Factors Affecting Landuse/Landcover Changes in Ughelli North Local Government Area of Delta State, Nigeria.

Oguduvwe, Jonathan I. Pius

Geography Department, Faculty of Environmental Science, Dennis Osadebay University, Anwai, Asaba, Delta State, Nigeria

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ABSTRACT

Land Use and Land Cover (LULC) change is one of the major environmental and socio-economic issues faced by rapidly developing areas of Nigeria. This research was conducted to identify causes of LULC changes among some selected communities in Ughelli North Local Government Area of Delta State, Nigeria. Primary and secondary data was collected. Secondary data were gathered by means of questionnaire surveys, interviews with people on site and field observation. Data were presented through table and multiple regression analysis was used for analyzing relationship among changes of LULC with some social-economic and developmental variables. Results showed an increase of family size and developmental activities as major factors affecting the magnitude and trend of LULC changes in this region. At the 0.05 significance level, the regression coefficients of several explanatory variables were statistically significant, while factors including increase in family size, physical expansion of settlements, unemployment, mining activities, and lumbering did not show statistically significant relationships with LULC change. These results show an increase due to population growth and development such as building activities, agriculture (farming), sand mining for construction purposes; and burning wood for domestic purposes. This research suggests improving employment options outside of agriculture (non-farm) and off-farm; regulating practices leading to accelerated deforestation; promoting sustainable management of natural resources.

Keywords: Land Use and Land Cover Change, Population, Growth, Developmental Activities, Environmental Resources, Ughelli North Delta State Nigeria.

BACKGROUND TO THE STUDY

From the 20th century to the early 21st century, the changes that the whole world has undergone are unmatched by any previous period—more and more people are inhabiting the planet, economies in various regions have developed one after another, more people have moved from rural areas to cities to live, and even the environmental appearance of the Earth has undergone an unprecedented drastic transformation. In just the one hundred years of the entire 20th century, the global population has grown to an unreasonable extent, climbing all the way, and by the statistics in 2024, the total number had reached approximately 8.2 billion.

In the relevant content released in 2024 by the United Nations Department of Economic and Social Affairs (UN DESA, 2024), a follow-up calculation was made for the global population: the population will continue to rise in the future, it is expected to reach about 9.6 billion by 2050, it will climb to a peak of about 10.3 billion by the mid-2080s, and after passing this peak, the population size will gradually decline. It is also mentioned in this content from the United Nations that the ongoing population growth, especially the rising population trend in developing regions, will bring far-reaching impacts on many aspects: the land resources available to us, the residential pattern of where people live and their distribution, the total amount of grain that can be produced, the various types of support that natural ecosystems can provide to humanity, and whether the stable development of the environment can be sustained in the long term, will all be affected by this issue (UN DESA, 2024).

Throughout the 20th century, plus the period of the early 21st century, several unprecedented large-scale changes have emerged across the world. First, the population surged, with new populations added everywhere; next, the economy took off, production and trade in all parts of the world came to life, with a development rate far exceeding that of the past; furthermore, more and more people moved from towns and villages into cities,

and the pace of urbanization was unstoppable; even the environment of the entire planet has been completely transformed along with these changes.

The outcome of the study will enhance the knowledge about land-use dynamics and processes which is very important for environmental planning and sustainable land resources management. It can provide evidence-based information that will help government agencies, local authorities, and environmental managers understand these dynamics and the factors that influence land-use changes, for effective management. The study intends to provide empirical information on LULC and its driving forces, so as to give insights to the local authorities and environmental development practitioners into areas that should receive priorities of intervention and check damaging environmental practices for sustainability. The LULC in Ughelli North LGA may be influenced by human livelihood activities such as agriculture, mining, sand harvesting, lumbering, fuelwood usage, construction, to mention a few, as well as population and urban growth. An understanding of land-use and land cover change is imperative for sustainable development. The study will focus on Afiesere, Agbarha, and Agbarho communities to ascertain the impacts of socio-economic and environmental practices on land-use and land cover change, and understand the driving forces of LULC change in Ughelli North, Delta State. Furthermore, the study provides the platform for integrating local knowledge, and practices into land policies, which would be beneficial for the concerned communities. Overall, the research outcome would help decision-makers enhance the management and conservation of the forest, wetland and agricultural land to ensure that the needs of the current and future socio-economic demands are achieved without compromising the ability to meet future needs.

HYPOTHESIS

The following hypothesis was postulated which the research verified in the course of this study. This is; Landuse/Landcover changes intensity is not a function of the perceived factors responsible for landuse/landcover changes in the area

THE STUDY AREA

Ughelli North Local Government Area (LGA) is located in the Niger Delta region of the south of Nigeria, in Delta state. The geographical coordinates of the study area are about 5°30′00.673″N and 5°59′37.802″E, while the study area is bounded by the following Local Government Areas: Ughelli North to the North, Ndokwa East to the North-East, Isoko North and Isoko South to the East, Patani to the South, Okpe and Uvwie to the South-West and Ughelli South to the West. It is headquartered in the town of Ughelli. The LGA has an estimated area of 818 km2 and is among the oil producing areas of Delta State making petroleum exploration and production activities one of the economic significance of the LGA (World Bank, 2015; Oguduvwe 2017).

The National Population Commission indicated that the population in Ughelli North in the 2006 census was 321,028. The population figures for the Delta State Government from more recent demographic planning shows that the population will reach 523,703 by 2024 and 566,357 by 2027 (Delta State Government, 2025). The numbers clearly reflect significant demographic increase, and offer a current framework for assessing the influence of urban growth on land-use/land-cover patterns. The LGA is composed of important clans of the Urhobo such as Ughelli, Orogun, Agbarha, Agbarho, Uwheru, Evwreni and Ogor with traditional leadership institutions. The Ovie of Ughelli, a traditional leader of the Urhobo people, is also based in the town of Ughelli (World Bank, 2015).

Geologically, Ughelli North is part of the relatively low lying and undulating plains of the Niger Delta. The relief of the terrain in the Ughelli area is very low as the elevations are generally below 50 m above mean sea level (Aweto, 2002). The climate in the region is tropical with two seasons of wet and dry. Various descriptions of the Ughelli area refer to a long rainy season (usually March or April to October) and a short dry season. The mean annual rainfall is about 2,800 mm and mean annual temperature is about 27°C (Aweto, 2002; ResearchGate, 2024). The amount of rainfall and what season it belongs to can vary from year to year and place to place however, so locally recorded meteorological data are preferred for detailed climatic analysis.

This low relief, high rainfall, and the presence of relatively unconsolidated sedimentary rock formations affect surface drainage, groundwater conditions, soil development, and distribution of hydrologically sensitive

environments such as wetlands. The groundwater quality study and soil contamination in recent studies in Ughelli has highlighted the need for research to look into the relationship between the environment and the activities of man (ResearchGate, 2024; Ofulue & Okpro, 2024).

The progressive urbanisation and population growth in Ughelli North has been matched by the development of commercial, institutional, industrial and residential activities. From 1952 to 1963, the population of Ughelli town rose steadily from about 13,000 to 45,000, during the 1991 and 2006 census periods. Urban functions have been correlated with the growth of need for housing, transportation facilities, employment, and public service. Economic activity in the region includes petroleum-related activities, agro-allied industries, wood processing, metal industries and trading. These activities have an impact on the conversion of natural vegetation, farm land and other land cover categories into built-up and industrial land landscapes (World Bank, 2015; Delta State Government, 2025).

The Delta State is divided into 25 Local Government Areas spread across the three Senatorial Districts namely Delta North, Delta Central and Delta South. Ughelli North is part of the Delta Central Senatorial District, and occupies a key strategic role in the urban and economic network of the state. Availability of sand and other construction materials in some parts of the Niger Delta facilitates building, infrastructure development and road construction. However, environmental management is required in the extraction process as poorly controlled sand mining and dredging may lead to vegetation loss, land degradation, erosion, deterioration of water quality and changes in drainage pattern in the area (Soladoye et al., 2022; Nwobodo et al., 2021).

The land-use and land-cover change in Ughelli North is thus affected by the interplay of various factors such as population growth, urbanization, industrialization, agriculture, petroleum operations, road construction and natural resources extraction. The activities of sand extraction and dredging are particularly relevant in the local environmental landscape given the development of the East-West Road and associated construction demand. The government's investment in infrastructure and urban development has continued in Ughelli North with recent projects include the construction of roads and other infrastructure. (Delta State Project Monitoring, 2026). The LGA serves as an important region to study the temporal and spatial characteristics of land-use/land-cover changes and their environmental implications through these processes.

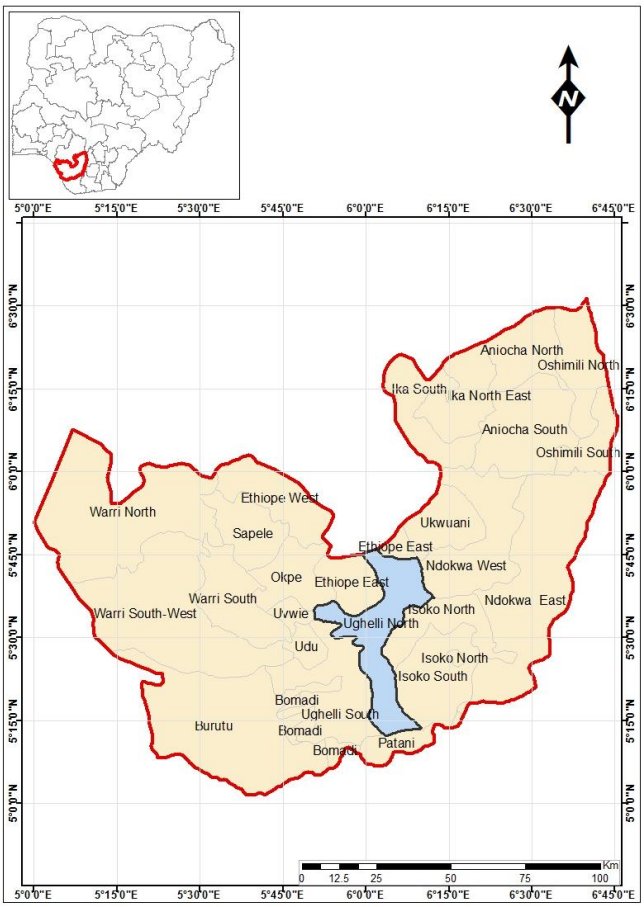

Fig.1: Map of Delta State showing the study area

CONCEPT OF LAND COVER AND LAND USE/LAND-COVER CHANGE

Land cover is the material or living things that cover the surface of the Earth that can be recognized from a distance in a particular area by their physical properties or by their biological activity. Modern land-cover classification includes both natural and anthropogenic elements, and is a basic component of environmental monitoring, ecosystem assessment, conservation of biodiversity, and sustainable land use (FAO, 2023; IPCC, 2022; U.S. Geological Survey, 2024).

Land use, however, refers to the arrangements, activities and inputs related to the use of a land cover type by people. This includes activities like agriculture, forestry, conservation, settlement, infrastructure development and mining. Land cover is critical to land use because one land cover type can have varying land uses. For instance, a tree cover can be located within a natural forest, a plantation or an urban park, and a built-up can be for residential, commercial or industrial uses (FAO, 2023; IPCC, 2022).

Land-use/land-cover change (LULCC) refers to changes in land-cover classes or changes in land-use categories over time. Both natural and anthropogenic processes, such as flooding, vegetation succession, erosion, climatic variability, agriculture, urbanization, and industrialization and mineral exploitation, can cause such changes. Thus, land-cover change is not necessarily associated with land-use change. Progressive degradation can occur in a forest due to logging or other disturbance processes but the forest still be in the same broad land use category (IPCC, 2022; U.S. Geological Survey, 2024).

Land use and land cover are thus interdependent and dynamic. There is an interplay between the physical and biological properties of the land surface and how well different land uses suit the environment and are sustainable over time. Vegetation, bare surfaces, wetlands and built up areas can undergo substantial transformations in the context of Ughelli North Local Government Area due to development of settlement expansion, agricultural activities, exploitation of forest resources, industrial activities, and natural-resource extraction. The use of remote sensing and geographic information systems (GIS) offers helpful methods to identify, classify, quantify, and map such changes at various time periods (FAO, 2023; U.S. Geological Survey, 2024).

In this current study land cover is defined as the observable biophysical attributes of the Earth's surface and land use as human activities and management of its attributes. Spatial distribution and temporal changes in selected land use/land cover classes is therefore the focus of the analysis of land use/land cover change in Ughelli North, carried out in the light of satellite imagery, image classification, GIS analysis and supporting field observations.

A list of land-use/land-cover classes and their descriptions.

The land-use/land-cover classes used in this study are modified and adapted from the classification used by Yitaferu (2007) and are redefined to facilitate the use of satellite images and ground truth verification.

1. Cultivated land

Cultivated land refers to the areas predominantly used for crop production such as intensively cultivated plains, gently undulating landscapes and agricultural fields. May have different amounts of bare soil, crop residues, fallow vegetation and isolated trees. Where the context and land management history suggest that a field was once used for agriculture, but is now bare, it is included. The distinguishing features of the class from other land-cover classes are signs of agricultural activity, including field boundaries, crop emergence, and cultivated surfaces (Yitaferu, 2007; FAO, 2023).

2. Shrub/bush land

These are areas with a predominant cover of shrubs, bushes, scattered trees and herbaceous vegetation. They can be found in areas of degraded forestry, fallow agricultural areas, zones of transition and riverine zones. The vegetation density ranges from fairly dense shrub cover to more open areas where the ground is not

completely covered with vegetation or grass. The class could be natural vegetation, secondary succession or man-made changes such as deforestation or agricultural abandonment (Yitaferu, 2007; FAO, 2005).

3. Grassland

Grassland is made up of lands where grasses and herbaceous vegetation are the primary land cover. These can be open grazing lands, seasonally flooded plains dominated by grasses and other landscapes with only a few woody plants. For this reason, the presence of grass-dominated surfaces must be taken into account for seasonal flooding conditions, vegetation phenology, grazing activities and potential mis-classification with cultivated fallow and shrub land in Ughelli North (FAO, 2005; IPCC, 2022).

4. Bare land

Bare land is areas of land with little or no vegetation cover, such as bare soil, sand, gravel or other uncovered earth materials. It can happen naturally or be caused by people (e.g. construction and road building, mining, sand extraction or clearing land). Field observations, image interpretation and contextual information, if available, can support the classification of bare surfaces, which may be temporary (FAO, 2005; U.S. Geological Survey, 2024).

5. Wetland

Wetland is land areas that are saturated or flooded, or have waterlogged conditions, either permanently or temporarily. Such areas can be marshes, swamps, seasonally flooded plains and other areas where hydrology affects soil characteristics and plant communities. Wetlands are especially significant in land-use/land-cover mapping as they can undergo seasonal and drainage changes, and be affected by changes in rainfall, land development and other environmental processes (IPCC, 2022; FAO, 2005).

The root causes of land use/land cover change are listed below:

A number of biophysical (e.g., climate, topography, soil properties, and vegetation cover) as well as demographic, socioeconomic, technological, institutional and cultural factors influence land-use/land-cover change. Land use is the function and use that people put their land to; Land cover is the physical and biological material on Earth's surface. Land use can directly influence land cover, while natural environmental processes can also influence land cover independently of human decisions on land use (FAO, 2025; IPCC, 2022).

Modern evaluations have pointed out the need to identify a multitude of factors that underlie land-use/land-cover change. Instead, it is the consequence of at the local, regional, and global scale interactive drivers. The causes of the direction and extent of land transformation can be shaped by a combination of population growth, agricultural demand, urbanization, infrastructure development, commodity markets, technological change, land tenure arrangements, governance and/or environmental conditions (IPCC, 2022; IPBES, 2019). These drivers also affect each other, such as population growth influencing the demand for housing and food, and the availability of economic opportunities and infrastructure influencing settlement and agricultural expansion.

The effect of LULC change on ecosystem services and biodiversity, carbon storage, hydrological regulation, and human well being are of critical importance. Land-use change, including deforestation and agricultural expansion, is a major driver of environmental change and GHGs, according to the IPCC (2022). Likewise, FAO (2025) highlights the challenges of livelihoods, land degradation, water scarcity and climate change for land and water resources stemming from agricultural production. The implications of these observations are the need to study human and natural factors to understand the dynamics of land-use/land-cover in Ughelli North Local Government Area.

Land-use/land-cover change can be attributed to natural (biophysical) or anthropogenic causes. There are two types of anthropogenic causes: proximate and underlying or driving causes.Anthropogenic causes are usually distinguished by their immediate effect on land cover, as proximate causes, and by their influence on decisions and conditions leading to changes in land cover, as underlying or driving causes (Geist & Lambin, 2002; IPCC, 2022).

Proximate causes of Land-Use/Land-Cover Change.

Also known as direct causes, proximate causes are immediate human activity or physical processes that lead to perceptible changes in land cover. They encompass agriculture expansion, forest clearance, extraction of wood, settlement construction, road building, mining, etc. that modify directly vegetation, soil, water bodies and built-up surfaces (Geist & Lambin, 2002; IPCC, 2022).

Agricultural expansion is one of the major proximate drivers of agricultural land use since it results in natural and other land cover types being converted into cropland or grazing land. Additionally, agricultural intensification can have an impact on current cultivated landscapes, including changes in cropping systems, irrigation, mechanization, land use, etc. Agriculture is one of the largest direct contributors to tropical deforestation, with its relative contribution differing by region, based on socioeconomic and environmental conditions (IPCC 2022).

Other immediate factors include the use of forests for exploitation and the extraction of wood. Deforestation of trees may lead to low forest density, habitat fragmentation and encroaching forest land for agriculture and settlements; all due to timber harvesting, fuel wood collection, charcoal making or other domestic/commercial uses. Even if a forest is not fully converted, the repeated extraction can lead to degradation of the forest (IPCC, 2022; FAO, 2020).

Infrastructure development, such as the construction of roads, houses, industrial facilities and related service networks, directly alters the land cover by substituting natural vegetation, agricultural land, or bare surfaces with artificial constructions. Infrastructure can also make previously less-developed parts more accessible, which can pave the way for further expansion of settlement, extraction of resources and agriculture (IPCC, 2022).

The proximate causes in Ughelli North include urban expansion, agricultural development, forest exploitation, road construction, sand extraction and industrial development. The extraction of construction material such as sand can directly lead to the removal of soil and sediment; it can change the water flow pattern; and it can convert natural or agricultural land into extraction sites. Further field observation, interpretation of satellite imagery and local evidence should be used to determine the nature and impact of these activities, rather than assuming they are the same throughout the LGA.

Direct land-cover changes also can be caused by natural processes. These include the effects of flooding, erosion, rainfall alteration, drought, wildfire and vegetation succession. The IPCC (2022) differentiates between natural effects and effects caused by direct and indirect human intervention, and acknowledges that there is often interaction between human activities and environmental processes. Changes in land use, such as land clearing and alterations to drainage, can affect exposure to erosion and the extent of wetlands and seasonally flooded areas, respectively.

Underlying or Driving Causes of Land-Use/Land-Cover Change

Also known as indirect drivers or root drivers, underlying causes are the conditions that shape the proximate drivers of land use, and include socioeconomic, demographic, political, institutional, technological, cultural and biophysical factors. In contrast to proximal causes, they can influence the extent, location, scale and intensity of direct land-use processes, but do not necessarily lead to a direct observable change in land cover (Geist & Lambin, 2002; IPCC, 2022).

Demographic factors

Population growth, migration, household formation and urbanization can bring about a rise in the demand for housing, food, jobs, transportation, and public facilities. Such pressures can help to promote agricultural development, settlement and natural vegetation changes. Demographic growth and urban expansion in Ughelli North are factors to consider in studying built up areas, agricultural land and vegetation cover. The link between land-cover change and population growth is context specific and should be considered in the context of land availability, economic opportunities, and planning regulation (IPCC, 2022; IPBES, 2019).

Economic and market factors

The economy has effects on land use choices regarding employment opportunities, commodity prices, income of the household, investment and demands for natural resources. There is a potential for agricultural markets to drive expansion and intensification of agriculture, and the demand for timber, building materials and industrial land may lead to forest exploitation, sand extraction and urbanization. The IPCC (2022) acknowledges the role of market forces and economic incentives as important indirect drivers of land use change, which differ by region and sector.

Issues related to institutional and governance factors.

How land is allocated and managed is affected by land-tenure systems, planning regulations, environmental laws, property rights, institutional coordination and enforcement mechanisms. Inadequate governance or enforcement could lead to unplanned development, illegal resource extraction and environmental degradation associated with land-use. On contrary, sound land-use planning and management of protected areas, and environmental regulation can help decrease land degradation and promote sustainable land management (IPCC, 2022; IPBES, 2019).

Technological factors

Technological development influences land-use change by enhancements in agricultural production, transport, earth moving, mineral extraction, construction and other resource extraction. Mechanization and better access can accelerate and expand the process of land transformation. The capacity for sand-dredging equipment, access to roads and construction technologies could affect the growth of sand-dredging activities and changes in land cover in the study area. The cultural and social aspects Individual interactions with land resources are influenced by cultural practices, traditional land management practices, social values, household livelihoods and community institutions. The existence or change of certain land cover types can be affected by local resource-use practices, farming traditions, customary land ownership and dependence on fuel wood. Where applicable, these factors should be explored in field interviews and through socioeconomic surveys. The factors that are related to the biology and climate are called biophysical factors. The suitability and resilience of various land uses are affected by topography, soil properties, hydrology, vegetation characteristics, rainfall, temperature and climatic variability. These conditions can influence the potential location of agricultural, settlement, forestry and other activities. The IPCC (2022) highlights that biophysical conditions drive human drivers and lead to variable outcomes of land use, depending on location and environmental conditions.

Multiple and Interacting Causes of Land-Use/Land-Cover Change

Land-use/land-cover change typically has more than one driver or causal agent. These factors are not equally important in all geographical areas or at all times, and depend on the attributes of the coupled human-environment system. IPCC (2022) recognizes that direct and indirect drivers are linked processes at varying spatial and temporal scales, while IPBES (2019) highlights links between direct drivers and societal conditions. Some drivers are slow moving over long time-frames, including population growth, economic development, technological change, and institutional change. Other factors can also serve as short-term triggers, such as flood, drought, economic shocks, commodity price fluctuations or construction of large-scale infrastructure. These more incremental and episodic influences can combine to cause incremental or sudden changes in land cover. Urban development in Ughelli North could lead to the expansion of land needs and the supply of construction materials, and road development may enhance accessibility to areas with resources and agriculture. Economic opportunities can be sources of migration and investment, while land tenure and environmental regulation can impact location and intensity of development. Concurrently, wetlands may not persist, agricultural yields may be reduced, and land may be unsuitable for development due to rainfall variability, flooding, soil condition, and drainage characteristics.

Methodology of the research

Identifying and selecting relevant data sources is a key part of creating reliable evidence and scientifically valid research results. The credibility of further analysis and interpretation is dependent on the quality,

relevance, completeness and accessibility of data. The researchers need to be aware of the limitations of the data available and consider whether they are appropriate for their research goals, study design and analysis needs (Li et al., 2024; Liu & Huang, 2025).

Hence, the data used in this study were primary and secondary. Secondary data are pre-existing data that are acquired by the researcher from various sources such as satellite data, official government data, census data, maps, scholarly literature, and other relevant institutional data, whereas primary data are information gathered directly by the researcher through field observation, administration of questionnaires, interviews, and/or ground truthing activities. The primary and secondary data integration enables the evaluation of LULC patterns, helps validate the remotely sensed data, and enhances the analysis of changes in the environment in the Ughelli North Local Government Area (Li et al., 2024; Liu & Huang, 2025).

Sample and Sampling Technique

The main goals of the field survey were to gather qualitative and quantitative data required for understanding, explaining and interpreting the socioeconomic, demographic, environmental and institutional drivers of land-use/land-cover (LULC) changes in Ughelli North Local Government Area. Local level information is especially useful in LULC studies, as it can accompany remotely sensed observations to aid in the interpretation and validation of LULC patterns at the local level (Alegbeleye et al., 2024; FAO, 2024). Household surveys, qualitative interviews and remote-sensing methods have been shown to be important tools used in the study of land-use changes and community perceptions of environmental change in recent studies in Nigeria (Effiong et al., 2024).

A random, cluster and purposive sampling techniques were used for the selection of a total sample of 360 respondents for the study. The study population was sampled using cluster sampling for the purposes of creating relevant geographical or settlement units, and random sampling for the opportunity to select respondents within the relevant clusters without any systematic researcher preference. Where a particular type of knowledge and/or experience in land-use activities and environmental changes was needed, purposive sampling was used. Sampling strategy allowed for collecting information from respondents who have knowledge of land-use and environmental changes as well as general household-level information.

Multiple sampling methods align with recent LULC research that incorporates household surveys and purposive and random selection to collect socioeconomic data with a representative sample of communities or land-use settings (Jellason et al., 2024). In recent years, it has also been proven that questionnaire surveys can be combined with remote sensing, field observations and qualitative information in investigating the drivers and impacts of LULC change (Effiong et al., 2024; Alegbeleye et al., 2024).

The field survey thus was used as an ancillary source of evidence for the satellite-derived LULC data. Respondents' information was used to determine the perceived drivers of land-use change, which in this instance include population growth, settlement expansion, agriculture, infrastructure, resource extraction and other socioeconomic factors. The field information from this exercise was then compared with the spatial pattern and temporal trends derived from the remotely sensed data to give a more complete picture of the LULC changes that have occurred in Ughelli North.

The ultimate purpose of the field survey conducted was to collect qualitative and quantitative information to help to better understand, explain and interpret the factors affecting Landuse/Landcover changes in Ughelli North, which is the core issue of this study. A sample of 360 was drawn using random, cluster and purposive techniques.

Method of data Analysis

The data obtained from the field were presented in tables and cartographic diagrams such as bar chart, histogram and pie charts. These were used to express the relationship between sets of data. Finally, Multiple Regression model was used for the testing and the validation of the hypothesis.

Questionnaire Method

Questionnaire was used to collect data on factors affecting LULC for this research work. A total of 360 copies of questionnaires were administered. Each community was divided into 6 clusters and 20 persons were sampled bringing the number of questionnaire issued to one hundred and twenty (120) copies through random sampling to attain the sample size of 360. In each cluster, all farmers of 20 years and above who consented to be included in the study were sampled. These include heads of communities, community chiefs, the spokesmen, elders and other opinion leaders. The choice of respondents was based on the fact that they are very knowledgeable and conversant with their area. Therefore, the data used in this study came from a survey conducted in October 2025 in Agbarha, Afiesere and Agbarho communities in Ughelli North of Delta State. In each cluster, the starting point was a random sampling technique, involving the targeting of individuals that suits the subject and nature of study using predetermined selection criterion randomly selected. Every first house along the major road in each cluster is the starting point and thereafter every tenth house is sampled. The interval of sampling is ten (10) houses. Also the sampling is dealing with fairly uniform size of population of the various communities. Relevant statistical tables were used in data presentation and analysis.

Secondary Data

These are data from documented materials. They include published materials, published statistics, unpublished statistics, updated topographical maps, satellite images, directories and historical sources. Secondary source of data is also referred to as archival data. Thus, the archival data used for this research work were from library search, stakeholder's paper presented at workshop and seminar papers, book material, magazines and Internet browsing.

Satellite Images

In order to cover the intended period of study, different type of images originating from different types of sensors were used. Hence, Landsat MultiSpectral Scanner (MSS), Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) from December 21st, 1987, and January 28th , 2002 along with ASTER image of 2014 were used for a time series of images for the land use/cover change study. In December and January, cloud cover effect is usually at its lowest. Similarly, errors resulting from seasonal differences were minimized since the images were acquired within an interval of one month. The study area is covered by Landsat scene with world reference system (WRS) Path/Row 189/056. Ughelli North Local Government Area, the study area, was extracted from the scene covering for analysis. The extent of Ughelli North Local Government Area is approximately 818km^2. Image processing were done using Idrisi software. Image composite were obtained from channels 4, 3 and 2. A combination of these channels, will show mature forest as deep red colour, settlement and bare surface as cyan, water bodies as black and other vegetation types in shades of red. The basic principles of image interpretation, texture, shape, colour, and other principles were employed in identifying features in the image.

Image classification and projection

Both Unsupervised and Supervised classification analysis was used. The unsupervised classification was applied to the image derived from image composite using the cluster module of Idrisi software. This procedure generated clusters and dominant classes which were used as a basis for the creation of training site and this was verified through field-visit/ground truthing exercise. The classes are settlement/bare surface, secondary vegetation/farmland, water body, swamp/wetland, and mature forest. Field visits was conducted to validate the land use classes.

RESULTS AND DISCUSSION

Table 1: Perception of factors responsible for LULC change in Ughelli North

Factors	Total	%
Increase in Population	61	16.9
Physical expansion of settlements	43	11.9

Sand Harvesting	45	12.5
Increase in Construction works (Roads, Bridges,Campsites)	45	12.5
Wood as source of fuel for domestic use	36	10
Farming systems	47	13.1
Unemployment	26	7.2
Mining activities	32	8.9
Lumbering works	25	6.9

The factors influencing LULCC.

Table 1 shows the land-use/land-cover (LULC) change major factors as identified by respondents in Ughelli North LGA. 16.9% of respondents indicated population growth as a very important issue. This perception is corroborated by recent Nigerian LULC research which indicates that population growth, urbanization and related demand for houses, infrastructure and economic activities are responsible for the expansion of built-up areas and the change of other vegetation and land-cover classes. Rapid population growth and economic development were also found to be significant contextual factors that are correlated with land-switch and land-cover transformation in Nigeria, in line with the results of the systematic review of LULC studies done in Nigeria (Alegbeleye et al., 2024). More recently, there has been evidence of significant deforestation of rainforest and mangrove cover in the Niger Delta region between 1986 and 2024, with corresponding increases in built-up and agricultural areas (Agumagu et al., 2025).

Population growth may lead to a greater demand for housing, road space, markets, schools, health centres, commercial premises and other urban infrastructure. In Ughelli North, these pressures can lead to the transformation of agriculture land, vegetation, wetlands and other unused lands to urban development. Studies conducted in the recent past in Nigeria's urban areas have also linked population growth, economic development, and infrastructure development to the process of urban expansion (Onuegbu & Egbu, 2024; Agumagu et al., 2025).

13.1% of the respondents suggested farming activities as an important driver of LULC change. Changes in farming practices may lead to removal of plant cover, changes to soil surfaces, and change of forest or shrub land to agriculture. Agriculture is still an important land use in the broader Niger Delta region, and land use changes including agricultural expansion and vegetation clearing have been identified as one of the processes that lead to natural vegetation cover changes in the region (Agumagu et al., 2025). In the case of Ughelli North, the vegetation clearance and repeated cultivation activities can potentially cause the alteration of forest, shrub/bush, cultivated and bare-land classes. However, reported bush burning should be seen with caution as the extent, frequency, and importance of bush burning in relation to observed LULC change needs to be backed up by field based evidence.

The other significant factors identified by the respondents were construction activities and sand harvesting which accounted for 12.5% each. Roads, bridges, camps, residences, markets and various other infrastructural developments involve land clearance and can lead to changes in vegetation, cultivated land, wetlands and other surfaces to built-up or disturbed land. Urban and infrastructure expansion have been shown to significantly contribute to built-up area, as vegetation and other land cover classes are reduced, in recent studies in Nigeria (Onuegbu & Egbu, 2024; Agumagu et al., 2025).

Localized changes in land surface conditions may occur and be of significant size in areas where sand extraction includes vegetation clearing, digging, stockpiling, access roads, changes to drainage etc. These activities are thus applicable to the area where construction material extraction and development activities have been reported around Agbarha, Afiesere and Agbarho areas. Specific impact of sand harvesting to LULC change in these areas should be backed up by the field observation or evidence derived from satellite and not just based on the perception of the respondents.

11.9% of responses were in the form of physical expansion of settlements. Settlement expansion is strongly linked to the change of land use (conversion) from agricultural uses to residential, commercial and institutional uses, as well as vegetative cover, bare surfaces and non-developed areas. Recent studies in Nigeria have

reported on the quick growth of built-up areas due to urbanization. For instance, the study of Onuegbu and Egbu (2024) showed that there was a significant landscape restructuring in Abakaliki LGA in the period 2000 to 2022, and a recent study conducted by Ota LGA, Ado-Odo Ota LGA, recorded a change of 127.3% in built-up land between 2015 and 2023. The results of this study give a wider evidence in Nigeria on the relevance of settlement expansion as a factor to consider in Ughelli North.

10.0% of the respondents identified wood fuel for domestic use. The use of wood and other biomass resources can lead to deforestation if harvesting rates are too high for natural reproduction rates. Logging, fuel wood collection, agricultural clearing and other processes of exploitation of vegetation are among processes that add to forest-cover change in the Niger Delta according to recent research (Agumagu et al., 2025). There is therefore a need to look at the importance of fuel wood use in Ughelli North in the context of household energy use, the availability of alternative energy sources, population growth and the distribution of woody plants in space.

Mining, mainly reported by the respondents in connection with sand dredging and extraction, accounted for 8.9%. Mineral extraction activities can directly alter the nature and function of land surfaces by clearing vegetation, excavation, disposal of extracted material, and alteration of drainage. Extraction may also affect sediment transport and hydrology in the immediate area where it is taking place, if it is occurring near watercourses. These processes are important for LULC analysis because extraction sites can be identified in satellite images as bare areas or water bodies and sometimes can then experience secondary vegetation regeneration or conversion to other land uses. It is therefore important to verify changes in these classes in the field.

The respondents gave the highest rating of 7.2 per cent to unemployment as the perceived contribution from the LULC change. Unemployment does not directly affect land cover in the same way as construction or vegetation clearance, but can do so indirectly through its impact on livelihoods, migration, resource dependency and involvement in agriculture or natural-resource extraction. In the modern literature on LULC, the importance of economic and socioeconomic conditions as underlying drivers that affect more direct activities of land use are highlighted (Allan et al., 2022; IPCC, 2022).

6.9% of respondents responded to lumbering activities. Sustained harvesting (such as timber extraction, fuel wood collection, furniture production, construction needs, etc.) can cause degradation of vegetation. In the broader Niger Delta, forest degradation has been linked to logging activities, fuel wood harvesting, agricultural encroachments, and petroleum related activities (Agumagu et al., 2025). Local activities like tree cutting for agricultural purposes, farm work, carpentry, construction and energy generation could then influence in the changing of vegetation cover in Ughelli North. But the size of this effect needs to be evaluated on the basis of field evidence and with reference to multi-temporal satellite data.

In general, results in Table 1 suggest that population growth was the most serious of the drivers listed, with farming coming in at second place, followed by construction works, sand harvesting (both 12.5%), settlement expansion (11.9%), wood fuel (10.0%), mining activities (8.9%), and unemployment (7.2%). These perceptions are largely aligned with recent evidence in Nigeria that urban development, population growth, agriculture development, infrastructure development and natural-resource exploitation are related to significant LULC change.

The results should, however, be interpreted as respondents' perceived drivers and not as evidence of the individual roles of the different drivers in driving the observed proportion of LULC change. This is achieved by comparing the questionnaire results and multi-temporal satellite-derived LULC maps with field observations and statistical analysis of socioeconomic variables, to obtain a stronger assessment. This triangulation can confirm if the drivers perceived are spatially and temporally linked to the actual land cover changes that are seen in Ughelli North.

Hypothesis Testing

It is recalled that hypothesis stated for this study states that Landuse/Landcover changes intensity is not a function of the perceived factors (X_1 – Increase in Family sizes, X_2 – Sand Harvesting, X_3 – Physical

expansion of Settlements, X_4 – Increase in Construction works, X_5 – Wood as source of fuel for Domestic use, X_6 – Farming systems, X_7 – Unemployment, X_8 – Mining activities and X_9 – Lumbering) responsible for landuse/landcover changes in the study area. Table 2 presents the regression summary. The R square value of 0.485 indicates that 48.5% of the variation in LULC is accounted for by Sand Harvesting, Increase in Construction works, Wood as source of fuel for Domestic use and Farming systems.

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.697[a]	.485	.472	.45306

Predictors: (Constant), X_1,X_2, X_3, X_4,X_5, X_6,X_7,X_8,X_9.

The regression coefficients for the independent variables, that is, X_1 (Increase in Family sizes) X_2 (Sand Harvesting), X_3 (Physical expansion of Settlements), X_4 (Increase in Construction works), X_5 (Wood as source of fuel for Domestic use), X_6 (Farming systems), X_7 (Unemployment), X_8 (Mining activities) and X_9 (Lumbering) in the analysis are presented in Table 2. The coefficients for Increase in Family sizes, Sand Harvesting, Physical expansion of Settlements, Increase in Construction works, Wood as source of fuel for Domestic use, Farming systems, Unemployment, Mining activities and Lumbering are 0.080, 0.145,- 0.039, 0.338, 0.150, 0.149, 0.023, -0.038, 0.013 respectively. The regression coefficients for the independent variables are significant at 0.05 confidence level with exception of those of X_1 (Increase in Family sizes), X_3 (Physical expansion of Settlements), X_7 (Unemployment), X_8 (Mining activities) and X_9 (Lumbering). The regression coefficients imply that given a unit change in X_2 (Sand Harvesting), X_4 (Increase in Construction works), X_5 (Wood as source of fuel for Domestic use), and X_6 (Farming systems), LULC will increase by 0.172, 0.340, 0.181 and 0.173 respectively. Consequently, the null hypothesis is rejected with respect to X_2 (Sand Harvesting), X_4 (Increase in Construction works), X_5 (Wood as source of fuel for Domestic use), and X_6 (Farming systems) and accepted for X_1 (Increase in Family sizes) X_2 (Sand Harvesting), X_3 (Physical expansion of Settlements), X_4 (Increase in Construction works), X_5 (Wood as source of fuel for Domestic use), X_6 (Farming systems), X_7 (Unemployment), X_8 (Mining activities) and X_9 (Lumbering) . This implies that the variation in LULC due to X_1 (Increase in Family sizes) X_2 (Sand Harvesting), X_3 (Physical expansion of Settlements), X_4 (Increase in Construction works), X_5 (Wood as source of fuel for Domestic use), X_6 (Farming systems), X_7 (Unemployment), X_8 (Mining activities) and X_9 (Lumbering) are by chance.

The overall regression equation will therefore take the form:

$$Y = 0.320+0.145X_2+0.338X_4+0.150X_5 +0.149X_6$$

Table 3: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.320	.167		1.917	.056
	Increase in family size	.080	.048	.082	1.660	.098
	Sand harvesting	.145	.045	.172	3.233	.001
	Physical expansion of settlements	-.039	.051	-.045	-.767	.444
	Increase in construction works	.338	.053	.340	6.386	.000
	Wood as source of fuel for domestic use	.150	.043	.181	3.507	.001
	Farming system	.149	.052	.173	2.880	.004
	Unemployment	.023	.035	.029	.678	.498
	Mining activities	-.038	.038	-.039	-.993	.321
	Lumbering	.013	.034	.015	.366	.714
a. Dependent Variable: LULC						

SUMMARY OF FINDINGS

The study shows LULC changes and the factors responsible for LULC in the areas to include; Sand Harvesting, Increase in Construction works, Wood as source of fuel for Domestic use, and Farming systems. They determine the extent of LULC changes. Soil erosion, river siltation and flooding have significantly contributed to the variation in LULC in the study area. However, the variation in LULC due to forest depletion is by chance.

The null hypothsis which stated that Landuse/Landcover changes intensity is not a function of the perceived factors responsible for landuse/landcover changes in the area was rejected with respect to X_2 (Sand Harvesting), X_4 (Increase in Construction works), X_5 (Wood as source of fuel for Domestic use), and X_6 (Farming systems) and accepted for X_1 (Increase in Family sizes), X_3 (Physical expansion of Settlements), X_7 (Unemployment), X_8 (Mining activities) and X_9 (Lumbering). This implies that the variation in LULC due to X_1 (Increase in Family sizes), X_3 (Physical expansion of Settlements), X_7 (Unemployment), X_8 (Mining activities) and X_9 (Lumbering) are by chance.

RECOMMENDATIONS

1. There is the need for individuals and construction companies to disregard illicit and discriminate sand dredging in Ughelli North. Appropriate policies should be geared towards this so that the rate of environmental degradation could be reduced

2. Government and Private sector should come up with sensitization programme to enlighten the local inhabitants on the dangers of illicit sand dredging, regular coppicing, over cultivation, bush burning and other harmful activities /practices on the environment to be discouraged and alternative and best way method to be made available and adopted

3. Physical expansion of the Settlements is a major factor of LULC. Therefore, there is the need to provide high rising buildings for the people to reduce the physical expansion rate of Settlements/Exposed surface in the area.

4. There is the need to discourage illegal sand mining along river banks and shallow areas to save the rate of riparian vegetation depletion in the area.

CONCLUSIONS

Based on the findings of this work, the following conclusions are made:

The factors that are responsible for LULC in the study area are Sand Harvesting, Increase in Construction works, Wood as source of fuel for Domestic use, and Farming systems.

REFERENCES

1. Aweto, M. 2002. Outline Geography of Urhobo land. Ibadan University Press, University of Ibadan, Ibadan, Nigeria.
2. Oguduvwe J.I.P, (2017). Factors Affecting Land use/Landcover Changes in Ughelli North Local Government Area of Delta State, Nigeria), M. Phil Thesis, University of Benin, Benin- City, Nigeri
3. Yitaferu, B., (2007), Land Degradation and Options for Sustainable Land Management in the Lake Tana Basin (LTB), Amhara Region, Ethiopia. PhD thesis, Centre for Development and Environment, University of Bern, Switzerland.
4. Food and Agriculture Organization of the United Nations. (2024). Land statistics 2001–2022: Global, regional and country trends. FAO.
5. IPBES. (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES Secretariat.

6. United Nations Department of Economic and Social Affairs, Population Division. (2024). World population prospects 2024: Summary of results. United Nations.
7. Delta State Government. (2025). Delta State medium-term development plan 2024–2027. Official planning document .
8. Delta State Project Monitoring. (2026). Construction and rehabilitation projects in Ughelli North Local Government Area. Project monitoring portal .
9. Nwobodo, T., Ogbuene, E. B., & Nzeadibe, C. (2021). Effects of sand mining on land use/land cover on river environment in developing countries: A case study of Ava River in Enugu State, Nigeria. IKENGA International Journal of Institute of African Studies, 22(3), 1–25. Publication record .
10. Ofulue, C. J., & Okpro, O. F. (2024). Assessment of micronutrient and heavy metal contamination in soils near refuse dumpsites in Ughelli North, Delta State, Nigeria. EQA—International Journal of Environmental Quality. Journal article .
11. Soladoye, O., et al. (2022). Sustaining urbanization while undermining sustainability: The socio-environmental characterization of coastal sand mining in Lagos, Nigeria. Environment, Development and Sustainability. Research article .
12. World Bank. (2015). Ughelli Environmental and Social Management Plan (ESMP). World Bank document .
13. Food and Agriculture Organization of the United Nations. (2005). Land cover classification system: Classification concepts and user manual (Software version 2). FAO. FAO Land Cover Classification System .
14. Food and Agriculture Organization of the United Nations. (2023). Land cover and crop monitoring. FAO Geospatial Platform. FAO geospatial information .
15. Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Impacts, adaptation and vulnerability—Annex II: Glossary. Cambridge University Press. IPCC glossary .
16. U.S. Geological Survey. (2024). An interagency perspective on improving consistency and transparency of land use and land cover mapping (Circular 1549). U.S. Geological Survey. USGS Circular 1549 .
18. Food and Agriculture Organization of the United Nations. (2020). The state of the world's forests 2020: Forests, biodiversity and people. FAO. FAO report .
19. Food and Agriculture Organization of the United Nations. (2025). The state of the world's land and water resources for food and agriculture 2025: The potential to produce more and better. FAO. FAO report .
20. Geist, H. J., & Lambin, E. F. (2002). Proximate causes and underlying driving forces of tropical deforestation. BioScience, 52(2), 143–150. Journal article .
21. Li, T., Higgins, J. P. T., & Deeks, J. J. (2024). Chapter 5: Collecting data. In J. P. T. Higgins et al. (Eds.), Cochrane handbook for systematic reviews of interventions (Version 6.5). Cochrane. Cochrane Handbook .
22. Liu, H., & Huang, H. (2025). The methodological discussion and academic value reassessment of secondary analysis. Research Data Journal, 4, 322–325. Journal article .
23. Alegbeleye, O. M., Rotimi, Y. O., Shomide, P., Oyediran, A., Ogundipe, O., & Akintunde-Alo, A. (2024). Land use land cover (LULC) analysis in Nigeria: A systematic review of data, methods, and platforms with future prospects. Bulletin of the National Research Centre, 48, 127.
24. Effiong, C., Ngang, E., & Ekott, I. (2024). Land use planning and climate change adaptation in river-dependent communities in Nigeria. Environmental Development, 49, 100970.
25. Agumagu, O. O., Marchant, R., & Stringer, L. C. (2025). Land use and land cover change dynamics in the Niger Delta Region of Nigeria from 1986 to 2024. Land, 14(4), 765.
26. Allan, A., Soltani, A., Abdi, M. H., & Zarei, M. (2022). Driving forces behind land use and land cover change: A systematic and bibliometric review. Land, 11.
27. Onuegbu, F. E., & Egbu, A. U. (2024). Employing post-classification comparison to detect land use cover change patterns and quantify conversions in Abakaliki LGA Nigeria from 2000 to 2022. Scientific Reports, 14, 9384.