Sub-Saharan

Africa. This outcome resonates with the position of Uduji and Okolo-Obasi (2022), who, in their study on promoting gender-equitable agricultural value chains in Nigeria's Niger Delta, established that women constitute the majority of participants in subsistence-oriented agricultural activities, yet remain constrained by structural inequalities in access to productive resources. Further convergence is found in the work of Uduji, Okolo-Obasi, and Asongu (2019), whose survey of 700 rural female farmers in the Niger Delta confirmed that women's empowerment initiatives in the region were effective in increasing agricultural productivity but fell short of contributing to genuine equality, underscoring the paradox of high female farming participation alongside systemic gender disadvantage. The gender disparity observed in this study is therefore not an isolated finding but is structurally and culturally determined, shaped by patriarchal traditions that channel women into subsistence food crop production while men dominate high-value cash crop and plot management roles.

Marital Status: A substantial majority of the farmers are married (70%), while a smaller percentage are single (16.7%), widowed (6.7%), or separated (6.7%). This suggests that farming households are largely family-oriented, which could influence labour availability and household responsibilities.

Household Size: Most households have 6-10 members (55%), followed by those with 1-5 members (27.5%). Larger households may provide more labour resources for farming activities, although they also imply greater household consumption needs.

Educational Level: A significant proportion of farmers have secondary education (40%), followed by primary education (35.8%). Only a small percentage have tertiary education (14.2%), and 10% have no formal education. The relatively low level of tertiary education may limit access to modern agricultural techniques and innovations. The preponderance of secondary and primary school-educated farmers is consistent with established researches on the educational composition of smallholder farming populations in Nigeria, as affirmed by the FAO (2016), which documents that the average educational attainment of Nigerian smallholder household heads approximates five years of schooling, reflecting a predominantly basic-level educational base across the sector. Inferentially, the secondary school-educated majority is not without productive significance; Paltasingh and Goyari (2018) demonstrate that as educational level increases, agricultural output increases correspondingly, with secondary school education yielding the highest returns on agricultural productivity among smallholder farmers, suggesting that the 40% of farmers with secondary education in this study constitute a critical human capital asset capable of mediating improved farm output. Similarly, Acheampong, Owusu and Asuming-Brempong (2017) establish that farmers who completed a minimum threshold of secondary level education are most likely to adopt modern varieties and experience the yield-augmenting effects of education, an inference that lends optimism to the productive potential of this cohort.

Source of Farm Land: The primary sources of farmland are hired land (33.3%), inherited land (24.2%), and family land (25%). This distribution indicates that land tenure is largely based on rental agreements or inheritance, which could affect long-term investments in land improvement.

Farm Experience: The farming population in this study is predominantly early-career, with 45.8% having 1–5 years of experience. While novice farmers exhibit greater receptivity to innovation, they lack accumulated agronomic knowledge, whereas experienced farmers resist technological change despite their competence (Ainembabazi and Mugisha, 2014; Karki et al., 2020, cited in Magpantay et al., 2025). Isaacson et al. (2025) and FAO (2023) recommend differentiated, participatory extension strategies to bridge this experiential divide effectively.

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Labour Source: The predominance of family labour (57.5%) underscores the subsistence-oriented nature of farming in the study area, where household members serve as the primary productive workforce — a pattern consistent with smallholder agriculture across Sub-Saharan Africa. Oluwatayo and Sekhampu (2014) associate heavy reliance on family labour with limited farm expansion and reduced productivity, while Doss (2018) argues that hired labour supplementation significantly enhances output. The underutilisation of hired labour in this study therefore signals constrained productive capacity and economic scalability among sampled farmers.

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Farm Size: The majority of farmers operate small farms of 1-3 hectares (86.7%), which is typical in many rural farming communities. This indicates a predominance of smallholder farming, with limited capacity for large-scale agricultural production.

Access to Credit: Most farmers do not have access to farm credit (5.9%), which is not crucial for purchasing inputs and investing in farm improvements.

Extension Services: A significant number of farmers have not received any extension visits (82.5%), which suggests a gap in the dissemination of agricultural knowledge and support from extension services.

Off-Farm Work and Income: While 57.5% of farmers do not engage in off-farm work, a substantial proportion (42.5%) does, indicating diversification of income sources. Among those who engage in off-farm work, the majority earn between ₦31,000-₦50,000 (62.5%).

Cooperative Membership: Most farmers are not members of any cooperative society (90.8%), which could limit their access to collective resources and bargaining power.

Distance to Market: The majority of farmers are located within 0-3 km from the nearest commodity market (87.5%), which facilitates access to markets for selling produce.

Farm Insurance: A very small percentage of farmers have farm insurance (7.5%), indicating a high level of vulnerability to risks such as crop failure or natural disasters.

Ascertaining the Factors Driving Land Degradation

This Table (4.2) presents the perceived severity of various factors contributing to land degradation.

Cattle grazing were identified very serious factor by 55.8% of respondents, reflecting the impact of livestock on soil compaction and vegetation loss. Acid Rain (57.5%) and Fire Disasters (75%) which were seen as very serious contributors to land degradation, highlighting environmental and anthropogenic threats to land quality. Oil Exploration and Urbanization were also perceived as significant, with oil exploration (75.8%) being particularly impactful, likely due to pollution and land-use change associated with these activities. The result also revealed that Soil Nutrient Loss and Erosion were substantial majority view indicating (79.2%) and (82.5%) were responsible for very serious issues, which are fundamental to the degradation of agricultural land. From the table, cattle grazing (83.3%) and deforestation (86.7%) were critical factors, underscoring the role of water management and forest cover in maintaining land productivity. This corroborates the study carried out by (Moldovan *et al*., 2022, and Edoja et al., 2021)/

Analyzing the Effects of Socio-Economic Characteristics on Land Degradation in the Study Area

The regression model yielded an R^2 of 0.123 and an Adjusted R^2 of 0.049, indicating that the socio-economic predictors collectively account for approximately 12.3% of the variation in land degradation, with the adjusted figure accounting for degrees of freedom. The model was statistically significant at the 1% level ($F = 1.670$; Prob > $F = 0.000$), confirming the overall joint significance of the socio-economic variables in explaining land degradation patterns in the study area.

Among the predictors, three variables emerged as statistically significant determinants of land degradation. Education ($\beta = -0.013$; $p < 0.05$) exerted a significant negative effect, implying that higher educational attainment among farmers is associated with reduced land degradation, consistent with the expectation that more educated farmers are better equipped to adopt sustainable land management practices (Nkonya et al., 2016). Household size ($\beta = 0.042$; $p < 0.05$) exerted a positive and significant influence, suggesting that larger households intensify pressure on farmland through increased labour deployment and subsistence demand, thereby accelerating degradation a finding corroborated by Mango et al. (2017), who associate larger household sizes with greater resource extraction from farm plots. Most notably, farming experience ($\beta = -0.194$; $p < 0.01$) emerged as the strongest and most significant predictor, with its negative coefficient indicating that more experienced farmers are significantly less likely to engage in land-degrading practices, presumably because accumulated agronomic knowledge informs more conservative and restorative land use decisions (Ainembabazi and Mugisha, 2014). Variables including age, sex, marital status, source of farm labour, farm size, access to credit, and cooperative membership were statistically non-significant, suggesting their influence on land degradation in this study area is indirect or mediated by other structural factors.

effects of slowly progressing land degradation processes, as farmers may not immediately attribute income changes to gradual environmental changes. Erosion and nutrient deficiencies were identified by 81.25 percent of sampled farmers as the most important indicators of land degradation in Kwara State, Nigeria (Tsado et al., 2021), affirming that these variables carry substantive real-world income implications that the current model's specification may not have fully captured.

Conclusion

This study examined the impact of land degradation on the socioeconomic livelihoods of small-scale farmers in Ethiope East Local Government Area of Delta State, Nigeria, using multiple linear regression analysis to test two null hypotheses namely, that socio-economic characteristics of farmers have no effect on land degradation, and that land degradation has no effect on farmers' income. Drawing on primary data from 120 respondents across ten communities affected by land degradation, the empirical analysis generates findings that are both internally consistent and strongly anchored in the broader literature on land degradation and smallholder agricultural economics in Nigeria and Sub-Saharan Africa.

The study identifies two categories of factors driving land degradation in Ethiope East LGA: socio-economic determinants operating at the household level, and biophysical and anthropogenic forces operating at the landscape level. At the household level, the multiple linear regression model ($F = 1.670$; $p < 0.01$; Adjusted $R^2 = 0.049$) established that educational attainment, household size, and farming experience are the statistically significant socio-economic determinants of land degradation in the study area. More specifically, higher educational attainment ($\beta = -0.013$; $p < 0.05$) and longer farming experience ($\beta = -0.194$; $p < 0.01$) were each found to exert significant negative effects on land degradation, confirming that human capital accumulation — whether through formal schooling or experiential agronomic practice — reduces farmers' propensity to engage in land-degrading behaviour. This finding is consistent with the conclusion of Nkonya, Mirzabaev and von Braun (2016), who demonstrate across multiple Sub-Saharan African countries that education and farming knowledge are among the strongest protective factors against land degradation at the farm level. Household size ($\beta = 0.042$; $p < 0.05$), by contrast, exerted a positive and significant effect, indicating that larger households intensify subsistence pressure on farmland, thereby accelerating degradation a pattern consistent with Mango et al. (2017), who associate household size with greater resource extraction from farm plots, and with Tefera et al. (2024), who affirm that demographic pressure constitutes one of the most persistent indirect drivers of land degradation across Sub-Saharan Africa. At the landscape level, farmer perception data revealed that deforestation (86.7%), sand dredging (89.2%), heavy rain (87.5%), cattle grazing (83.3%), land pollution (85.0%), and erosion (82.5%) were the most severely perceived contributors to land

degradation, with all thirteen factors assessed scoring above the 2.5 Likert mean threshold. Unsustainable agricultural practices and deforestation are the leading causes of land degradation in Sub-Saharan Africa, with nearly 70% of the region's soil resources affected by soil erosion and nutrient depletion (Tefera et al., 2024), a finding that directly substantiates the perceptual landscape described by farmers in this study. Soil erosion, drought, deforestation, and climate change, alongside socio-economic factors such as poverty, land tenure insecurity, population pressure, and economic instability, are the key factors that drive land degradation (Slayi et al., 2024), a multi-causal typology that maps directly onto the thirteen degradation indicators identified in this study. The convergence of socio-economic household-level drivers with broader anthropogenic landscape pressures including oil exploration (75.8%) and industrialisation (80.0%), which are distinctive features of the Niger Delta context confirms that land degradation in Ethiope East LGA is a structurally embedded and multi-dimensional environmental crisis rather than a singular agronomic problem.

The income regression model ($F = 1.001$; $p < 0.056$; Adjusted $R^2 = 0.20$) confirmed that land degradation exerts a statistically significant collective effect on the income of smallholder farming households in the study area, thereby validating the rejection of H_{02}. Three degradation variables emerged as significant determinants of income: cattle grazing ($\beta = -0.180$; $p < 0.05$) and soil nutrient loss ($\beta = -0.059$; $p < 0.01$) exerted significant negative effects on farm income, while fire disaster ($\beta = 0.782$; $p < 0.05$) registered a counterintuitive positive coefficient — explicable in the context of short-term slash-and-burn cultivation cycles rather than any genuine income enhancement. The income-depressing effects of cattle grazing and soil nutrient loss on farmers' livelihoods are consistent with the extensive empirical literature on land degradation and poverty in Nigeria. Land degradation spurs rural poverty, with land-degraded farmers exhibiting a livelihood security composite index of only 0.33 compared to 0.72 among non-degraded farmers, confirming the severe livelihood erosion that progressive land degradation imposes on smallholder households (Tsado, Umar and Sadiq, 2021). More than 80% of smallholder farmers in North-Central Nigeria affirm that land degradation has direct impacts on both crop yield and livestock production, with gender, age, education, farmland size, and family size each exerting statistically significant influence on income diversification as a coping response (Tsado et al., 2021). The livelihood consequences documented in this study extend beyond immediate income loss to encompass forced occupational diversification: 42.5% of sampled farmers had engaged in off-farm work, with the majority earning between ₦31,000 and ₦50,000 monthly from non-farm activities a pattern that Nyamamu et al. (2025) characterise as a distress-driven rather than opportunity-driven diversification response, arising not from expanded livelihood options but from the compulsion to compensate for declining agricultural income. Impoverished communities are frequently driven to overexploit their natural resources, leading to land degradation and subsequently perpetuating their state of poverty a poverty-environment trap (Gambo et al., 2024) that is clearly observable in the study population, where land degradation, income erosion, and structural institutional deprivation mutually reinforce one another. The near-total exclusion of farmers from formal credit markets (94.2% without credit access), the pervasive absence of extension contact (82.5%), and non-membership in cooperative societies (90.8%) collectively compound the livelihood consequences of land degradation by stripping farmers of the institutional buffers through which degradation effects could otherwise be moderated. Environmental degradation in the Niger Delta has rendered many traditional livelihoods unviable, creating a feedback loop wherein climate-induced environmental stressors and corporate-induced destruction mutually reinforce local vulnerabilities (Josiah and Akpuh, 2022) a characterisation that captures with precision the interlocking livelihood crisis confronting smallholder farmers in Ethiope East LGA.

In sum, the study affirms that land degradation in Ethiope East Local Government Area is driven by a convergence of socio-economic household characteristics — principally low education, large household size, and limited farming experience — and pervasive anthropogenic landscape pressures including deforestation, cattle grazing, erosion, and oil-related pollution. Its effects on the livelihoods of smallholder farmers are measurable, statistically significant, and deeply consequential, manifesting in direct income reduction through cattle grazing and soil nutrient loss and compelling involuntary livelihood diversification into low-return non-farm activities. These findings further validate the foundational position of Akinanagbe and Umukoro (2011) that land degradation substantively affects agricultural activities in the study area, while extending that insight to establish the income and livelihood pathways through which degradation translates into household poverty. Addressing land degradation in Ethiope East LGA therefore requires an integrated response that simultaneously targets the socio-economic determinants of degradation, the specific biophysical drivers beginning urgently with deforestation and unregulated cattle grazing and the structural institutional deficits that constrain farmers' adaptive capacity and income resilience.

Policy Implications

The findings of this study generate empirically grounded policy imperatives across five interconnected domains. First, the statistically significant income-depressing effect of cattle grazing ($\beta = -0.180$; $p < 0.05$) demands the decisive enforcement of Delta State's Prohibition of Open Cattle Grazing Law, supported by community monitoring structures and ranching incentive programmes, given IFAD's (2024) documentation that unregulated grazing is progressively eroding Nigeria's smallholder agricultural productivity base. Second, the robust negative effect of soil nutrient loss on income ($\beta = -0.059$; $p < 0.01$) necessitates the mass scaling of subsidised organic soil amendment packages encompassing compost,

agroforestry integration, and crop rotation delivered through revitalised Delta State ADP farmer field schools, since education ($p < 0.05$) and farming experience ($p < 0.01$) are confirmed protective factors against degradation (Olumba et al., 2025). Third, the near-total credit exclusion of farmers (94.2%) demands NIRSAL and Bank of Agriculture land-restoration-linked credit products specifically designed for smallholder farmers in the Niger Delta. Fourth, cooperative formation programmes should be operationalised to bridge institutional deficits that leave 90.8% of farmers without collective support. Fifth, gender-responsive land titling is indispensable for unlocking the productive potential of the female farming majority (75.8%), whose structural exclusion from land ownership, credit, and extension systems perpetuates the degradation-poverty trap documented in this study (Tsado et al., 2021; Adeyemo and Adeagbo, 2024; Barbier and Hochard, 2018).

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