

## RURAL LAND USE ON AGRICULTURAL ACTIVITIES IN IKWERE LOCAL GOVERNMENT AREA

**Didia Michael Uzodiana**  
**Department of Geography and Environment**  
**Faculty of Environmental Sciences**  
**Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Nigeria**  
[michael.didia@ust.edu.ng](mailto:michael.didia@ust.edu.ng)

### ABSTRACT

Abstract Rural land use plays a critical role in shaping agricultural productivity, environmental sustainability, and community livelihoods. In Ikwere Local Government Area (LGA) of Rivers State, rapid urbanization and land-use changes have raised concerns about their effects on agriculture. This study examines the impact of rural land use on agricultural activities in Ikwere LGA between 2010 and 2023, focusing on the patterns of land use and their socio-economic drivers. The study employed satellite imagery processed using ArcGIS software, which classified the region into five land cover types: natural vegetation, agricultural land, built-up areas, bare land, and water bodies. The Maximum Likelihood Classification (MLC) algorithm was used to track land use changes over the years. Additionally, a survey of 389 residents provided insights into the socio-economic factors influencing land use decisions. Findings revealed significant shifts in land use between 2010 and 2023, primarily driven by urbanization. In 2010, Ikwere LGA was largely covered by dense vegetation (597.7 km<sup>2</sup>), with built-up areas occupying only 47.2 km<sup>2</sup>. However, by 2023, built-up areas had expanded to 80.5 km<sup>2</sup>, while dense vegetation drastically declined to 418.4 km<sup>2</sup>. The increase in bare soil from 94.1 km<sup>2</sup> in 2020 to 110.7 km<sup>2</sup> in 2023 suggests growing land degradation, potentially leading to soil erosion and biodiversity loss. Urbanization, spurred by population growth, industrialization, and rising land demand for housing and infrastructure, was identified as the primary factor behind these changes. Economic development, coupled with rising land prices and government policies that prioritize urban expansion over agriculture, further reduced the availability of agricultural land. Cultural practices, such as land inheritance and communal ownership, also influenced land use decisions. The study underscores the urgent need for sustainable land use planning in Ikwere LGA to mitigate the adverse effects of urban expansion on agricultural productivity and environmental health. Without intervention, continued deforestation and land degradation could undermine food security and the livelihoods of rural communities. In conclusion, this research highlights the critical link between rural land use and agricultural sustainability, urging policymakers to balance urban development with the preservation of agricultural and natural landscapes.

**Keywords:** *Rural Land Use; Agricultural Activities; Land Use Change; Urbanization and Environmental sustainability*

### INTRODUCTION

#### Background of Study

Rural land use is pivotal in shaping agricultural activities and sustainability by impacting productivity, environmental health, and community livelihoods. This influence extends to land allocation, soil quality, water management, biodiversity conservation, and socioeconomic dynamics, emphasizing the interdependence of land use and agricultural outcomes (Liu et al., 2023). This study examined the impact of rural land use on agricultural activities in Nigeria, focusing on the Ikwere Local Government Area in Rivers State as a case study.

Rural land use is a complex and dynamic aspect of environmental management that encompasses a diverse range of activities and practices in rural areas. Land is allocated for a variety of purposes, including agriculture, forestry, residential development, conservation, and infrastructure (Liu et al., 2023). Sustainable rural land management is critical for preserving ecological integrity, supporting livelihoods, and improving overall well-being in rural communities (Umar et al., 2023).

In many rural areas, agriculture remains a dominant land use activity. Sustainable agricultural practices prioritize optimizing land use efficiency, conserving natural resources, and reducing environmental impact. These practices include crop rotation, agroforestry, integrated pest management, and soil conservation techniques (Çakmakçı et al., 2023). Sustainable agriculture not only improves food security, but it also helps to conserve biodiversity and build climate resilience.

Agriculture is a critical sector in Nigeria, contributing significantly to the country's economy, employment, and food security. It is the largest non-oil sector, employing about 70% of the labour force and providing livelihoods for millions of rural households (Romanus et al., 2020). Nigeria's diverse agroecological zones enable the cultivation of a wide range of crops, including cereals, root crops, fruits, vegetables, and cash crops such as cocoa, oil palm, and rubber (Geoinfotech, 2023). The Food and Agriculture Organization of the United Nations (FAO) reported in 2021 that agriculture is a significant contributor to Nigeria's economy, accounting for 22.35% of the country's GDP. However, the dynamics of Nigerian agricultural practices have far-reaching implications for rural land use.

The conversion of agricultural land to non-agricultural purposes has significant implications for rural land use and agricultural practices (Li et al., 2024). Farmers often struggle to make ends meet due to insufficient agricultural investment and support, resulting in farmland abandonment. This abandoned land is then vulnerable to conversion for other purposes, such as housing, infrastructure development, or industrial use, contributing to urban sprawl and the loss of fertile agricultural land (Oluwatayo et al., 2019).

The intensification of agricultural activities in rural areas is a direct consequence. With population growth and rising food demand, farmers turn to more intensive practices to increase yields (Akano et al., 2023). However, this intensified approach causes land overuse, soil deterioration, and biodiversity loss, posing sustainability challenges for rural landscapes. This trend emphasizes the critical need for sustainable farming methods to reduce negative environmental impacts and ensure long-term agricultural viability in rural communities (Gomiero, 2016).

However, monoculture practices, which are commonly associated with cash crops such as cocoa, oil palm, and rubber, have an impact on rural land use. These crops require extensive land areas, resulting in large plots of land dedicated solely to their cultivation (Loh et al., 2022). This monoculture approach causes soil exhaustion due to the continuous cultivation of the same crop, resulting in decreased fertility and productivity over time. Monoculture reduces crop diversity, making agricultural systems more susceptible to pests and diseases that spread quickly across vast monoculture fields, posing significant challenges for farmers in maintaining crop health and yields (Gomiero, 2016).

Furthermore, the study area, Ikwere Local Government Area in Rivers State, serves as a microcosm of these issues, grappling with the consequences of land use changes and the resultant agricultural activities. This study advocates for a comprehensive and context-specific approach to addressing the impact of rural land use on agricultural activities in Ikwere Local Government Area, Rivers State.

### **Statement of the Problem**

The conversion of rural land use to urban land use is a common phenomenon in most parts of the world due to the perceived benefits of urban living over rural living (Nuissl & Siedentop, 2020). Rivers State, located in southern Nigeria, is known for its diverse agricultural activities, which include crop cultivation and livestock rearing. However, in recent years, the region's land use patterns have shifted dramatically, particularly in rural areas such as the Ikwere Local Government Area. Population growth, urbanization, industrialization, and infrastructure development are among the factors driving these changes (Eludoyin et al., 2011).

Growing amounts of agricultural land being converted into non-agricultural land is one of the main problems with rural land use in Nigeria. This includes the expansion of residential areas, the construction of commercial complexes, and the establishment of industrial zones (Saleh et al., 2014). As a result, agricultural land is becoming scarce, fragmented, and less productive. This trend endangers not

only the livelihoods of rural communities that rely on agriculture but also has far-reaching implications for food security and environmental sustainability (Oluwatayo et al., 2019).

Land fragmentation, a direct consequence of land use change, leads to smaller farm sizes and reduced economies of scale for farmers. This makes farming less profitable and hinders agricultural development in the region. Furthermore, the loss of biodiversity due to habitat destruction and the use of agrochemicals in non-agricultural activities poses ecological challenges, affecting local ecosystems and natural resources (Obayelu et al., 2019). Further to that, the conversion of agricultural land frequently results in deforestation and land degradation, which contribute to climate change and environmental degradation. This has implications not only for the local communities but also for the broader region and global efforts towards sustainable development and conservation (Ibrahim et al., 2018).

In light of these challenges, it is critical to understand the impact of rural land use on agricultural activities in Ikwere LGA. Comprehensive research is required to determine the extent of land use change, analyze its effects on agricultural productivity, assess socioeconomic impacts on rural communities, and recommend sustainable land use strategies. This study aims to provide useful insights and evidence-based recommendations for Rivers State policymakers, land use planners, and agricultural development initiatives.

### **Research Questions**

The impact of rural land use on agricultural activities in Ikwere Local Government Area, Rivers State, Nigeria, is a critical area of study due to its implications for food security, environmental sustainability, and rural development. As urbanization and industrialization accelerate, rural areas face increased pressure to convert their land, resulting in land fragmentation, biodiversity loss, and changes in agricultural practices. It is essential to comprehend these dynamics to develop agricultural practices and land use regulations that sustainably balance rural communities' economic growth and environmental preservation. The research questions for this study intend to answer the following;

- i. What are the key factors driving changes in land use patterns in the rural areas of the study area?
- ii. How do land tenure systems and land use policies influence agricultural practices and land management in the study area?
- iii. What are the socioeconomic implications of land fragmentation and loss of agricultural land in rural communities in the study area?
- iv. How do climate change and environmental degradation impact agricultural activities and land use practices in the study area?
- v. What are the strategies and interventions adopted by local stakeholders to address the challenges associated with rural land use and agricultural productivity in the study area?

### **Aim and Objectives**

The study aims to examine the impact of rural land use on agricultural activities in Ikwere Local Government Area, Rivers State. The objectives of the study are to:

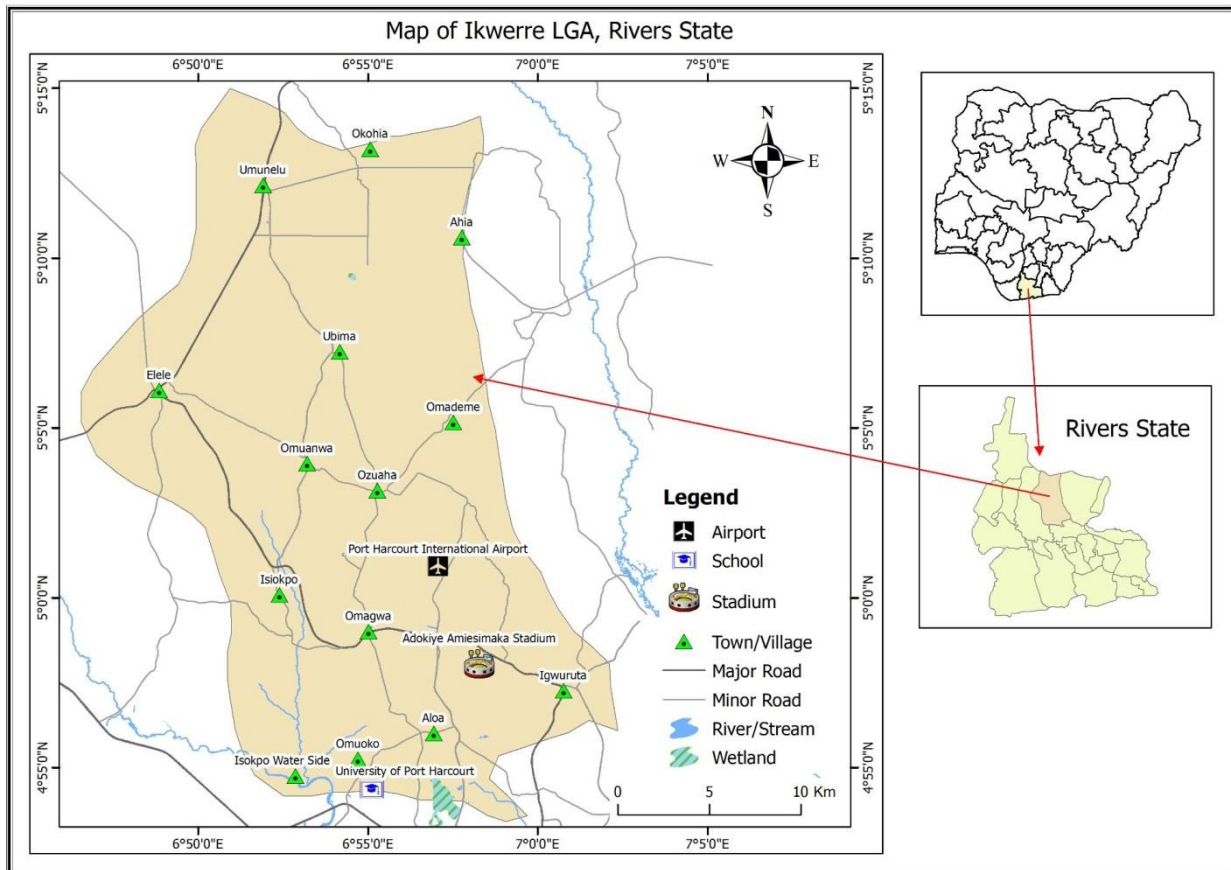
- i. evaluate the current land use patterns in the study area and identify areas where agricultural activities are prevalent.
- ii. assess the types of rural land use changes occurring in the study area and their impacts on agricultural practices.
- iii. investigate the socio-economic factors driving rural land use changes in the study area.
- iv. propose strategies and recommendations for balancing rural development needs with agricultural sustainability in the study area.

### **Study Area**

#### **Location, Position and Size**

Ikwere Local Government Area is situated in Rivers State, Nigeria, within the Niger Delta region in the southern part of Nigeria. It is strategically located near major cities and transportation routes, making it an important area for economic activities and development initiatives (Chinda, 2017). Ikwere

Local Government Area lies between latitudes 4°58' 33" N and longitudes 6°53'21" E. The local government area covers 530 km<sup>2</sup> (1,380 sq mi). It shares borders with other local government areas, including Obio/Akpor to the south, Emohua to the east, Etche to the northeast, and Port Harcourt City to the west. This location places it within the broader context of Rivers State's administrative and economic landscape (Elekwachi et al., 2021).



**Figure 1.1:** Map of Rivers State showing Ikwerre Local Government Area  
**Source:** Ministry of Environment (2024)

### Population and People

According to the National Population Commission (NPC, 2006), the population of Ikwerre Local Government Area in Rivers State, Nigeria, as of 2006 was 188,930, with an annual population change of 2.3%. However, this data may have changed over time due to natural population growth, migration, and other demographic factors.

Nevertheless, the Ikwerre ethnic nationality constitutes one of the major ethnic groups in Rivers State of Nigeria, with an estimated population of about 1.5 million people. It inhabits at present four local government areas, namely, Emohua, Ikwerre, Obio/Akpor and Port Harcourt. They are blessed with rivers, streams, and very fertile soil. The people are, therefore, invariably farmers, fishermen, and traders. Their food crops, among others, include cassava and yam, while palm oil is their main cash crop (Ogoloma, 2013). Factors such as population growth, urbanization, and migration patterns have implications for land use planning, infrastructure development, and resource allocation in the Ikwerre Local Government Area.

## CONCEPTUAL FRAMEWORK, THEORETICAL FRAMEWORK AND LITERATURE REVIEW

### Theoretical Framework

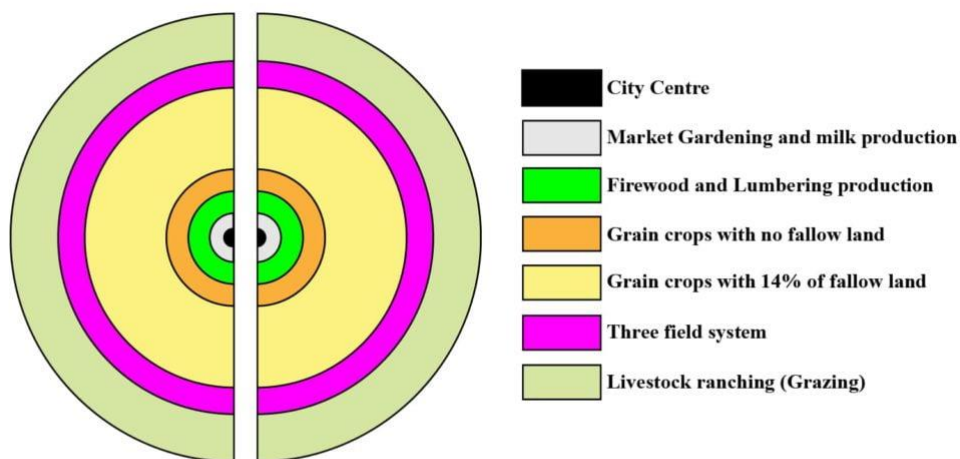
Rural land use theory is a field of study that explores how land in rural areas is utilized and managed. It encompasses various aspects such as agricultural practices, resource allocation, environmental conservation, and community development. Some key theories in rural land use include:

#### Von Thünen's Agricultural Location Theory

Johann Heinrich von Thünen proposed it in the early nineteenth century as a pioneering concept in rural land use. According to the theory, transportation costs and market demand drive the spatial distribution of agricultural activities. It implies that different types of farming activities will be located at varying distances from urban centres, depending on the cost of transporting goods to market (Von Thünen, 1826).

According to Von Thünen's model, intensive farming practices that produce perishable goods with high transportation costs, such as fruits and vegetables, are located close to cities to reduce transportation costs while ensuring fresh delivery to consumers. Extensive farming activities, such as livestock grazing or forestry, which have lower transportation costs and produce less perishable goods, are located further away from urban areas.

The theory also considers the concentric rings of land use surrounding a city, with the most intensive and high-value crops grown closest to the city and less intensive or extensive land uses in the outer rings (see Figure 2.1). This spatial organization assists agricultural producers in maximizing land use efficiency and economic returns while taking into account market accessibility and transportation constraints (Thakur, 2022).



*Von Thunen's System of Agricultural Landuse*

**Figure 2.1:** Von Thunen's Model of Agricultural Location

**Source:** Kapoor (2023)

Von Thunen's model, as seen in Figure 2.1, imagines agriculture arranged in concentric rings around a market city. Various farming activities are represented by each ring, which is primarily determined by crop values and transportation costs.

- The innermost ring consists of crops that have high value for their weight, like fruits, vegetables, and dairy products. Even though these farms are further away from markets, the value of their produce can offset the costs of transporting them into the city. This first ring practices market gardening and dairy farming.
- The next ring outward contains forestry. Timber and firewood are bulky products with moderate value, so they perform best when located near consumption areas but not directly adjacent to cities. This intermediate zone works well for forestry.
- The third ring is dedicated to the cultivation of less valuable field crops, such as grains, which have a lower value per unit weight. These crops perform best when grown close to markets to reduce transportation costs, which eat into their lower profits. Grains such as wheat and corn dominate the middle ring.
- The outermost ring is dedicated to ranching and livestock grazing. Since livestock have the lowest value-to-weight ratio of all, they require the greatest amount of land per dollar of output. They are located farthest from markets to make use of cheaper pastures that are less suitable.

In the model, each ring denotes an agricultural activity that finds the best location by balancing the cost of transportation with the value of the goods sold. Higher-value crops and livestock per unit of weight can offset higher transportation costs if they are located further away from markets.

### **Bid-Rent Theory**

The Bid-Rent Theory is a fundamental concept in urban and rural land use economics that explains how land use patterns change depending on the economic value of land at different distances from market centres. This theory expands on Johann Heinrich von Thünen's agricultural land use model, offering insights into the spatial organization of agricultural and urban activities (Britannica, 2019).

The basic tenet of the bid-rent theory is that land rent falls with distance from the central market or urban centre. The declining accessibility and convenience for economic activity are reflected in this decline in land rent (Chidi, 2019). The theory assumes that land users, whether agricultural or urban, seek to maximize their profits or utility, leading to strategic decisions about where to locate based on the costs associated with land and transportation (Britannica, 2014).

The bid-rent theory helps to explain why specific farming practices are concentrated in large markets or urban areas. Growers of high-value or perishable crops may choose to operate closer to markets in order to ensure freshness and lower transportation costs. Less intensive agricultural practices, like forestry or broad livestock grazing, are typically found farther from cities, where land prices are lower (Jäger, 2020).

In terms of urban land use patterns, the bid-rent theory is also applicable. Land rents near urban centres are higher for businesses and industries that need to be close to suppliers or customers. As a result, less land-intensive or lower-value activities are pushed towards the urban periphery, and commercial, residential, and industrial activities are concentrated in inner city areas (Chidi, 2019).

### **Agricultural Land Use Intensity Theory**

A theory called Agricultural Land Use Intensity Theory explores the process farmers use to determine how intensely to use land for agricultural activities. It centres on making the best use of available land to increase productivity while taking into account variables like market demand, soil quality, climate, technology, and sustainability (Zhang & Li, 2016). Essentially, this theory acknowledges that the potential for productivity varies across different types of land. The suitability of land for different types of agricultural activities is influenced by several factors, including slope, drainage, fertility of the soil, and the availability of water. Farmers must assess these factors to determine the most appropriate land use intensity for their specific circumstances (Bodaghabadi et al., 2019).

Crop selection and rotation are central to one aspect of this theory. Planting crops that are well-suited to the features of their land allows farmers to do things like plant crops that grow well in acidic soils or crops that are resistant to drought in arid regions. Crop rotation techniques are also used to minimize pest pressure, preserve soil fertility, and gradually maximize yields (Yu et al., 2022). Using

agricultural inputs, such as pesticides, fertilizers, and irrigation, is another essential component. The intensity of input use is determined by factors such as soil nutrient levels, pest infestation risks, water availability, and economic concerns (Karunathilake et al., 2023).

Moreover, technological advancements influence land use intensity. Modern agricultural practices, such as mechanization, genetic engineering, and precision farming technologies, enable farmers to increase productivity per unit of land while lowering labour costs (Karunathilake et al., 2023). Market demand also influences land-use intensity decisions. For high-value crops or livestock products that sell for more money on the market, farmers intensify the use of their land. For goods with lower market value but lower production costs, on the other hand, they choose to employ extensive land use practices (Khan et al., 2019).

Agricultural Land Use Intensity Theory provides farmers and policymakers with a framework for making informed decisions about land use practices in agricultural landscapes that balance productivity, economic viability, environmental sustainability, and social concerns.

## **Conceptual Framework**

### **Spatial Organization**

Spatial organization refers to the arrangement and distribution of land uses, resources, and activities within a geographical area. It is essential to the sustainability, efficiency, and functionality of rural landscapes, especially when it comes to agricultural operations (Yin et al., 2023). Analyzing the arrangement and interactions between various elements—such as land parcels, infrastructure, natural features, and human settlements—is necessary to comprehend spatial organization.

Land use patterns play a major role in the spatial organization of rural areas. These patterns differ significantly depending on topography, soil fertility, climate, land ownership systems, and historical land use practices (Gobin et al., 2001). For instance, in regions with fertile soil and favourable climate conditions, agricultural land use may dominate, with farms and fields arranged in a patchwork pattern reflecting different crops or livestock activities. Whereas some areas may be set aside for forestry or conservation, areas with rough terrain or environmental restrictions might have more scattered or clustered land uses (Muschler, 2016).

Spatial organization is also significantly influenced by infrastructure. The accessibility, use, and development of land are influenced by infrastructure components such as roads, railroads, irrigation systems, and others (Liu et al., 2020). Strategic infrastructure placement increases agricultural productivity by improving market access, facilitating input and product transportation, and enabling efficient water management practices. Further to that, spatial organization is inextricably linked to land use planning and management. The use and development of land is influenced by planning laws and policies, including zoning codes, conservation easements, and land use designations (Gomes et al., 2024). Sustainable utilization of rural landscapes is ensured through effective land use planning, which aims to strike a balance between conflicting interests like agricultural production, environmental preservation, urban development, and cultural heritage preservation (Liu et al., 2023).

Furthermore, spatial organization impacts social dynamics and community interactions. For rural residents, quality of life, social cohesion, and economic opportunities are influenced by settlement patterns, community amenities, and service accessibility. Designing inclusive and resilient rural landscapes that support a variety of livelihoods and cultural identities requires an understanding of these social dimensions (Gharaibeh et al., 2021).

### **Land Use Planning**

Land use planning is a systematic process that aims to guide the use and development of land in a manner that balances economic, social, and environmental needs. To achieve sustainable and equitable land use patterns, goals must be established, suitable land uses identified, resources allocated, and policies and regulations implemented (Van & Wrachien, 2002). This concept is critical for managing both urban and rural areas, resolving land-use conflicts, and encouraging efficient resource allocation.

Zoning is a fundamental component of land use planning; it establishes boundaries between areas of land and sets rules regarding permitted uses, building densities, and development requirements (Fischel, 2000). Zoning helps to organize land uses, prevent incompatible land uses from co-locating, and protect sensitive areas such as agricultural lands, natural habitats, and residential neighbourhoods (Millman Land, 2021). The primary types of zoning include:

- i. **Residential Zoning:** This pertains to the building of residential structures, including single-family residences, apartments, mobile homes, and condominiums. Residential zoning laws typically govern the use of residential land, such as prohibiting farm animals in suburban neighbourhoods and limiting construction projects.
- ii. **Commercial Zoning:** This primarily refers to non-industrial businesses such as offices, shopping malls, nightclubs, and hotels. Laws or regulations may exist that prohibit or restrict adult entertainment businesses, such as gentlemen's clubs and taverns, to specific geographic areas. Typically, these businesses must be located a certain distance from existing schools, churches, and parks.
- iii. **Industrial Zoning:** Similar to commercial zoning, industrial zoning focuses on business. The difference is that industrial zoning regulates businesses based on environmental factors like noise, air quality, and use. Airports and manufacturing plants are examples of typical industrial sector businesses. Lastly, unlike commercial zones, set-back requirements are higher for industrial-zoned properties.
- iv. **Agricultural Zoning:** This refers to mostly agricultural communities. This zoning type limits the density of development and restricts the non-agricultural use of land within this zone. Density is typically controlled by setting sizeable minimum lot sizes, but it may vary depending on the type of operations to take place on the property. Lastly, the purpose of this zoning type is to protect farming communities from fragmentation brought on by commercialization and housing development.

Land use planning also involves strategic spatial planning, which takes a broader perspective on land use issues at regional or national scales. It integrates economic, social, and environmental considerations to identify growth areas, infrastructure needs, conservation priorities, and areas suitable for different land uses (Oliveira & Meyfroidt, 2022). Strategic spatial planning helps to coordinate development activities, minimize sprawl, and promote sustainable land use patterns.

Moreover, involving stakeholders like local communities, landowners, businesses, and government agencies, public participation is another essential part of land use planning (Badiora, 2020). Engaging stakeholders in the planning process aids in identifying diverse viewpoints, gathering local knowledge, achieving consensus, and ensuring that land use decisions reflect community values and priorities (Zikargae et al., 2022).

Further to that, environmental considerations are also factored into land use planning using tools like environmental impact assessments (EIAs), sustainability assessments, and land suitability analysis. These tools assist in assessing the potential environmental effects of proposed land uses, identifying mitigation measures, and ensuring that land use decisions are consistent with environmental conservation objectives (Enoguanbhor et al., 2021).

## Sustainability

In rural land use, sustainability is defined as the ability to maintain ecological balance, economic viability, and social well-being over time. It entails practices and policies that reduce environmental impacts, increase agricultural profitability, and support rural communities' livelihoods (Sundberg, 2022). Sustainability is fundamentally defined as the ability to meet current needs without jeopardizing future generations' ability to meet their own. It consists of three interconnected pillars: economic, social, and environmental sustainability (Mensah, 2019).

- i. **Environmental sustainability** focuses on preserving and improving the natural resources and ecosystems that sustain life. Practices that reduce adverse effects on soil, water, air quality, biodiversity, and ecosystem services are the basis of environmental sustainability in rural land use.

This includes implementing sustainable farming techniques such as organic farming, agroforestry, conservation tillage, and water-efficient irrigation. The objective is to protect agricultural lands' long-term productivity while simultaneously preserving the resilience and health of ecosystems.

- ii. **Economic Sustainability:** The viability and resilience of agricultural businesses and rural economies are highlighted by economic sustainability in rural land use. In order to achieve this, policies that support diversified and value-added agricultural products, improve market access and value chains, lower input costs through resource-efficient methods, and create fair and stable incomes for farmers must be promoted. To increase the competitiveness and sustainability of rural businesses, economic sustainability also entails making investments in rural infrastructure, loan availability, training, and technology transfer.
- iii. **Social Sustainability:** The goal of social sustainability is to create thriving, welcoming rural communities where people can live in excellent conditions. This involves making certain that people have access to necessities like housing, healthcare, transportation, and education. Aside from social equity, social sustainability also tackles issues of cultural preservation, community involvement in decision-making, and the empowerment of marginalized groups like rural women, smallholder farmers, and indigenous communities.

### Land Tenure Systems and Property Rights

Land tenure systems and property rights are foundational concepts that underpin the management and utilization of land resources worldwide. These systems define the rights, responsibilities, and relationships that individuals, communities, and institutions have concerning land ownership, access, and use (Nchanji et al., 2023). The diversity of land tenure arrangements reflects varying social, cultural, economic, and legal contexts across different regions and societies.

Land tenure systems cover a wide range of arrangements that govern how land is owned, accessed, and managed. Nigeria's land tenure systems are diverse and frequently reflect historical, cultural, and legal influences (Maduekwe, 2014). The main types of land tenure systems in Nigeria include:

- **Communal Tenure:** This is one of the most common land tenure systems in Nigeria, especially in rural areas. Land under communal tenure is owned and managed collectively by a community or family. Customary practices and communal agreements establish land use and access rights. Communal tenure frequently includes communal farming, grazing lands, and community-based decision-making on land allocation and management.
- **Statutory or Formal Tenure:** This refers to land ownership that is formally recognized by statutory laws and legal structures. It covers situations in which people or organizations have legal titles to land granted by the government under freehold and leasehold agreements. Land that is purchased, sold, or leased through official land markets and transactions is typically subject to statutory tenure in urban and peri-urban areas.
- **Customary Tenure:** Nigeria has a large number of areas with customary land tenure systems, particularly in its rural and traditional communities. These legal frameworks for land ownership, use, and inheritance are derived from customary laws, traditions, and practices. With rights and obligations set by customary authorities and community norms, customary tenure frequently entails communal ownership.
- **Government/Public Land:** This category includes land that is owned and operated by public institutions or the government. It includes lands set aside for public infrastructure, conservation areas, government projects, and communal amenities. Legal procedures and administrative mechanisms are used to lease or allocate government or public land for specific purposes.

### Property Rights in Land Tenure Systems

Property rights are the legal and social rights and responsibilities that individuals, groups, or entities have with respect to tangible and intangible assets such as land, real estate, natural resources, intellectual property, and personal possessions (Kenton, 2024). These rights define individuals' or groups'

ability to use, control, transfer, and profit from property that they own or have rights to. Property rights are critical to economic development, social stability, and the preservation of individual liberties (Alchian, 2018).

Property rights within land tenure systems are shaped by a complex interplay of statutory laws, customary practices, and evolving legal frameworks. It is essential to comprehend these property rights in order to address issues with land governance, advance sustainable development, and assist with agricultural activities (Murken and Gornott, 2022). Property rights within land tenure systems encompass a range of rights and interests, including;

- **Use Rights:** These rights allow people or organizations to use land for specific uses, such as farming, building, commerce, or protecting the environment. According to legal, social, and environmental regulations, use rights determine how land can be used and the activities that are allowed on the property (World Bank, 2020).
- **Rights of Control:** These rights confer the ability of people or organizations to decide how to manage land, distribute resources, and utilize land. Control rights include the power to choose farming practices, plans for land development, infrastructure projects, and conservation strategies. These choices have an impact on the general productivity and sustainability of land use (Ostrom, 1990).
- **Transfer Rights:** The ability to assign ownership or leasehold interests in land to third parties is granted by transfer rights. Transfer rights facilitate the transfer of property rights between parties through the enabling of transactions like the selling of land, its inheritance, its leasing to tenants, or the signing of contracts (FAO, 2018).
- **Exclusion Rights:** These rights enable landowners to bar unauthorized users and visitors from using or entering their property. This entails limiting access to the land, prohibiting trespassing, protecting the owner's authority over the land, and guaranteeing security, privacy, and compliance with land-use agreements (FAO, 2018).

The concepts presented here are fundamental to discussions about land tenure, property rights, and sustainable land management practices.

### Empirical Literature

Research on the impact of rural land use on agricultural activities in Nigeria is quite extensive. Several empirical studies have explored various aspects of this topic, including socio-economic drivers of land use changes, land use patterns, agricultural productivity, environmental sustainability, and rural livelihoods.

The study conducted by Wizer&Eludonyi (2020) aimed to identify the changes that occurred in the peri-urban areas of Choba, Aluu, and Alakahia, which are host communities of the University of Port Harcourt, between the years 2005-2010 and 2010-2015. The researchers used GIS and remote sensing to map changes in land use and land cover in these areas. The purpose of the study is to identify and map the area's land cover and use over a ten-year period (2005-2015). After layer-strapping three data sets of Landsat satellite photos, supervised mapping was done using Arc GIS software and classification was done using EARDAS Imagine software. There were five distinct categories for land cover and use: vegetation, water bodies, agriculture, built-up areas, and vegetation. The study's findings indicate that built-up land increased rapidly between 2010 and 2015, while this class of land also increased between 2005 and 2010. Wizer and Eludonyi (2020) claim that the sharp increase in built-up areas is due to the peri-urban area's rapid urbanization and industrialization. It was also noted that the growing number of students in the area is creating a greater demand for housing, which has had a negative impact on the area's land cover recently. The study thus recommends, among other things, land use regulation in the peri-urban area, government and other critical stakeholders encouraging afforestation, and the implementation of a mitigating control measure to realistically address the contemporary issues of rapid urbanization in the peri-urban areas.

In 2023, Eze conducted research on how changes in land cover and use in the semi-arid region of Nigeria affected agricultural productivity. Changes in land use and land cover have an impact on

ecosystem services and functions, which causes migration of people, primarily in rural areas. The study examines the variables influencing changes in land cover and use as well as their effects on agricultural productivity. To achieve this, a remote sensing technique was used. Landsat Thematic Mapper images from 1990, 2005, and 2020 were collected and analyzed. The Earth Resource Development Assessment System Imagery 9.1 software was used to obtain six land use and land cover classes. Between 1990 and 2020, the land area occupied by wetlands, shrubland, and water bodies decreased, while the land area occupied by bare lands/dunes, settlements, and scattered cultivation increased. The increase in bare land/dune, scattered cultivation, and settlement was primarily caused by climate change, which resulted from overgrazing, the southward movement of dunes from the Sahara desert, increased farming activities, and an increasing demand for shelter by the growing population. The decrease in shrubland, water bodies, and wetland was also linked to climate change, which was caused by increased deforestation and the use of wetland for farming activities. Based on the findings, it is recommended that measures be implemented to integrate sustainable land management and climate change adaptation options for sustainable agriculture.

Adegbola and Adebayo (2017) conducted a study in Oyo State, Nigeria, to investigate the socioeconomic drivers of rural land use changes. The study, which used statistical analysis and household surveys, discovered that rising population levels raise the demand for land, which causes changes in land use, such as the conversion of agricultural land to residential or commercial uses. Higher-income levels among rural households also influence the decisions made about land use, such as the conversion of land for more lucrative uses or investment in non-agricultural ventures. According to research by Adegbola and Adebayo (2017), the kind of land tenure system in existence—community or individual ownership— influences management practices and decisions about land use, which in turn affects the kind and extent of changes to land use.

A study by Oluwatayo and Ajayi (2018) examined the socioeconomic factors that influence changes in land use in rural communities in Osun State, Nigeria. To determine how different factors affect land use patterns, they used regression analysis and Geographic Information System (GIS) techniques. The key factors they investigated included how rural residents' education levels influence land use decisions, as educated individuals may be more aware of sustainable land use practices and have different aspirations for land use than those with lower levels of education. Oluwatayo and Ajayi (2018) also noted that larger households have different land use needs and engage in a variety of agricultural activities to support their livelihoods, implying that household size influences land fragmentation and consolidation patterns. Oluwatayo and Ajayi's (2018) goal was to comprehend how socio-economic dynamics influence changes in land use in Osun State's rural areas by examining these variables.

Ogundare et al. (2018) investigated the relationship between land use and agricultural productivity in Ogun State, Nigeria. They identified four types of land use changes: the conversion of agricultural land to urban and built-up areas, the expansion of commercial and industrial activities into rural areas, deforestation for timber and other uses, and the conversion of natural habitats to agricultural land. The study by Ogundare et al. demonstrated how these land use changes had a negative impact on agricultural practices in Ogun State. Ogundare et al. identified several key consequences, including reduced agricultural land availability, biodiversity loss, changes in soil quality, and potential soil erosion. These findings highlight the importance of sustainable land management practices and land use policies that strike a balance between urban development and the preservation of agricultural land and natural ecosystems.

Enisan et al. (2023) investigated the impact of land use change on infrastructure planning and development in Ikwerre Local Government Area, Rivers State, Nigeria. This is to investigate the impact of land use change on infrastructure planning while also ensuring infrastructure sustainability and urban development in the study area. This was accomplished by collecting relevant information about the research problem using a questionnaire and analyzing it using the Statistical Package for Social Scientists (SPSS). The formulated hypothesis for this study was tested using the available dataset and the prescribed method; the alternative hypothesis (H<sub>1</sub>) was accepted, while the null hypothesis (H<sub>0</sub>) was rejected. The conclusion was drawn in accordance with the recommendation; the sample size is derived from a sample

drawn from the study's total projected population, including the number of households and building units per compound. According to the research findings, there was land use change and infrastructure development in the study area. Furthermore, land use changes over time as a result of individual development desires, government land use planning, and community land use in general. The different land use changes resulted in different uses and different infrastructure development, which altered specific land use planning in one way or another. Various recommendations were made, including revitalization, land use and infrastructure sustainability, development control, the use of Geographic Information Systems (GIS), community and stakeholder participation, and public awareness participation.

In Ondo State, Nigeria, Oladipo et al. (2019) carried out a study with an emphasis on the impacts of land use changes on agricultural productivity and soil fertility. They identified a number of significant changes in land use, such as the intensification of farming practices that degrade the soil, the growth of infrastructure and settlements that encroach on agricultural land, and the conversion of forested areas to agricultural use without appropriate conservation measures. These land use changes have a significant impact on soil health, biodiversity, and agricultural productivity. Agricultural intensification without sustainable management causes soil erosion, nutrient depletion, and reduced crop yields over time. The expansion of settlements and infrastructure into agricultural areas reduces available farmland and disrupts traditional farming systems. Converting forested areas to agricultural land without adequate conservation measures leads to deforestation, biodiversity loss, and soil degradation. All of these factors emphasize the importance of implementing sustainable land management practices in Ondo State and other regions to maintain soil fertility and support agricultural activities. Oladipo et al.'s findings highlight the importance of policies and practices that promote sustainable land use, natural resource conservation, and the use of agricultural techniques that have a low environmental impact while increasing productivity.

## **Summary of Reviewed Literature**

### **Land Use Changes**

Significant changes in rural land use patterns in Nigeria have been extensively documented in studies, reflecting a dynamic landscape with notable transformations. Urbanization and built-up areas have replaced agricultural land as one of the most noticeable changes (Adeoye et al., 2020).

Cities and towns are spreading into formerly agricultural areas due to rapid urbanization caused by population growth and economic activity. The amount of land that is available for agriculture is decreased when this transition is frequently coupled with changes in land use from farming to residential, commercial, or industrial uses (Lasisi et al., 2017). On agricultural land, there has also been a discernible increase in the number of settlements and infrastructure developments. The demand for housing, utilities, roads, and other infrastructure increases along with the growth of population centers. The fragmentation of agricultural land that frequently follows this expansion has an impact on farming methods, field accessibility, and overall productivity (Ganguly et al., 2020).

Furthermore, the intensification of agricultural practices is another significant change observed in rural areas. Farmers are implementing more intensive farming practices in response to the rising demand for food production and to meet the needs of a growing population. This includes practices like increased mechanization, the use of pesticides, and high-yield crop varieties (Adolph et al., 2023). Although these methods increase output, they also bring up issues with biodiversity loss, soil deterioration, and environmental sustainability.

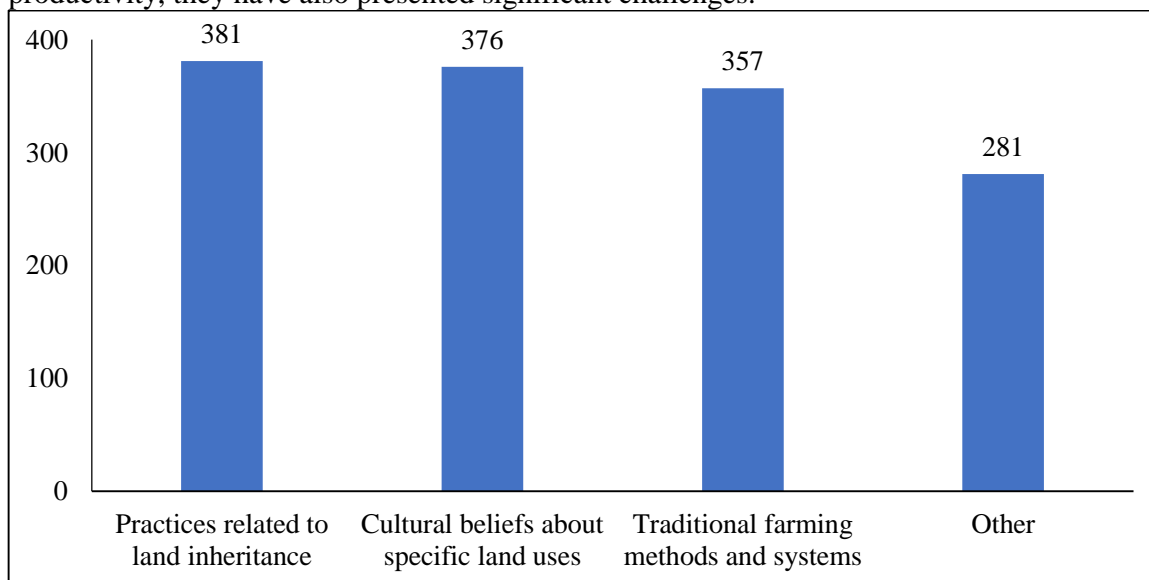
### **Impact on Agricultural Productivity**

Changes in rural land use in Nigeria have a complicated effect on agricultural productivity that can have both beneficial and negative effects. Positively, modern farming methods have been adopted, agricultural intensification has increased, and rural farmers now have better access to markets and services. For instance, the development of transportation networks and roads has made it easier to get agricultural products to markets, which has decreased post-harvest losses and increased farmer incomes (Kehinde et al., 2021).

In some areas, the use of contemporary farming technologies like mechanization, irrigation systems, and improved seeds has also increased crop yields and productivity (Oluwasola et al., 2019). Farmers are now able to cultivate crops more effectively, lower production costs, and diversify their agricultural practices thanks to technological advancements.

However, these positive effects are tempered by significant challenges and negative consequences. Loss of farmland due to urbanization, infrastructure development, and land conversion for non-agricultural uses is one of the most important problems. As a result of this loss, there is less land available for farming, which lowers agricultural productivity and food security (Ike, 2018). The long-term sustainability of agricultural systems is also impacted by quick changes in land use, which lead to soil erosion, degradation, and loss of fertility (Ezeaku & Onyenweaku, 2017). These changes in land use also lead to decreased biodiversity, deforestation, and habitat loss, which have an effect on ecosystem services and climate change resilience (Ogunmuyiwa et al., 2021).

The problems faced by rural farmers are made worse by conflicts over resource competition and land use, especially when it comes to grazing areas, water, and land access (Amaechina & Nwankwo, 2016). Conflicts like these have the potential to impede livelihoods, hinder agriculture, and jeopardize efforts at rural development. The complex interactions between agricultural development, land use dynamics, and environmental conservation require long-term land management practices, effective policies, and community engagement. While Nigeria's rural land use changes have increased agricultural productivity, they have also presented significant challenges.



Landsat 4 TM, Landsat 7 ETM, and Landsat 8 OLI TIRS images of the years 1991, 2003, 2014, and 2023 obtained from the United States Geological Survey (USGS) data depository website ([www.earthexplorer.usgs.gov](http://www.earthexplorer.usgs.gov)) have been utilized, USGS Earth Explorer database provides L1T level processed data that is geometrically and radiometrically corrected. Hence, there is no requirement for geo-referencing and checking the shift in the image. In the past years, urban driving factors have been applied in cellular automata (CA) modelling to predict possible urban growth (Wahyudi & Liu, 2016). These driving factors include physical, human disturbance, economic, demographic, economic, and institutional, all of which are significant to urban LULC change. CA triggers the dynamics of the change events based on the proximity concept so that regions closer to existing areas of the same class are more likely to change to a different class (Chaula, 2019). Thus, the need for proximity comes from socio-economic factors such as roads (roads play an important part in urbanization because they enable citizens to have access to various services daily), exiting built-up areas, public places, or facilities (schools, hospitals, police stations, and fire stations). The National Population Commission (NPC) figures were used to get the population statistics of Ikwere Local Government Area (LGA) for the year 2023, as well as the population density as a driving factor. Institutional factors such as urban planning and land development regulations are also

important determinants of urban growth dynamics. It is also important to state that the boundary of Ikwere Local Government Area, River State, Nigeria, was clipped out using the local government boundary and the Nigeria Administrative Map. Landsat 4 TM, Landsat 7 ETM, and Landsat 8 OLI TIRS images of the years 1991, 2003, 2014, and 2023 obtained from the United States Geological Survey (USGS) data depository website ([www.earthexplorer.usgs.gov](http://www.earthexplorer.usgs.gov)) have been utilized, USGS Earth Explorer database provides L1T level processed data that is geometrically and radiometrically corrected. Hence, there is no requirement for geo-referencing and checking the shift in the image. In the past years, urban driving factors have been applied in cellular automata (CA) modelling to predict possible urban growth (Wahyudi& Liu, 2016). These driving factors include physical, human disturbance, economic, demographic, economic, and institutional, all of which are significant to urban LULC change. CA triggers the dynamics of the change events based on the proximity concept so that regions closer to existing areas of the same class are more likely to change to a different class (Chaula, 2019). Thus, the need for proximity comes from socio-economic factors such as roads (roads play an important part in urbanization because they enable citizens to have access to various services daily), exiting built-up areas, public places, or facilities (schools, hospitals, police stations, and fire stations). The National Population Commission (NPC) figures were used to get the population statistics of Ikwere Local Government Area (LGA) for the year 2023, as well as the population density as a driving factor. Institutional factors such as urban planning and land development regulations are also important determinants of urban growth dynamics. It is also important to state that the boundary of Ikwere Local Government Area, River State, Nigeria, was clipped out using the local government boundary and the Nigeria Administrative Map.

### **Research design**

Landsat 4 TM, Landsat 7 ETM, and Landsat 8 OLI TIRS images of the years 1991, 2003, 2014, and 2023 obtained from the United States Geological Survey (USGS) data depository website ([www.earthexplorer.usgs.gov](http://www.earthexplorer.usgs.gov)) have been utilized, USGS Earth Explorer database provides L1T level processed data that is geometrically and radiometrically corrected. Hence, there is no requirement for geo-referencing and checking the shift in the image. In the past years, urban driving factors have been applied in cellular automata (CA) modelling to predict possible urban growth (Wahyudi& Liu, 2016). These driving factors include physical, human disturbance, economic, demographic, economic, and institutional, all of which are significant to urban LULC change. CA triggers the dynamics of the change events based on the proximity concept so that regions closer to existing areas of the same class are more likely to change to a different class (Chaula, 2019). Thus, the need for proximity comes from socio-economic factors such as roads (roads play an important part in urbanization because they enable citizens to have access to various services daily), exiting built-up areas, public places, or facilities (schools, hospitals, police stations, and fire stations). The National Population Commission (NPC) figures were used to get the population statistics of Ikwere Local Government Area (LGA) for the year 2023, as well as the population density as a driving factor. Institutional factors such as urban planning and land development regulations are also important determinants of urban growth dynamics. It is also important to state that the boundary of Ikwere Local Government Area, River State, Nigeria, was clipped out using the local government boundary and the Nigeria Administrative

## **MATERIALS AND METHODOLOGY**

### **Research Design**

The research aims to investigate the impact of rural land use on agricultural activities in Ikwere Local Government Area (LGA), Rivers State. The study is significant as it addresses the evolving dynamics between land use patterns, rural development, and agricultural sustainability. The research aims to offer important insights to stakeholders in agriculture, land managers, and policymakers through an assessment of the changes in rural land use and the socio-economic factors influencing these changes.

### **Data Used and Sources**

The data sources for this study are both primary and secondary.

### **Primary Data**

Primary data were collected through questionnaire administration, field observation, and oral interviews. The questionnaire related land use practices, agricultural activities, land ownership, socio-economic status, and perceptions of land use changes.

### **Secondary Data**

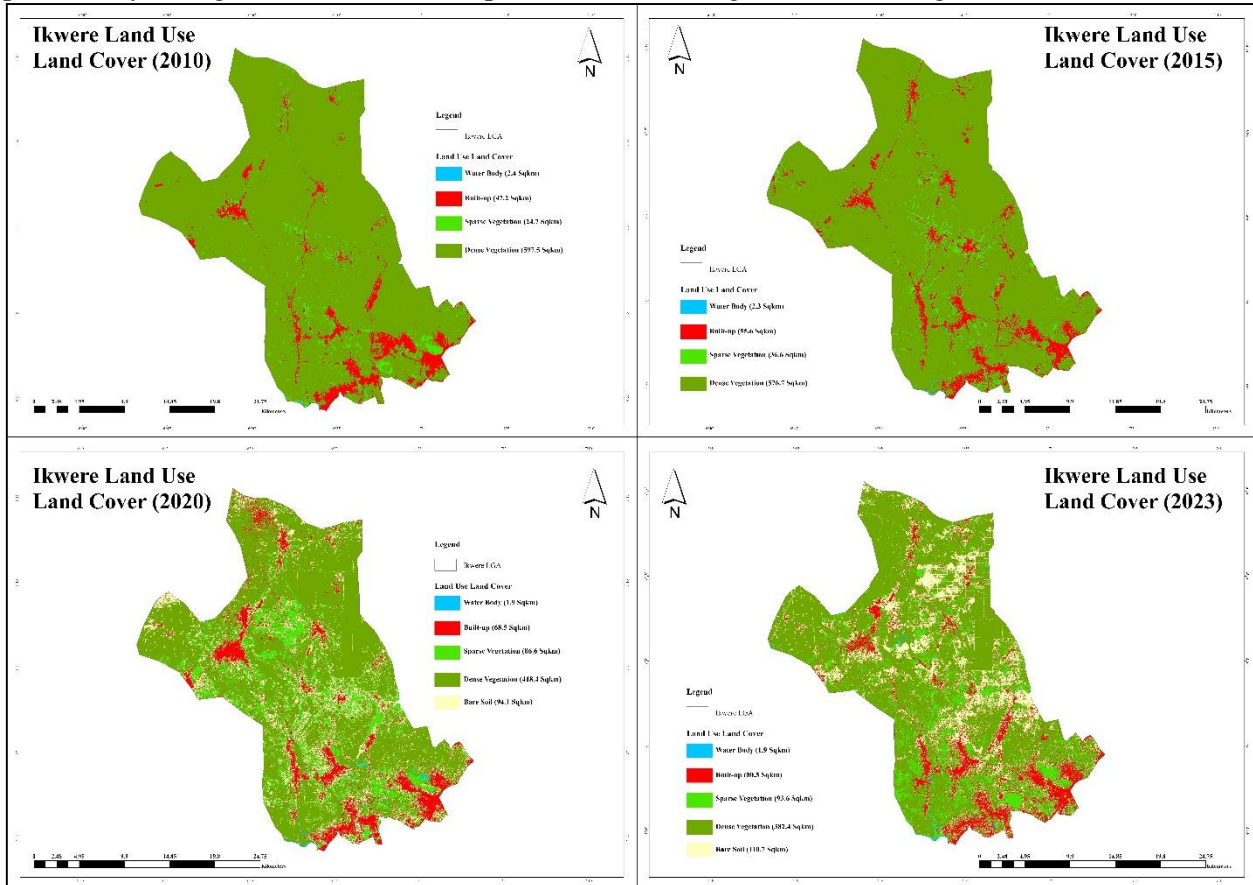
In this research study, table 4.1 shows the different datasets used and their sources. A high-resolution Google Earth image of the study area was acquired and used as a base map for subtle examination of the different land cover types and to derive training and validation points, Landsat 4 TM, Landsat 7 ETM, and Landsat 8 OLI TIRS images of the years 1991, 2003, 2014, and 2023 obtained from the United States Geological Survey (USGS) data depository website ([www.earthexplorer.usgs.gov](http://www.earthexplorer.usgs.gov)) have been utilized, USGS Earth Explorer database provides L1T level processed data that is geometrically and radiometrically corrected. Hence, there is no requirement for geo-referencing and checking the shift in the image.

## RESULTS AND PRESENTATION

This chapter presents the analysis of data acquired, interpretation and discussion of results for this study. The results are presented in the sub-sections below.

### Rural Land Use Patterns of the Study Area from 2010 to 2023

The rural land use patterns in Ikwere from 2010 to 2023 show significant transformations, particularly in vegetation cover, built-up areas, and land degradation (see Figure 4.1).



**Figure 4.1: Map Showing the Land Use Land Cover of the Study Area from 2010 to 2023 (Source: GIS Map, 2024)**

In 2010, the area was largely dominated by dense vegetation (597.7 km<sup>2</sup>), indicating a primarily rural landscape with limited human settlement or infrastructure development. The built-up area (47.2 km<sup>2</sup>) was relatively small, reflecting minimal urbanization. Sparse vegetation (24.7 km<sup>2</sup>) likely represents areas of cleared land for agriculture or low-intensity human use. The low value for water bodies (2.4 km<sup>2</sup>) suggests limited significant surface water features in the region. The absence of bare soil points to limited land degradation at this time. This year shows a landscape primarily used for agriculture and natural vegetation, with minimal human interference.

By 2015, there was an increase in built-up areas to 55.6 km<sup>2</sup>, suggesting expanding settlements or infrastructure. Sparse vegetation also increased to 36.6 km<sup>2</sup>, indicating more land clearing, possibly for agriculture or urban development. Dense vegetation decreased to 576.7 km<sup>2</sup>, signaling a gradual loss of natural cover. Water bodies remained relatively stable. This period marks the onset of greater land use conversion, with increased human settlement and agricultural expansion reducing dense vegetation cover.

In 2020, built-up areas increased significantly to 68.5 km<sup>2</sup>, reflecting growing urbanization and infrastructure. Sparse vegetation almost doubled to 86.6 km<sup>2</sup>, indicating more land is being used for agriculture or left in transitional stages after deforestation. Dense vegetation saw a notable decrease to 418.4 km<sup>2</sup>, indicating a major shift from natural to human-dominated landscapes. Bare soil appeared for the first time (94.1 km<sup>2</sup>), signaling land degradation, deforestation, or overuse. By 2020, the impacts of

urban sprawl and deforestation were more pronounced, leading to significant vegetation loss and land degradation. The introduction of bare soil indicates environmental stresses such as soil erosion or improper land management.

In 2023, built-up areas reached 80.5 km<sup>2</sup>, continuing the trend of urbanization. Sparse vegetation increased further to 93.6 km<sup>2</sup>, showing ongoing land clearing or transitional land use. Dense vegetation reduced again to 382.4 km<sup>2</sup>, emphasizing the continued decline in natural forest cover. Bare soil expanded to 110.7 km<sup>2</sup>, marking increasing land degradation, likely due to over-farming, deforestation, or infrastructure development. The trend of urbanization and deforestation is accelerating, leading to a loss of natural habitats and an increase in land degradation. Bare soil expansion suggests worsening environmental issues like erosion, which could have long-term consequences for agriculture and biodiversity.

Furthermore, the overall implications indicate that the land use data from 2010 to 2023 reflects increasing urbanization and deforestation in Ikwere, with substantial shifts from dense vegetation to built-up areas and bare soil. The growing built-up area points to expanding human activities such as housing, infrastructure, and commercial development. The increase in bare soil suggests environmental degradation, possibly linked to unsustainable land use practices. If these trends continue, the area may face challenges related to soil erosion, biodiversity loss, and reduced agricultural productivity. Sustainable land use planning will be essential to manage future growth and environmental impacts.

### Demographic Information of Respondents

Several demographic factors were examined to determine the respondents' socio-demographic characteristics, including gender, age group, educational level, and length of stay in the study area (see table 4.2).

Table 4.1 reveals that 63.5% of the survey respondents were male, while 36.5% were female, indicating a higher level of participation among men compared to women in the study. This suggests that men outnumber women in the sampled population. In terms of age distribution, the largest proportion of respondents (32.4%) fell within the 31 to 45-year-old age group, reflecting the prominence of this demographic in the survey. Meanwhile, the smallest representation came from respondents under 18 years old, who made up only 9.8% of the sample. This age distribution highlights the predominance of middle-aged individuals in the study, with younger participants being less involved.

A detailed analysis of the respondents' educational levels, as shown in Table 4.1, indicates a diverse range of educational backgrounds. Of the sample, 21.3% had completed secondary education, 9.5% had only attained primary education, and 34.2% held tertiary qualifications. Additionally, 30.1% reported receiving vocational or technical training, while 4.9% had no formal education. These findings reveal that the majority of respondents possess some form of formal or specialized education. This level of literacy enhances their ability to understand and provide precise, well-informed responses, thereby increasing the reliability and accuracy of the study's data and overall findings.

The research findings indicate that a significant portion of the respondents (167, 42.9%) have resided in Ikwere LGA for more than 20 years, while another 129 respondents (33.2%) have lived there for over ten years. This suggests that over 76% of the respondents have deep-rooted connections to the area, which likely contributes to their comprehensive understanding of rural land use patterns and socio-economic changes over time. Additionally, 57 respondents (14.7%) have stayed between one and five years, and only a few (36 respondents, 9.3%) have lived there for less than a year. The diverse range of tenures among the respondents offers a balanced perspective, with long-term residents providing valuable insights into historical land use shifts, and newer residents offering fresh observations. The socio-economic factors influencing land use changes can be further investigated through their perspectives (see table 4.1).

**Table 4.2:** Socio-Demographic Characteristics of Respondents (n=389)

Variables	Frequency	Percentages (%)
<b>Gender</b>		
Male	247	63.5

Female	142	36.5
<b>Age</b>		
Under 18 years old	38	9.8
18 to 30 years	103	26.5
31 to 45 years	126	32.4
46 to 60 years	71	18.3
over 60 years	51	13.1
<b>Educational level</b>		
Primary school	37	9.5
Secondary school	83	21.3
Vocational/Technical training	117	30.1
University degree	133	34.2
No Formal Education	19	4.9
<b>Duration of Stay (Years)</b>		
Less than 5 years	36	9.3
5 to 10 years	57	14.7
11 to 20 years	129	33.2
Over 20 years	167	42.9

**Source:** Author's Field Survey, 2024

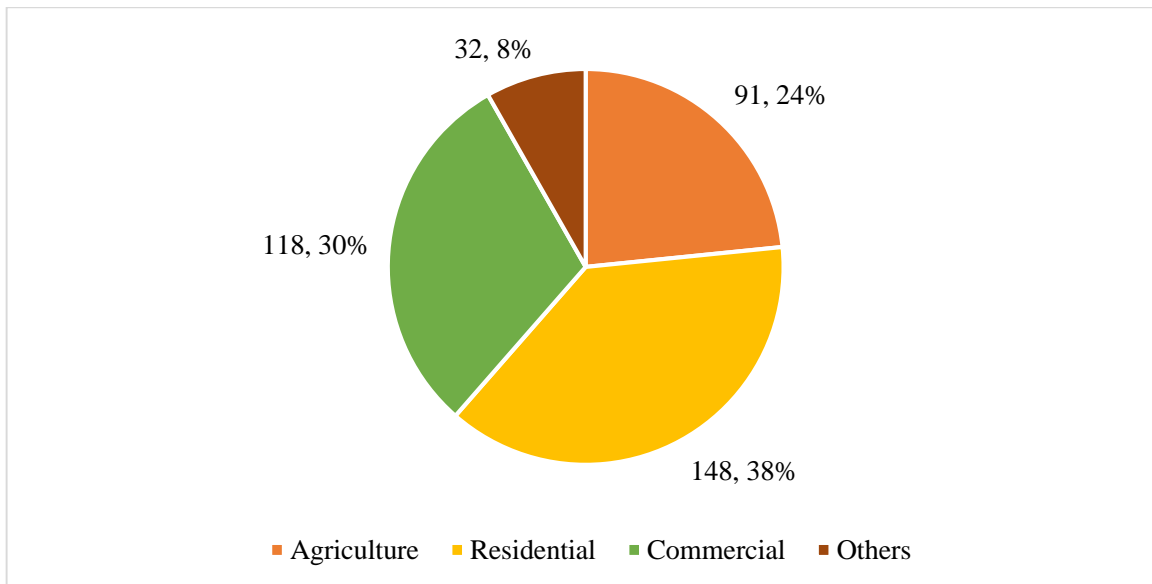
### Rural Land Use Changes and Their Impacts on Agricultural Practices in the Study Area

Rural land use changes have a profound impact on agricultural practices, particularly in regions undergoing population shifts, economic growth, or environmental pressures. Such transformations can directly influence agricultural productivity, food security, and the livelihoods of rural communities (Li et al., 2024). This section explores the dominant land use patterns in Ikwere Local Government Area (LGA), tracing how these patterns have evolved over the past decade. It also examines the predominant crops cultivated in the region, highlighting shifts in agricultural focus and practices in response to these changes.

#### Primary Land Use Pattern in the Study Area

Figure 4.2 presents the primary land use patterns in Ikwere Local Government Area as reported by respondents. According to the survey, 38% of respondents identified residential land use as the dominant pattern in the area. This likely reflects the growing population and increasing housing demands in Ikwere, as more people move to the area for better living conditions and proximity to urban centers. Commercial land use was cited by 30% of respondents, highlighting the expanding economic activities, such as markets, shops, and small businesses, which cater to both local residents and visitors. Meanwhile, 24% of respondents recognized agricultural land use as a major land use pattern, signifying the area's continued engagement in farming and food production, although this sector may be experiencing pressure from urban expansion.

Additionally, 8% of respondents reported observing other land use patterns, including industrial and recreational areas. The presence of industrial land use could indicate the development of small-scale industries or factories, contributing to local employment and economic growth. Recreational land use might include parks or leisure spaces, reflecting an effort to improve the quality of life and community well-being by providing spaces for relaxation and social activities. These diverse land use patterns demonstrate the dynamic nature of land use in Ikwere, influenced by urbanization, economic activities, and the ongoing demand for residential spaces.



**Figure 4.2:** Primary Land Use Pattern

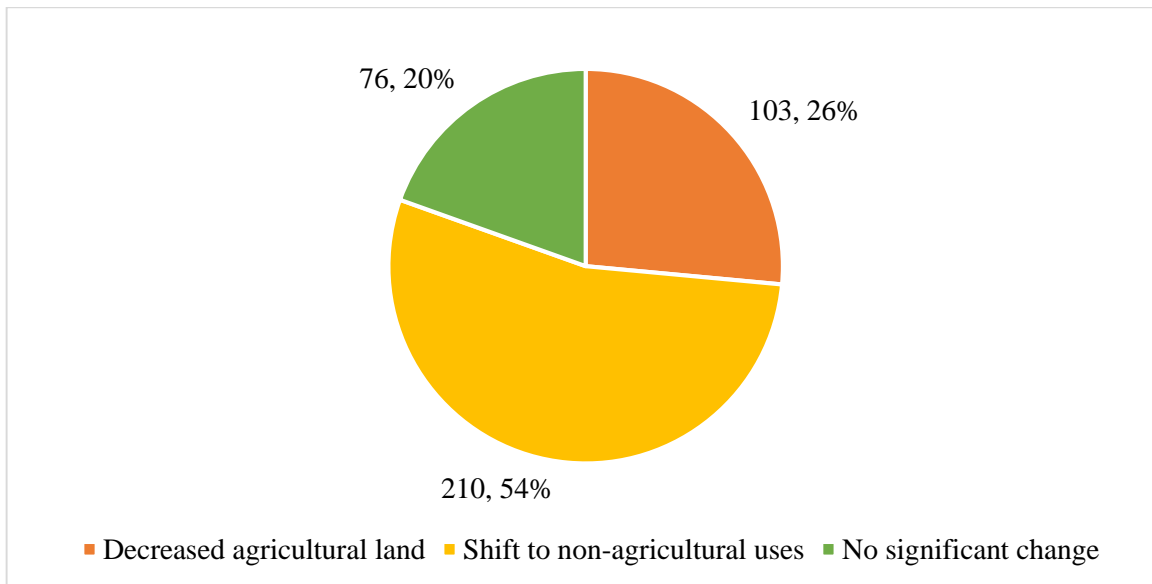
**Source:** Author’s Field Survey, 2024

### Changes in Land Use Over the Past Decade in the Study Area

As illustrated in Figure 4.3, respondents provided their perspectives on land use changes observed over the past decade. A majority (54%) of respondents reported that agricultural lands have been converted to non-agricultural uses. According to these respondents, key reasons for this change include urban expansion, the need for residential development, and the establishment of commercial facilities, driven by population growth and economic opportunities in the area. Additionally, infrastructure projects such as road construction have also contributed to the conversion of farmland to other uses.

Meanwhile, 26% of respondents noted a decrease in agricultural land presence. They attributed this to factors like the abandonment of farming activities due to declining soil fertility, economic challenges in sustaining agricultural production, and the allure of more profitable ventures in urban centers. On the other hand, 20% of respondents claimed there has been no significant change in land use in the study area over the past decade, suggesting that certain regions have maintained their traditional land-use patterns.

Some respondents also highlighted other notable land use changes, such as the increase in industrial activities, where farmlands were converted into factories and industrial parks. The construction of recreational facilities and the expansion of schools were also mentioned as new developments that have altered land use. These changes were primarily driven by the area's growing demand for education and leisure, alongside industrialization, which has reshaped the rural landscape.

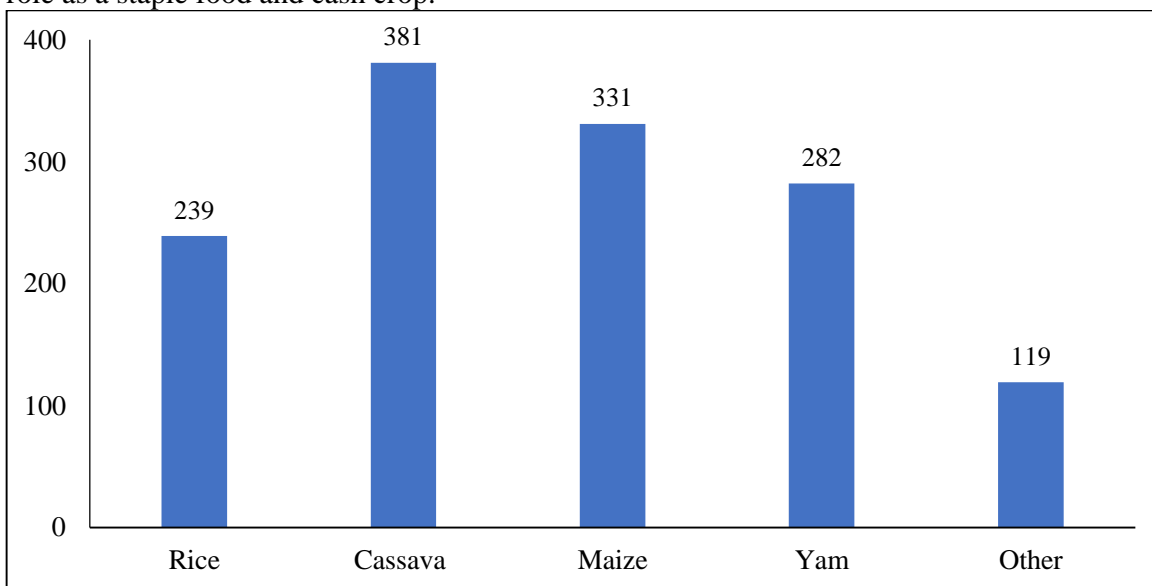


**Figure 4.3:** Changes in Land Use Over the Past Decade

**Source:** Author’s Field Survey, 2024

**Crops Cultivated Predominantly in the Study Area**

Figure 4.4 presents the findings from the survey on the predominant crops cultivated in the study area. The survey results indicate that cassava is the most widely grown crop, with 381 respondents identifying it as their primary crop. This is followed by maize, which was selected by 331 respondents, yam by 282 respondents, and rice by 239 respondents. Additionally, other crops cultivated in the region include oil palm trees, plantains, bananas, cocoyam, and various vegetables. These results reflect the diverse agricultural practices in the area, with cassava emerging as the dominant crop, likely due to its role as a staple food and cash crop.



**Figure 4.4:** Changes in Land Use Over the Past Decade

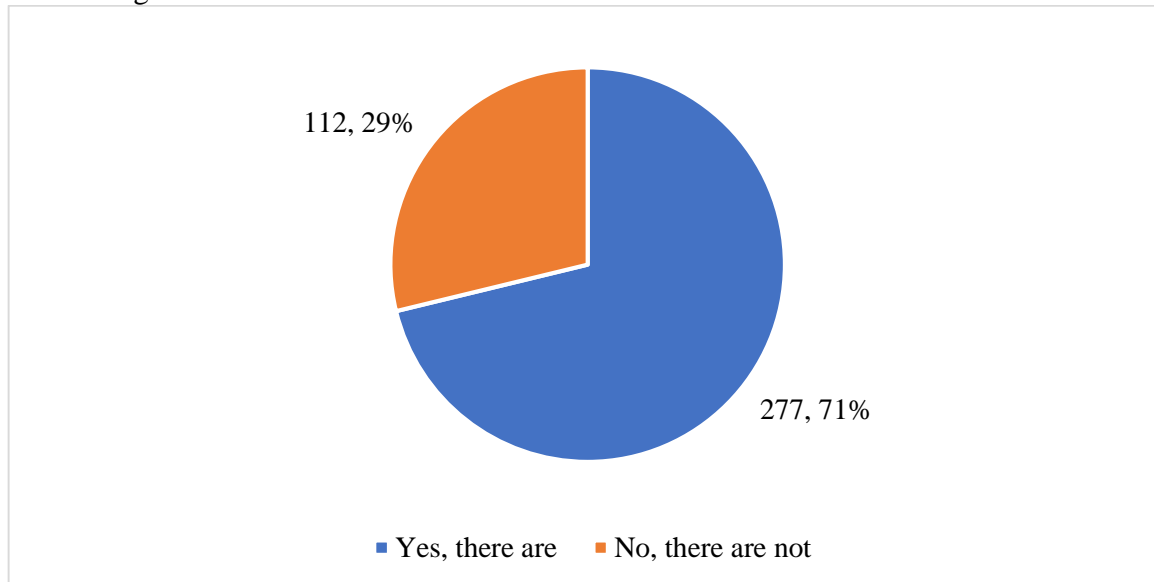
**Source:** Author’s Field Survey, 2024

**Specific Areas Designated for Agriculture in the Study Area**

Figure 4.5 presents the percentage responses from the survey regarding whether specific areas are designated for agriculture in the study area. A significant majority of respondents, 277 (71%), indicated that there are indeed designated areas for agricultural purposes. These respondents identified the outskirts

of their towns as the primary locations for these agricultural zones, where farming activities are more concentrated due to the availability of larger plots of land.

However, 112 respondents (29%) stated that no specific areas are designated for agriculture. They explained that land originally intended for agricultural purposes has increasingly been repurposed for construction projects. This shift is largely attributed to changes in land ownership, where new owners prioritize urban developments, residential housing, or commercial establishments, leading to the encroachment of agricultural lands. These respondents also pointed out that as urban expansion continues, agricultural zones are often sacrificed for infrastructural development, further reducing the available land for farming activities.



**Figure 4.5:** Specific Areas Designated for Agriculture  
**Source:** Author’s Field Survey, 2024

### Socio-Economic Factors Driving Rural Land Use Changes in the Study Area

Changes in rural land use are shaped by a variety of socio-economic factors that can significantly impact how land is utilized for agriculture, settlement, and other purposes. This subsection aims to explore the key factors driving changes in rural land use, focusing on elements that affect agricultural activities in the study area. It will examine the role of government policies in shaping land use decisions, the impact of population growth on land availability for agriculture, and the effects of urbanization on rural land use and agricultural practices. Further to that, the influence of economic development on land use choices will be investigated, along with any cultural or traditional factors that may affect land use decisions in the study area.

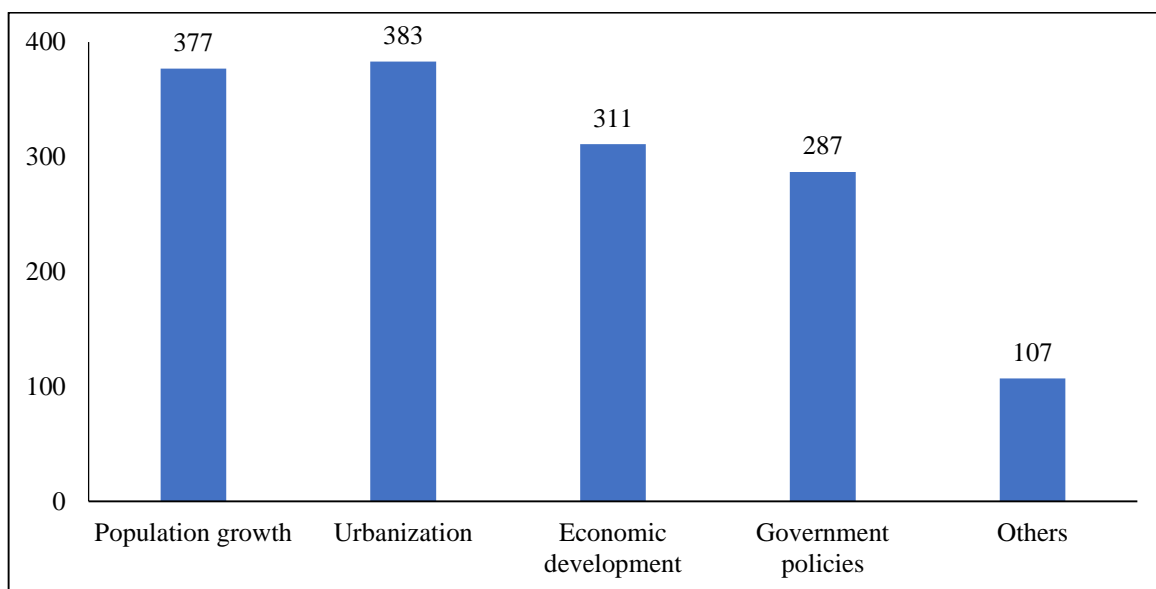
### Factors Influencing Changes in Rural Land Use in the Study Area

As illustrated in Figure 4.6, a survey was conducted to identify the primary factors influencing changes in rural land use among respondents. The most significant factor, cited by 383 respondents, is urbanization. This phenomenon reflects the increasing migration of people from rural areas to urban centers, leading to the expansion of cities and towns. As urban areas grow, agricultural land is often repurposed for housing, infrastructure, and commercial development. This transition can lead to a reduction in arable land, disrupting traditional agricultural practices and altering land-use patterns (Dadi et al., 2023).

A close second, with 377 respondents indicating population growth as a crucial factor. As populations increase, the demand for housing, food, and services also rises, intensifying pressure on rural land. Higher population densities necessitate the conversion of agricultural and natural areas into residential and industrial spaces to accommodate expanding communities, which can strain existing resources and affect land use (Ortiz et al., 2021). Cited by 311 respondents, economic development plays

a significant role in shaping rural land use. As economies grow, there is often a shift toward more intensive agricultural practices and the development of infrastructure, such as roads and utilities. This enhances productivity but may also lead to the overexploitation of land and natural resources, resulting in changes to land-use patterns that prioritize economic gain over environmental sustainability (Wang & Azam, 2023).

Additionally, 107 respondents identified various other factors contributing to changes in rural land use. These factors include technological advancements in agriculture, which eventually lead to more efficient land use but also encourages monoculture practices that diminish biodiversity. Climate change is another vital factor stated by the respondents; as weather patterns shift, agricultural practices must adapt, influencing land-use decisions. Moreover, governmental policies and land tenure systems were also identified as factors that significantly affect land ownership and management, impacting how land is utilized over time.



**Figure 4.6:** Factors Influencing Changes in Rural Land Use

**Source:** Author’s Field Survey, 2024

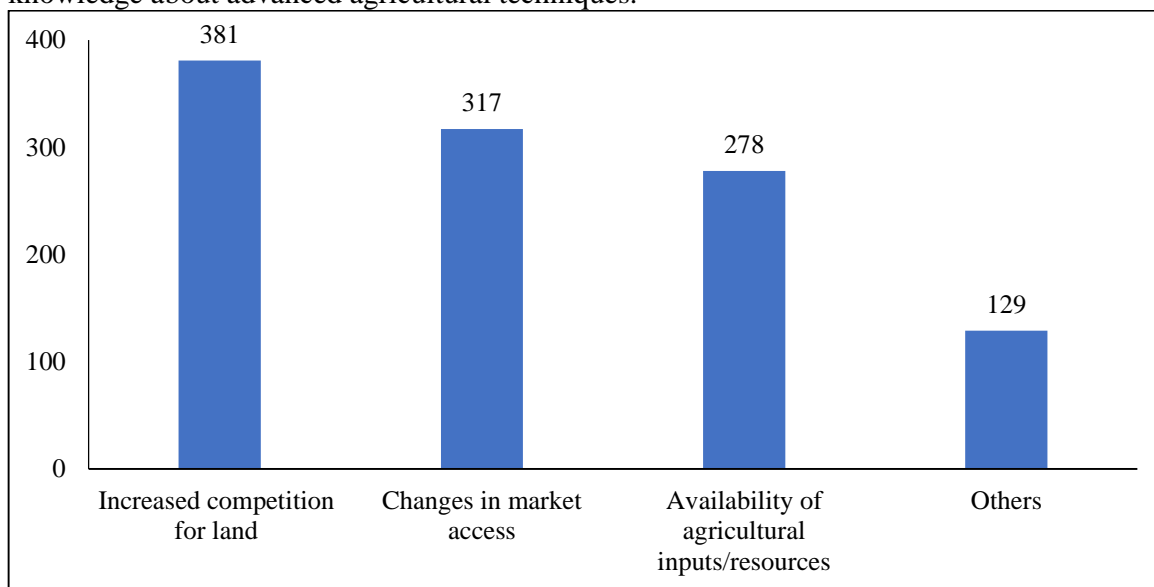
### Factors Affect Agricultural Activities in the Study Area

Figure 4.7 illustrates the survey results regarding the factors influencing agricultural activities in the study area. Increased competition of land (381) was identified as the most significant influence on agricultural activities. The growing competition for limited arable land has become increasingly pronounced due to factors such as urbanization and population growth. As more individuals seek to engage in agricultural production, the demand for land escalates, leading to higher land prices and potential conflicts over land ownership and usage rights. This intensified competition can result in some farmers being priced out of the market, forcing them to reduce their farming operations or abandon agriculture altogether (Tanentzap et al., 2015). Consequently, the availability of land for cultivation diminishes, which poses a substantial challenge to food production and sustainability in the region.

317 respondents highlighted changes in market access as another critical factor affecting their agricultural activities. The ability to access markets is essential for farmers to sell their produce at fair prices. Factors such as the development of new infrastructure, fluctuations in transportation costs, and changes in local market dynamics can significantly impact how easily farmers can reach their customers (Wudad et al., 2021). When market access is restricted, farmers may face difficulties in selling their goods, which can lead to economic losses and discourage them from investing in their farms. Additionally, limited access to markets can hinder the diversification of crops, affecting overall agricultural productivity and food security.

The survey results indicate that the availability of key agricultural inputs (278 respondents), such as seeds, fertilizers, and farming equipment, plays a crucial role in agricultural productivity. Access to high-quality inputs enables farmers to optimize their yields and implement effective farming practices. When these resources are scarce or prohibitively expensive, farmers may resort to using lower-quality materials, which can compromise crop health and yields (Çakmakçı et al., 2023). Furthermore, inadequate access to technology and technical support can limit farmers' capacity to adopt innovative farming methods, hindering their ability to compete effectively in the market (Dhillon & Moncur, 2023).

In addition to the major factors discussed, 129 respondents identified several other influences on agricultural activities. These include environmental conditions, such as climate variability, which directly impact crop production and resilience. Socio-economic factors, such as access to credit, education, and training programs, were also mentioned. Farmers with limited access to financial resources struggle to invest in improvements and modernization efforts, while those with low educational levels might lack knowledge about advanced agricultural techniques.



**Figure 4.7:** Factors Affect Agricultural Activities in the Study Area

**Source:** Author's Field Survey, 2024

### Role of Government Policy in Shaping Land Use Decisions in the Study Area

Figure 4.8 presents the survey results on the role of government policy in shaping land use decisions in the study area. The findings highlight several key areas of government influence, as perceived by respondents:

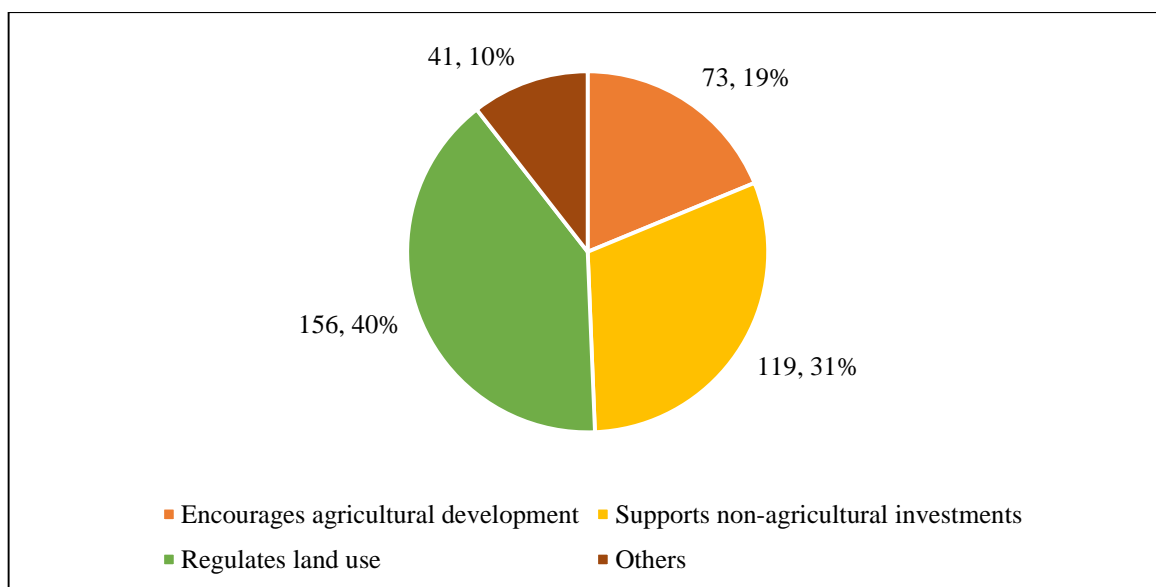
The majority of respondents believe that the primary role of government policy is the regulation of land use (40%). This includes policies governing zoning laws, land ownership rights, and land-use planning. Through regulatory frameworks, the government can control how land is allocated and utilized, ensuring that land designated for agriculture, residential, industrial, or conservation purposes is appropriately managed (Otubu, 2018). This role also involves the enforcement of restrictions on land conversion to ensure the preservation of farmland and natural resources, which can directly impact agricultural productivity and environmental sustainability.

31% of respondents pointed out that government policies often favor non-agricultural investments, such as infrastructure development, real estate, and industrial projects. These policies may incentivize the conversion of agricultural land into commercial or urban developments, contributing to a reduction in available farmland. While these investments can boost economic growth and create job opportunities, they can also challenge the long-term sustainability of agricultural activities in the region by prioritizing other sectors over farming.

A smaller percentage of respondents (19%) indicated that government policies are aimed at encouraging agricultural development. This can involve providing subsidies, grants, or tax incentives to

farmers, promoting modern farming techniques, and investing in rural infrastructure such as irrigation systems, roads, and agricultural research. Policies in this area are intended to support the growth of the agricultural sector, improve productivity, and ensure food security. However, the lower percentage suggests that many respondents feel these efforts are either insufficient or overshadowed by policies supporting other industries.

Furthermore, the remaining respondents (10%) identified additional roles of government policy that influence land use decisions. These roles include: policies aimed at protecting natural habitats, forests, and water resources which limit the expansion of agricultural land but are crucial for ensuring long-term environmental sustainability; in some cases, government policies focus on land redistribution to address inequalities in land ownership or to provide land access to marginalized groups, which can impact land use dynamics and agricultural productivity; and the construction of roads, bridges, and public utilities significantly alter land use patterns by improving access to markets and attracting investment to previously underdeveloped areas.



**Figure 4.8:** Role of Government Policy in Shaping Land Use Decisions in the Study Area  
**Source:** Author’s Field Survey, 2024

### Impact of Population Growth on Land Availability for Agriculture in the Study Area

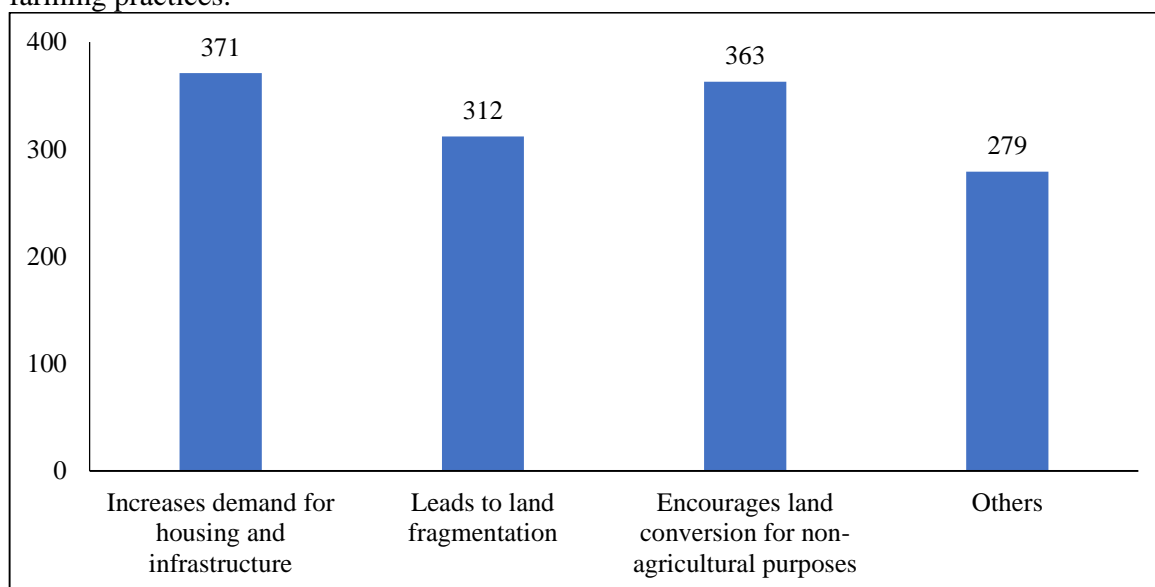
Figure 4.9 highlights the impacts of population growth on land availability for agriculture in the study area. The majority of respondents (371) identified the rising demand for housing and infrastructure as the most significant impact of population growth on agricultural land availability. As the population grows, there is a greater need for residential buildings, roads, schools, and other public amenities. This often leads to the conversion of fertile agricultural land into urban developments, shrinking the area available for farming. This trend not only reduces the land farmers have for cultivation but also raises land prices, making it difficult for farmers to afford additional plots for expansion (Coulibaly & Li, 2020). In the long run, this creates a strain on food production and threatens agricultural sustainability in the region.

A close second, 363 respondents noted that population growth accelerates the conversion of land for non-agricultural uses, such as industrial, commercial, or residential developments. As the need for services and amenities increases alongside the growing population, agricultural land is often viewed as more profitable for other purposes. This shift diverts essential land resources away from farming and disrupts rural livelihoods. Moreover, the loss of agricultural land can reduce local food production, increase dependency on imports, and pose challenges for long-term food security in the area.

A significant number of respondents (312) also pointed out that population growth contributes to land fragmentation. As population density increases, agricultural lands are divided into smaller plots,

either through inheritance or sales, to accommodate more families. This division of land reduces the efficiency of agricultural practices, making it harder to engage in large-scale farming. Fragmented plots are often too small for mechanization and modern farming techniques, which hinders productivity and forces farmers to rely on labor-intensive methods. Furthermore, fragmented land is less viable for crop rotation and other sustainable practices, contributing to soil degradation and reduced agricultural output.

Additional impacts discussed by 279 respondents include environmental degradation, competition for water resources, and increased land disputes. With growing populations, natural resources such as water become scarce, and agricultural lands suffer from overuse, leading to soil depletion and reduced fertility. Deforestation, often driven by the need for new housing or infrastructure, further exacerbates environmental concerns, reducing biodiversity and increasing the vulnerability of agricultural ecosystems. Additionally, increased pressure on limited land resources lead to conflicts over land ownership and use, making it difficult for farmers to secure long-term tenure or invest in sustainable farming practices.



**Figure 4.9:** Impact of Population Growth on Land Availability for Agriculture in the Study Area

**Source:** Author's Field Survey, 2024

### Effects of Urbanization on Rural Land Use and Agricultural Activities in the Study Area

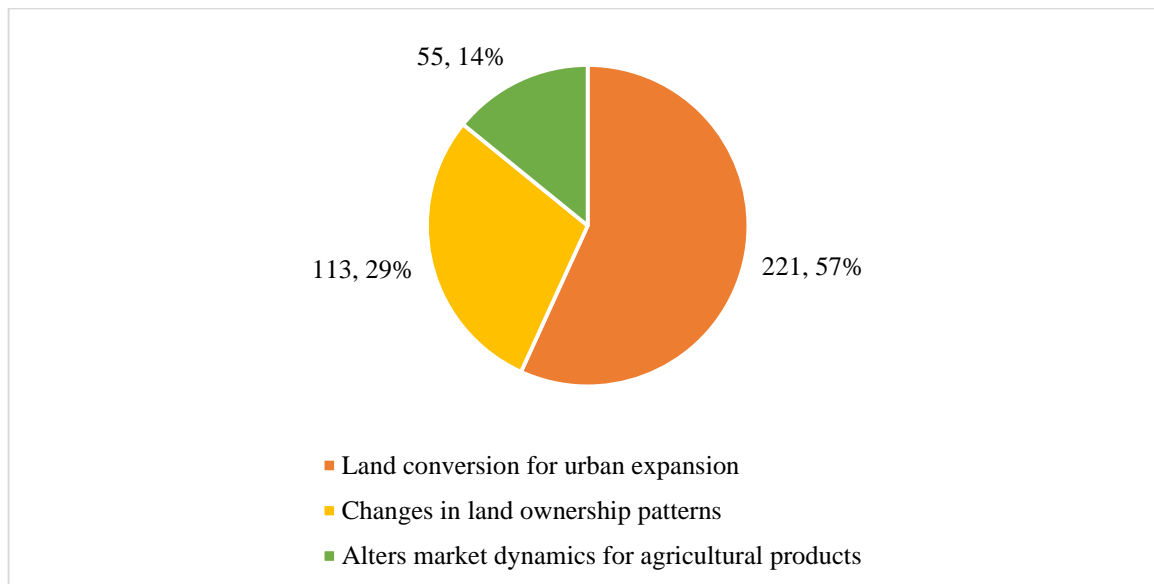
Figure 4.10 presents the survey results on the impact of urbanization on rural land use and agricultural activities. According to the respondents, the most significant effect is the conversion of rural or agricultural lands for urban expansion, with 57% of the respondents identifying this as a major concern. As urban areas expand, previously arable land is repurposed for infrastructure development, housing, and commercial activities, leading to a reduction in the land available for agricultural use. This conversion disrupts local food production, displaces farming communities, and often results in reduced biodiversity and the loss of ecosystems that support agricultural productivity.

Another significant effect cited by respondents is changes in land ownership patterns, which have been influenced by urbanization. As demand for land near urban areas increases, traditional land tenure systems may be altered, with agricultural lands being sold or leased to developers and investors. This shift can lead to the displacement of smallholder farmers, who may lose access to land that has been in their families for generations. The fragmentation of agricultural lands due to new ownership structures also reduce the scale and efficiency of farming operations, making it more difficult for farmers to maintain viable agricultural enterprises.

14% of the respondents noted that urbanization has affected market dynamics for agricultural products. As urban centers grow, they influence both the supply and demand for agricultural products. On one hand, urbanization can create new markets for farmers, offering opportunities to sell their products to a larger population. On the other hand, increased competition from urban-based industries and imported

goods can drive down prices for local agricultural products, making it harder for rural farmers to compete. Furthermore, the shift in focus toward urban economies may lead to the neglect of rural agricultural infrastructure, such as transportation networks and storage facilities, which are crucial for getting agricultural products to market efficiently (Sakketa, 2023).

Respondents also discussed other specific effects of urbanization on rural land use and agricultural activities. These include the decline in labor availability for farming, as more rural residents seek employment in urban areas, leading to a labor shortage in agriculture. The lure of higher wages and better living conditions in urban centers draws young people away from farming, leaving behind an aging farming population and reducing the human resources necessary for maintaining agricultural productivity. Additionally, the increase in land prices due to urban expansion makes it more difficult for farmers to acquire or maintain land for agricultural purposes, further complicating efforts to sustain rural livelihoods.



**Figure 4.10:** Effects of Urbanization on Rural Land Use and Agricultural Activities  
**Source:** Author's Field Survey, 2024

### Influence of Economic Development Towards Land Use Decisions in the Study Area

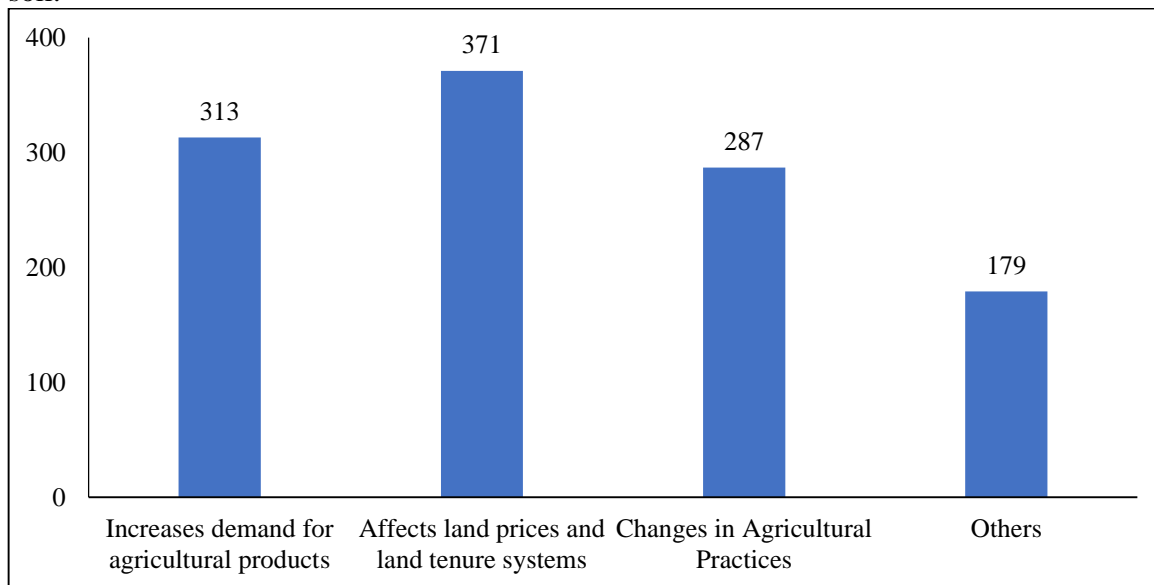
Figure 4.10 presents the results of a survey on the influence of economic development on land use decisions in the study area. The survey highlights several key factors through the perspectives of the respondents.

The majority of respondents indicated that economic development directly affects land prices and land tenure systems (371). As economic activities expand, particularly in areas experiencing rapid urbanization or industrial growth, the value of land tends to rise. This increase in land prices makes it more difficult for smallholder farmers and low-income households to acquire or retain land. Additionally, changes in land tenure systems, driven by legal reforms or market forces, can introduce complexities in land ownership and access. This can lead to land disputes, insecurity of tenure, and in some cases, displacement of rural communities. Moreover, the pressure from rising land prices often encourages shifts in land use, with agricultural land being converted for more profitable commercial or residential purposes.

Economic development was also seen as a driving force behind the growing demand for agricultural products (331). As the economy develops, populations tend to grow, and urbanization increases, leading to greater consumption of food and agricultural goods. Respondents noted that this surge in demand incentivizes farmers to increase production and diversify their crops to meet market needs. However, this heightened demand also presents challenges, as farmers must find ways to scale up production sustainably while managing the rising costs of inputs and dealing with environmental constraints. In some cases, the focus on meeting market demands may result in the adoption of intensive agricultural practices, which could have long-term impacts on soil fertility and biodiversity.

Another significant influence of economic development is the shift in agricultural practices (287). Respondents observed that as the economy evolves, farmers are encouraged to adopt new technologies, improve mechanization, and implement modern farming techniques. These changes are often aimed at increasing productivity and efficiency in response to market pressures. However, while these advancements can improve yields and income for some farmers, they may also widen the gap between large-scale and small-scale producers. Smallholder farmers, in particular, may struggle to afford new technologies or may lack the training necessary to implement advanced practices effectively. This disparity could lead to unequal growth and the marginalization of certain farming communities.

Beyond the factors mentioned above, respondents highlighted several other ways in which economic development influences land use decisions. One key factor mentioned is infrastructure development, such as the construction of roads, bridges, and utilities, which can open up previously inaccessible areas for agricultural or commercial use. Improved infrastructure often leads to increased land value and shifts in land use patterns, as farmers gain better access to markets and resources. Additionally, policy changes driven by economic development can impact land use. For example, government incentives or subsidies for particular crops or land uses can steer farmers toward certain types of agriculture, sometimes at the expense of traditional or subsistence farming. Lastly, environmental concerns linked to economic growth, such as pollution or deforestation, were mentioned as factors that can shape land use decisions by affecting the quality and availability of natural resources like water and soil.



**Figure 4.11:** Influence of Economic Development Towards Land Use Decisions

**Source:** Author’s Field Survey, 202

### Cultural or Traditional Factors that Influence Land Use Decisions in the Study Area

Figure 4.12 presents the survey results regarding the cultural or traditional factors that influence land use decisions in the study area. Several key factors were highlighted by respondents.

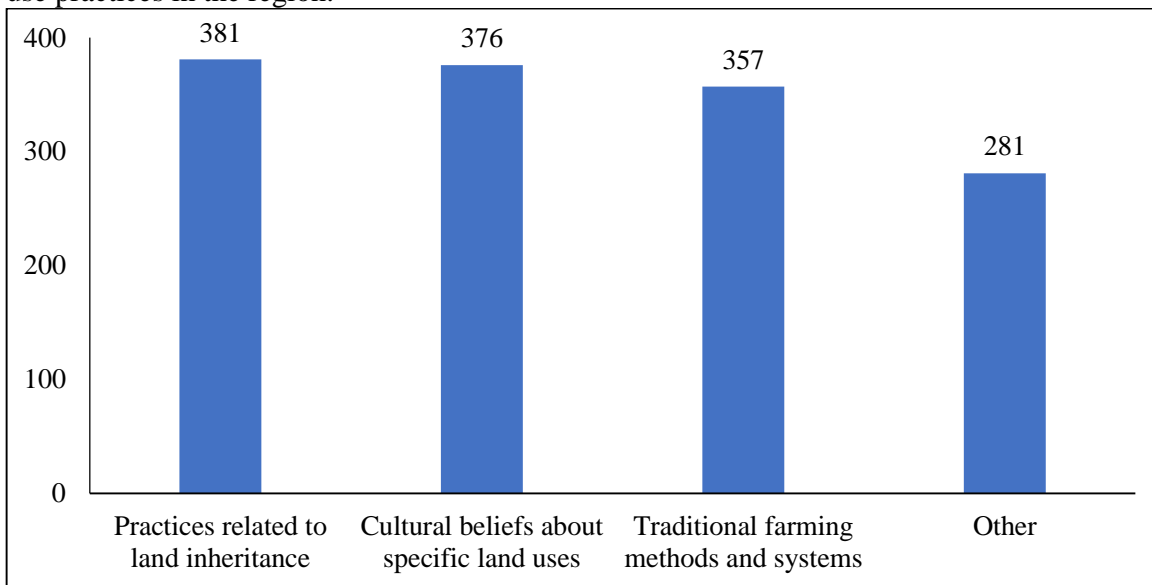
381 respondents stated that land inheritance customs play a significant role in shaping how land is used and distributed. In their traditional systems, land is passed down through generations within families, often leading to the subdivision of plots over time. However, this practice can result in smaller, less productive parcels of land, which may hinder large-scale agricultural operations or more efficient land use. Additionally, inheritance disputes might arise when family members contest their share of land, further complicating land management decisions. As a result, traditional inheritance practices often contribute to land fragmentation and limit opportunities.

376 respondents highlighted the influence of cultural beliefs on land use, with certain land areas or uses being deemed sacred or unsuitable for specific types of activities. For example, some communities in the study area regard certain plots as ancestral lands that should not be cultivated or sold. In other cases,

specific crops or farming methods might be viewed as inappropriate due to cultural taboos. These beliefs create restrictions on how land is used and may prevent the adoption of more efficient or profitable agricultural practices. While these customs help preserve cultural heritage, they may also limit the flexibility of land use in the face of changing economic or environmental conditions.

Many farmers in the study area continue to rely on traditional farming methods, passed down through generations. These systems often prioritize sustainable, low-input practices that align with the local climate and soil conditions. However, traditional methods can sometimes conflict with modern agricultural techniques that aim to maximize productivity and efficiency. While these practices may be well-suited to local contexts, they may also limit the ability of farmers to adopt new technologies or practices that could improve yields. Furthermore, the reliance on manual labor and traditional tools may hinder efforts to scale up agricultural operations or increase mechanization.

Respondents also mentioned various other cultural and traditional factors that influence land use decisions. For example, social norms and community expectations often dictate land allocation and management practices. In some communities, land ownership and use are collective decisions made by elders or local leaders, which sometimes slow down decision-making processes or prevent individual innovation. Additionally, ceremonial or ritual land use, such as dedicating land for festivals or religious events, can restrict the availability of agricultural land. These cultural factors often reflect deeply rooted values and traditions, making them important considerations in any effort to reform or modernize land use practices in the region.



**Figure 4.12:** Cultural or Traditional Factors that Influence Land Use Decisions

**Source:** Author’s Field Survey, 2024

## DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

### Discussion

The study investigated the impact of rural land use on agricultural activities in Ikwere Local Government Area, Rivers State, from 2010 to 2023. Its primary objectives were to assess the rural land use patterns in the area during this period, analyze the changes in land use, and explore the socio-economic factors influencing these changes and their effects on agricultural land use and productivity. ArcGIS software was utilized to process Landsat satellite imagery, which was classified into four land cover types: natural vegetation, agricultural land, built-up areas, bare land, and water bodies, using the Maximum Likelihood Classification (MLC) algorithm. A total of 400 questionnaires were distributed to residents of Ikwere LGA, of which 389 were returned and deemed valid for the study.

The land use pattern in the study area from 2010 to 2023 revealed significant changes, with Ikwere undergoing rapid urbanization and deforestation. In 2010, the landscape was primarily covered by dense vegetation (597.7 km<sup>2</sup>), with small portions allocated to built-up areas (47.2 km<sup>2</sup>) and sparse vegetation

(24.7 km<sup>2</sup>). By 2015, urban expansion increased the built-up areas to 55.6 km<sup>2</sup>, while dense vegetation saw a slight decline. This urbanization trend intensified by 2020, with built-up areas reaching 68.5 km<sup>2</sup> and dense vegetation shrinking sharply to 418.4 km<sup>2</sup>. The appearance of bare soil (94.1 km<sup>2</sup>) indicated land degradation. By 2023, built-up areas further expanded to 80.5 km<sup>2</sup>, and bare soil increased to 110.7 km<sup>2</sup>, reflecting growing environmental concerns such as erosion and deforestation. If the trends of urban sprawl and deforestation continue, long-term consequences like biodiversity loss, soil degradation, and reduced agricultural productivity are likely, highlighting the urgent need for sustainable land use planning.

The survey results on rural land use changes and their impacts on agricultural practices reveal that residential land use is the dominant pattern in the study area. Respondents shared their observations on land use changes over the past decade, with the majority reporting that agricultural land has been increasingly converted to non-agricultural purposes. Cassava emerged as the most commonly cultivated crop in the region, likely because of its importance as both a staple food and a cash crop. Most respondents confirmed the existence of designated agricultural zones, primarily located on the outskirts of their towns, where farming activities are concentrated due to the availability of larger land plots.

The survey results on socio-economic factors driving rural land use changes in the study area reveal that urbanization is the most significant factor influencing land use changes among respondents. When it comes to factors affecting agricultural activities, increased competition for land emerged as the most notable influence. The majority of respondents believe that the primary role of government policy is to regulate land use, including zoning laws, land ownership rights, and land-use planning. Furthermore, most respondents identified the rising demand for housing and infrastructure as the greatest impact of population growth on the availability of agricultural land. In terms of urbanization's impact on rural land use and agricultural activities, the most significant effect reported is the conversion of rural or agricultural land for urban expansion.

Additionally, the survey on the influence of economic development on land use decisions shows that most respondents believe economic development directly impacts land prices and tenure systems. Cultural or traditional factors influencing land use decisions were also highlighted in the survey. Key factors include land inheritance customs, cultural beliefs related to land use, traditional farming methods, social norms, and community expectations. Land ownership and use are often collective decisions made by elders or local leaders, and ceremonial or ritual land use is also significant. These cultural factors reflect deeply rooted values and traditions in the community.

## **Conclusion**

This study sought to investigate the impact of rural land use changes on agricultural activities in Ikwere Local Government Area, Rivers State, from 2010 to 2023. Using ArcGIS software for land cover analysis and a survey of 389 respondents, the research provides a detailed examination of land use patterns, changes over time, and the socio-economic factors driving these changes. Key land cover types, including natural vegetation, agricultural land, built-up areas, bare land, and water bodies, were mapped to understand the implications for agricultural productivity and sustainability. The study reveals a dramatic shift in land use in Ikwere LGA, driven primarily by urbanization and deforestation. From 2010 to 2023, dense vegetation and agricultural land diminished significantly as built-up areas expanded. By 2023, built-up areas covered 80.5 km<sup>2</sup>, up from 47.2 km<sup>2</sup> in 2010, while agricultural zones were largely confined to peripheral areas with lower productivity potential. Although agricultural activities are concentrated on the outskirts, the increasing conversion of arable land to non-agricultural purposes threatens long-term sustainability and productivity, with cassava being the predominant crop.

Urbanization emerged as the dominant factor influencing land use changes, driven by population growth and increased demand for housing and infrastructure. Rising land prices and competition for land due to economic development further exacerbated the reduction in agricultural land. Cultural and traditional practices, such as land inheritance customs, collective land ownership, and ceremonial land use, also play significant roles in land use decisions. Respondents highlighted that economic

development, social norms, and government policy—including land use regulations and zoning laws—are critical in shaping land use patterns, often prioritizing non-agricultural uses over farming.

The study emphasizes the urgent need for sustainable land use planning in Ikwere LGA to address the negative impacts of urbanization and ensure agricultural productivity. If unchecked, the ongoing urban expansion, deforestation, and land degradation could lead to long-term consequences such as soil erosion, loss of biodiversity, and diminished agricultural capacity, threatening both food security and the rural economy.

### **Recommendation**

Based on the findings of this study on the impact of rural land use on agricultural activities in Ikwere Local Government Area, Rivers State, the following recommendations are made:

- i. **Promote Sustainable Land Use Planning:** Implement and enforce strict zoning laws to balance urban development and agricultural land preservation. Designated agricultural zones should be legally protected to prevent further conversion to non-agricultural purposes.
- ii. **Reforestation and Environmental Protection:** Promote soil conservation strategies such as agroforestry, terracing, and cover crops to combat land degradation and erosion resulting from the increase in bare soil.
- iii. **Support Sustainable Agricultural Practices:** Encourage farmers to adopt sustainable agricultural practices like organic farming, crop rotation, and conservation tillage. This could enhance soil fertility, increase productivity, and reduce environmental degradation.
- iv. **Strengthen Land Tenure and Ownership Systems:** Review existing land policies to ensure equitable access to land for both agricultural and residential purposes, taking into account population growth and rising land demand.
- v. **Address Socio-Economic and Cultural Factors:** Diversify the local economy to reduce overreliance on land for both agricultural and residential use. Promote industries that do not require extensive land use, such as agro-processing, craft industries, and digital businesses.

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