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Land secession in Nigeria Forest: Integrating Evidence from Agricultural Practices and Land Use Change of Omotosho Forest Reserve, Ondo State, Nigeria.

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Abstract— This study assessed agricultural activities and landuse dynamic in land seccesssion of Omotosho Forest Reserve, Ondo State -Nigeria by identifying the landuse/cover in the study area, examined the pattern of change; measured the extent of land secession and finally assessed the drivers of forest secession in the study area.

Landsat ETM+ 2000, Landsat OLI 2010, Sentinel 2015 and Sentinel 2020 were acquired for this study. Digital image processing involving georectification, enhancement, sub-mapping and classification were performed on the images. The classification produced six landuse/cover classes which are; dense forest, shrubs, farmland, water body, open spaces and settlement. Area analysis involving cross tabulation analysis, and calculation of the landuse area in hectares and square kilometres were used to determine the pattern and extent of forest land secession in the study area. More so, Six settlements; Akinfosile, Aye, Igbotako, Ikoya, Iju-Odo and Omotosho were selected for key informant interview from where six respondents each encompassing both male and female gender of 30years above were selected for interview. And their responses were analysed using content analysis approach.

The results of the digital image processing showed that dense forest occupied 29,727 Ha in year 2000, and decrease although to 16,071 Ha in year 2020. Similarly, shrubs area increased all through the study period from 10,108 Ha in 2000, to 14,348 Ha in 2020. Farmland occupied 9,247 Ha in 2000 and 13,462 Ha in 2020 indicating increase secession in farmland all through the study period. Area occupied by Water body decreased all through the study period from 1,064 Ha in 2000, to 699 Ha in 2020. The forest land was seceded to open spaces from 984 Ha in 2000, to 3,014 Ha in 2020. The settlement area expanded in the study area from 4,718 Ha in 2000, to 8,252 Ha in 2020 representing significant increase with time. The drivers of forest land secession from the key informant interview conducted were agricultural activities, deforestation and settlement expansion with agricultural activities accounting for the highest land secession.

This study therefore concluded that the larger portion of the Omotosho Forest Reserve seceded to other land uses and majorly attributed to agricultural land use and its associated activities.

Keywords— Agriculture, georeferenced, Farm practices, Landuse-dynamics, Secession.

INTRODUCTION

Agriculture has come to be a lucrative venture in contemporary Nigeria that is capable of employing the two-third of the working population and provide food, income and other economic benefit for the nation's economy (Akinsanmi, 2000). The history of Agriculture in Nigeria dates as far back as the creation of the nation and this can be segmented to pre-colonial, Colonial and post-colonial era. Hence the Agricultural life in Nigeria when looked at from this point of view can be visualized to be favoured by nature given the fact that the soil is rich, the temperature is warm, favour agricultural production and the annual rainfall is well distributed and there are no extreme natural disasters posing any threats to land, crops and other source of agricultural production (Akinsanmi, 2000). In the quest for food and shelter however, man has adopted many agricultural practices through the ages among which are; hunting and gathering; pure subsistence agriculture: mixed subsistence with some cash crops production and pure commercial agriculture. However, between these main divisions are many transitions and overlapping stages depending on the state of economic development and local population (Akinsanmi, 2000; Allaby, 2010; and Fuller, 2007). Given the above comprehensive background however, the term Agriculture is derived from two Latin words: ager, meaning field and cultura, meaning cultivation. Today however, the

term is more broadly defined as the production of plant and rearing of animal useful to man. It covers not only the cultivation of the soil, feeding and management of crops and livestock, but also the preparation of plant and animal products for the use of man, and the disposal of these products by marketing (Fuller,2007). Agriculture has come to subsume a very wide spectrum of activities that are integral to it and having their own descriptive terms, such as cultivation, domestication, horticulture, arboriculture, cash crop farming, and vegeculture, as well as forms of livestock management such as mixed crop-livestock farming, pastoralism, and transhumance (Iwena, 2007; FAO 2019; FMEDCC, 2021).

Agricultural activities as well as other anthropogenic factors have impact on land cover changes and the biodiversity causing the disappearance of traditional flora and fauna especially in arable land and forest reserve when allowed even in controlled manner (Orimoogunje, 2009; Olanusi, 2024). In recent times however, the increasing agricultural intensity has generated great pressure not only on land resources but also across the whole environment hence this makes agriculture a top priority sector for economic development (Ekanade and Salami, 1996; Lambin, 2001). Changes in the modality of practices of agricultural activities contribute a great deal to the changes in the nature of land cover, the disappearance of traditional agricultural landscape and also responsible for vegetation modifications, which usually have impact on regional climate, carbon sequestration, biodiversity loss and ecosystems services (Akinsanmi, 2000). The practice of agriculture involves several approaches and methodologies with their peculiarity in practice to the tropical region such that determines the level of productivity, income accruement, agricultural landscape and the nature of the natural ecosystem (Iwena, 2007,; Mohammad and Janet, 2022). Land use by humans has a long history, emerging more than 10,000 years ago having being argued on the basis of public utility, planning and dominant activities. The geographical location of a land defines its use to a great extent given the policies governing the ownership of the piece of land and the legal regime of land ownership whether it is leasehold, communal, freehold, individual, inheritance, gift and government tenure system. According to UNFAO (2010), agricultural activities are the most practiced in the tropical rainforest zone of most developing nations in Africa, especially Nigeria as such the concept behind agricultural land-use changes premised on the fact that there are different forms of agricultural activities and farming practices each of which forms the land-use where it is being practiced. Sequel to this, the changes from one agricultural method or farming system to another give a clear-cut direction of the pattern of the land-use and changes especially as it pertains with the land secession. (Adebisi, 1999; Shaw, 1997). Agricultural activities such as bush burning, tillage, clean clearing, shifting cultivation, grazing and the host of other farm practices, all contribute significantly to periodic and rapid deterioration of biodiversity globally in terms of forest cover degeneration and animal extinction in recent years (Orimoogunje, 2009; Akinyemi and Ifejika, 2021).

It has however been recorded that more than 99.9% of total species that ever lived on earth, amounting to over five billion species are estimated to be extinct and as such it has been discovered that over the past fifty years ecosystem structure has changed more rapidly than at any other period of human history (Orimoogunje, 2009; Ogungemite, 2012; Eludoyin and Iyanda, 2018). This period however has been discovered to be somewhat connected with high agricultural intensification on the land in many parts of the tropical rainforest belt and its reserves (Lambin, 2001; Ogunjemite, 2012). Furthermore, researchers have assessed the nature of the vegetation cover areas within Nigeria forest reserves and shown that there is a total of 1163 forested reserves and protected land in Nigeria covering a total land area of 10,752,703km2 (Oyebo, 2006). However, these forested areas overtime have been discovered to have been reduced to almost bare-land marked here and there by shrubs, few trees, and few animals reflecting the degree at which some of the earlier known plant and animal species have been endangered and extinct (Salami, 2006; Orimoogunje, 2000; Olanusi, 2024). However, it has been observed that agricultural practices constitute about 25% to the total destruction of forested areas due to its recurrent and consistence practice (Iwena, 20007). In 2005, 12.2% which was the equivalent of 11,089,000 hectares of total vegetation cover area in Nigeria had been deforested.

The conservation measures employed in managing forest reserves go a long way in determining the long-term sustainability of its flora resource, yet this has not been able to bring to check the various permitted agricultural activities already taking place in the forest beyond the level of permit. More so, several studies have explored forest degradation in recent times but none has been able to reveal changes in Omotosho forest land use

and its secession by agricultural activities with accurate and known figure. It is from this, that this research is based on assessment of Agricultural Activities and land secession in Omotosho Forest Reserve, Ondo State, Nigeria, using Geographic Information System and Remote Sensing tools to determine the, pattern, extent and drivers of forest loss and secession in the forest.

Problem Statement

Agriculture is a means of livelihood employing not less than two-third of the working population in the universe (Akinsanmi, 2000; Ogunjemite, 2012, Mojisola et al., 2023). And its practice provides food, shelter, raw materials, tourism, foreign exchange earnings and creates employment for human (Iwena, 2007; FAO,2024). Despite the huge economic importance inherent in the practice of agriculture and farming on arable lands, some agricultural practices pose some potent harm to the environment breaking the cycle of the natural existence of the forest ecosystem and compromising the primary purpose of the forest reserve. However, there have several researched in separated studies on forest degradation and its associated factors in Nigeria. Despite the cover area and reliability of all these researches, none has been able to narrow it down to agricultural activities and landuse assessment in Land secession of Omotosho Forest Reserve with the aim of determining with accurate figure the rate, extent of forest loss and drivers of forest secession, hence this study

The Study Area

The study area is Omotosho Forest Reserve in Ondo State, South-western Nigeria which is a typical rainforest reserve and one of the major protected land in the region and found in Okitipupa Local Government Area but extending to other neighbouring local government like Irele, and Odigbo. The forest reserve is an extension of the Omo-Shasha-Oluwa Forest which extends to several States such as Edo, Ogun and Ondo State. The Omotosho forest is an extensional part of the Oluwa Forest Reserve and the forest is named after Omotosho, a major settlement in that area. Generally, the forest covers a total land area of 829 km 2 (Ogunjemite, 2012). The Forested Reserve is being separated from the Omo Forest by Afore Reserve along Lagos-Benin express way. Omotosho Forest Reserve is located between latitudes 60 26’ 0’’N to 60 42' 30’’N and longitudes 40 37’0”E to 40 48’ 0" E (Ogunjemite, 2012) sharing boundary with Ogun State in the extreme southwest and Edo State in the extreme Southeast. The forest reserve cut across several villages and towns such as Omotosho, Akinfosile, Ore, Aye, Igbotako, Okitipua, Erinje, and the fringe of Irele. The forest is replete with various species of hardwood for timber production. The infrastructural facilities of the study area include the Omotosho Power plant, the Ondo State Ethanol factory and the Omo wood processing plant. The region is drained by Oluwa river, Ominla, Ominju, Labata , Lupopo, Akinhun, and Ugwi river Ogunjemite (2012).

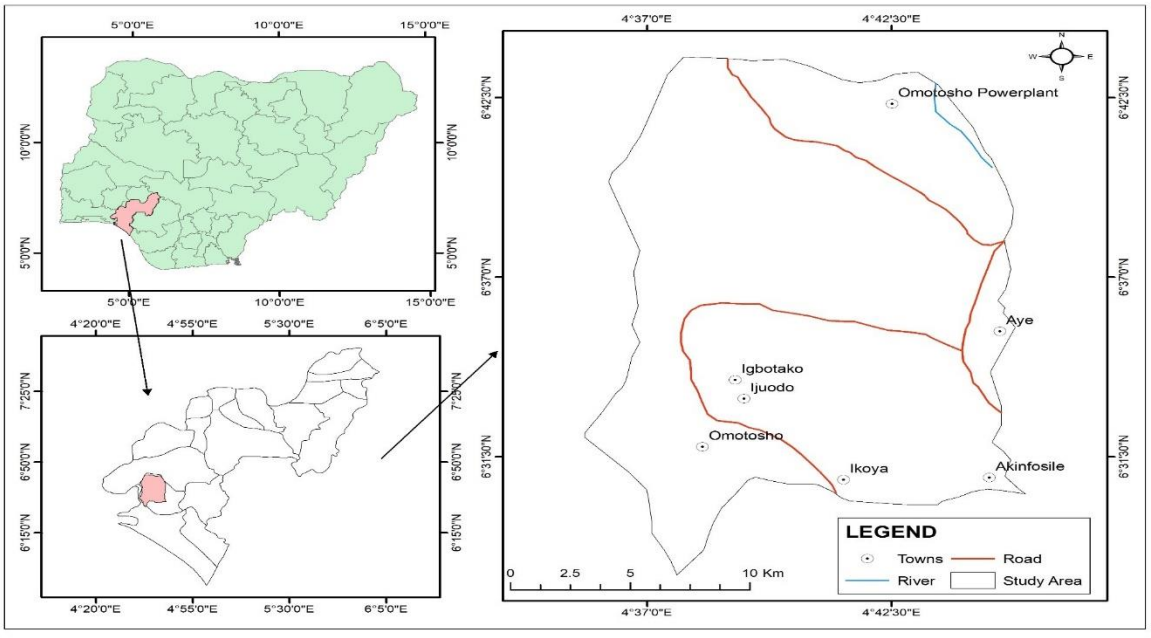

Figure 1: *Map showing the Study Area*

Conceptual Framework and Literature Review

This section gives a synoptic review of similar studies carried out. It also examines the use of various theoretical and conceptual frame-works that have been described by various researches in bringing about a comprehensive explanation on land use, land use change, agricultural activities, forest loss and forest secession.

Review of Related Literature

Adeoye, et al., (2012) carried out a study on the geospatial analysis of deforestation and land-use dynamics in a region of southwestern Nigeria. He created an assessment platform to explore and analyse the activities of man in the southwestern region such that was capable of causing environmental degradation and forest loss in the tropical rain forest reserve. The study adopted remote sensing techniques in analysing the acquired data. However, the study made use of Landsat images because it was purely based on vegetation monitoring and analysis. The study observed that the human activities which borders primarily on forest conversion, lumbering, poaching, illegal wood fetching for firewood, illegal burning of the forest and seasonal change in climate were responsible for the degradation of the forest environment in the study area and as such recommended a periodic monitoring and conservation strategy using overhead monitoring. In the same manner, Orimoogunje 2009 conducted a study on the impact of land use dynamic on Oluwa forest reserve in Ondo State, South-Western Nigeria. The study adopted the use of remote sensing and geographic information system techniques in the analysis and interpretation of the date-set acquired for the study. The study however observed the land-use dynamics of the Oluwa forest reserve a certain period of time and this was done by the use of Landsat images which was downloaded from the United state geological survey website (USGS) in the earth explore window and the digital Image processing (DIP) techniques which principally included classification was used to calculate the area loss in the study area. Similarly, the study embraced the use of questionnaire to elite information from the respondent on their perception on the use of the forest reserve and the drivers of the forest loss. However, the study concluded that degradation and changes in the forest primarily caused by political thugs who lumber woods in the forest for self-benefit. Furthermore, Ogunjemite (2012) also conducted a study on the analysis of the chimpanzee of the Omotosho Forest reserve. In his research, concluded and established the fact that the fauna of the forest which has been native and originally known to be abundant in the Forest reserve in the 19th century has gone loss to hunting and illegal invasion by man and as such they have gone to extinction. However, his study based on the application of remote sensing and geographic information systems to forest monitoring and inventory.

Similarly, prominent studies such as Salami (2006), Marguba (2002), Adetula (2008), Lawal (2014), Martha (2016), Igbokwe (2016) and Eludoyin and Iyanda (2018) in separated studies have conducted research on the evaluation of landuse dynamics within Nigeria forest and nature reserve they have also established the rate of forest degradation and adduced the cause of forest loss to human activities which border on the means of livelihood sustenance. Over the last three centuries, human uses have come to dominate the earth's land surface, progressively eroding the area that is in natural state. Land is a resource endowed by nature to be used by man as source for the obtaining food, mineral resource, raw materials for further production and source of support for human daily activities and they opinionated the fact that land is used for different purposes and the use to which the a particular piece of land is put to in a geographical region is used classified the region and the land use itself given its unique characteristics.

Conceptual Framework

Several theories abound on the spatial distribution of forest reserve, agricultural land-use, land-use changes, forest biodiversity distribution, forest composition extinction, and resource conservation hence these theories have their application in this study. In the operation and Conservation forest reserve, the sustainability of the forest resource is essential and as such should bored in mind. This however explains the concept of sustainability theory in forest reserve management and it is well known for its application tropical forest studies as the theory premised on the proposition that the forest reserve should be used manner that will satisfy present needs and still not compromise the future availability. In the same way, Chaos theory of Forest biodiversity distribution has its application in the study as it relates to biodiversity extinction to a physical system and holds the assumption that if there is a shift or irregularities in equilibrium of a system that could result in chaos sensitive to the initial condition of the system and having underlying patterns, interconnectedness, constant feed-back loops,

repetition, self-similarity, fractals, and self-organization. However, small alteration in initial conditions of an ecosystem, such as those due to influence of human activities, can yield widely diverging outcomes for such dynamic systems, rendering long-term prediction of their behavior impossible. Other applicable theories included the law of diminishing agricultural productivity by David Richado and the Unified Neutral Theory of Species Diversity (UNTB) by P.Hubbell.

Research Design and Methods

The Research design adopted for this study included both the quantitative and qualitative design. The qualitative design involves the collection of data using the key informant interview and analysing same with content analysis model.

Data Acquisition and Sources

Data used for this research were sourced from both primary and secondary sources. The Global Navigation System receiver was used to obtain the (X, Y) ground coordinate points of certain features such as intersection of roads, waterbodies, settlements and farmland in order to aid easy identification on the satellite imageries. These points were used to guide the training site in supervised classification. The study also involved fieldwork and physical observation of the settlements and other land uses around the forest reserve in the form of reconnaissance survey. The key informant interview method was used to elicit information from the respondent who are settler in the settlements around the forest reserve which included Omotosho, Aye, Iju-odo, Igbotako, Akinfosile, and Ikoya. A group of six respondents each were interviewed across these six settlements and their responses were harmonized to a single most pressing factor. The settlements and respondent's selection were due to their size, population and impact on the forest. Similarly, a staff of the forest reserve was also interviewed in line with the principle of purposive sampling. Both males and females of above age 30 with above 10 years length of residence were selected for the interview on the various land uses in and around the forest, land cover status of the forest, agricultural practices, land-use/cover change, forest loss and the driver of land secession in the forest.

The satellite images constituted the secondary data for this research and they were sourced from the Global land Cover Facility (GLCF) and United State Geological survey USGS website : https://gisgeography.com/usgs-glovis-download-free.

These images majorly include: Landsat 2000, Landsat 2010, Sentinel 1 image of 2015, Sentinel 1 data of 2020. The google earth image was also used and this served as baseline information for the selected images. The combination of this images was to ensure a clear imagery with high resolution and Sentinel images does not cover the early period of the research that is (2000-2010) but only covers 2015 years and above being first launched in 2014. However, reasons for the selection of Sentinel and Landsat imageries for this research include;

i. Availability of high-quality images with little or no cloud cover;
ii. Coverage of the study area within the period under study;
iii. Suitability in conducting land use and land cover studies due to its resolution (10-12 meters and 30 meters);
iv. Economy due to free and open access.

Table 1 shows shows the nature and sources of Data that w ere used for this study.

Table 1. *Nature of the datasets that were used for the study*

S/N	Data type	Data Year	Swath (Km)	Path/row/Tiles	Spatial Resolution (m)	Date of Capture	Source
1	Landsat imagery	2000	185	190/55	30	13//12/2000	USGS
2	Landsat imagery	2010	185	190/55	30	11/12/2010	GLOVIS
3	Sentinel-1Imagery	2015	185	190/55	10	08/12/2015	GLOVIS
4	Sentinel-2 Imagery	2020	185	190/55	10	09/02/2020	USGS

Source: Field Survey, 2025

Method of Data Processing

In order to make the collected data relevant and arriving at a valid result, there was need for adequate digital image processing on the acquired data sets (satellite images). And this was carried out phases in ARCGIS 10.4 environment. The first phase involved registration

of the acquired satellite imageries and this is called Georeferencing.

Geo referencing

This was carried out in ArcMap 10.4 environment after the image registration to give the true position of the features on ground. The process of georeferencing in this study started with the identification of features on the image data which can clearly be recognized on the google earth image whose geographic location was clearly defined. Known rivers, settlement and the intersection of highways were used as ground control points. The Images were geo-referenced to Universal Transverse Mercator Projection of WGS84 coordinate system, zone 31N Minna Datum with Clarke 1880 Spheroid. Moreso, necessary error correction was done on the image data to ensure the validity of the results.

Digitizing

On-screen digitizing of selected land use features such as the Omotosho power plant was performed after geo-referencing in order to change the spatial features from raster data format to vector in form of points, line and polygon or area for the purpose of delineate their boundary in terms of area cover.

Image Resampling

The digital image analysis properly started by re-sampling of multi-dated land-sat and Sentinel images with 10m spatial resolutions (Landsat 2000 and 2010 and Sentinel images of 2015 and 2020). This was carried out in ArcGIS 10.4 environment using the re-sampling tool.

The varying spatial resolution were converted to automatically adjust and equalize the varying dataset in order to harmonize the differences in their spatial resolution and correspond it with accurate data operations of 10m.

Image Sub-Mapping

Sub-map creation was performed on the multi-dated satellite images that were used in this research. However, when the sub-map of the study area was rightly created, the real size of the study area and the constituent land cover categories were correctly calculated. The process of sub-mapping started by defining the boundary of the study area.

The implication of this if not properly done or out-rightly left undone is that it will incorporate areas outside the study area into the study area thereby invalidating the accuracy of the land cover.

Mapping out the sub-scene from the images was done using the “WINDOW” ARCGIS, to extract the study area because the entire datasets were not being utilized. The corners of the image were extracted using values that correspond to the extent of the study area from the top to the bottom. This process gives result in the form of an irregular shape

Image Enhancement

Image enhancement through the composite was performed on the three selected bands from the satellite images in order to aid visual interpretation by enhancing the images to natural color composite. Image enhancement was based on the ability to relate colors and patterns in the image to real world feature to aid accurate visualization.

The enhancement was necessary because the features contained in the images may not be easily identified from the separate band as such they were merge into composite image.

However, the images were enhanced to both false and naturally colour using the following combination of bands: for Landsat 2000 which was landsat 7 ETM+, band 4,3,2 were combined to form the false color image, and 3,2,1 for natural color image, Landsat 8, OLI 2010, band 5,4,3 were combined to form its false color image, and band 4,3,2 to form the true colour composite, for sentinel 2015 and 2020, band 8,4,3 and 4,3,2 were combined to produce the false colour and true colour images respectively from the false colour composite image, water body appeared dark blue or black, dense forest appeared dark red, shrubs appeared light red tending toward pink, settlement appeared light blue or cyan, open space appeared dark brown and farmland appeared pink but easily differentiated with its definite shape.

Conversely, the enhanced satellite imageries are shown in the Figure 2 for easy comparison and detection of changes that have occurred in the Forest Reserve for the period of years under investigation.

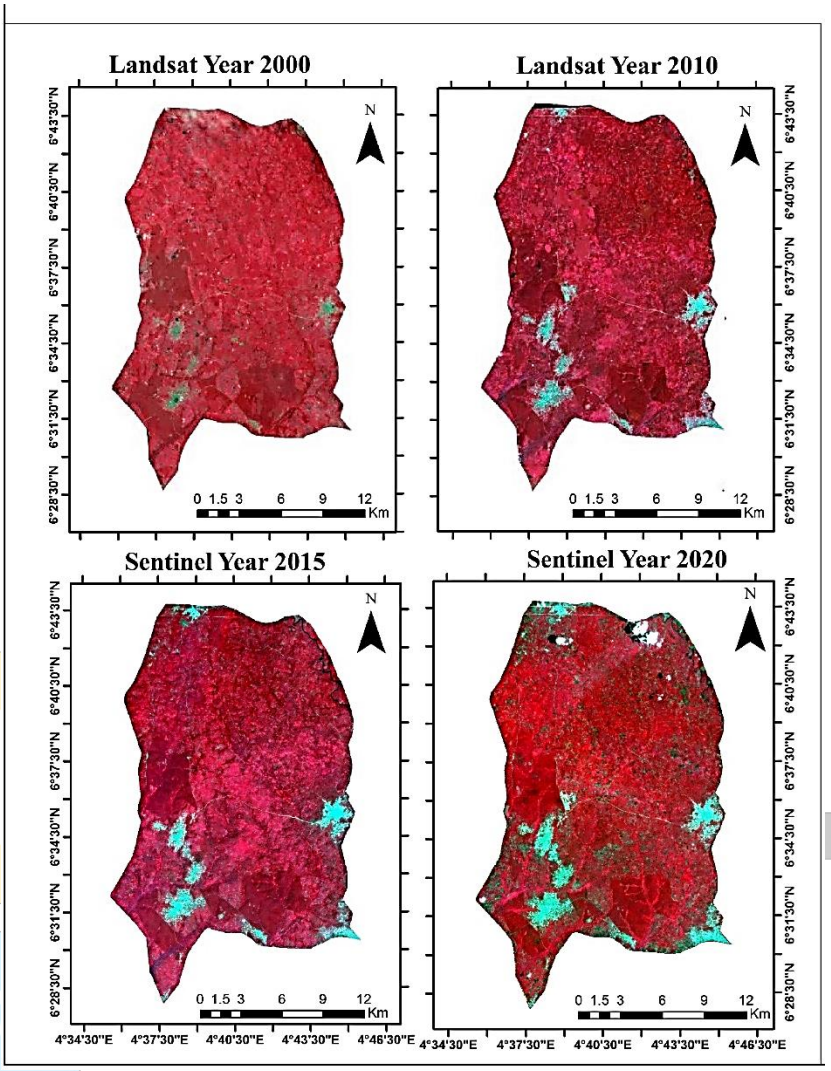

Figure 2: *Enhanced Multi-date satellite imageries* | ***Source:*** *Author's Fieldwork, 2025*

Generation of Training Sites (Signature Development)

Prior to image classification, the sample set was generated as these represent the various land use/cover classes in the study (dense forest, shrubs, farmlands, open spaces, settlements, and water body), using ARC GIS 10.4 version this is thus termed signature development the spectral characteristics of those known areas were used to train the classification algorithm for eventual land use or land cover mapping of the images.

Image Classification

Supervised classification carried on the acquired multi-date satellite images study was based on the knowledge of the area and modelled after the existing study of Ayeni (2010). However, this gives a broad classification where each of the land use/cover was identified by a class in which these classes were well defined on the four images (Landsat 2000, Landsat 2010, sentinel 2015 and Sentinel 2020). Land uses with similar spectral signatures were classified as one feature, based on the different characteristics they manifested. The combined characteristics of the visual image interpretation of tones, colour, patterns, shapes, size, and texture were used to identify the homogenous group of pixels which represent various land use of interest. The real-world phenomenal which have been identified during ground-truthing includes settlement, farmland, open space, dense forest, shrubs and water-bodies. The algorithm of the GIS software was trained to use the spectral characteristics of known areas to identify and classify the rest. Hence, they were represented by pale green, dark brown, dark green, light green, blue colour. Table 2 and Figure 3 identified landuse/cover classes and the general landuse/cover classification of the study area.

Table 2. *Adopted Supervised Classification Format*

Land Cover Categories	Description of Land Cover	Description of colour
Shrubs	Light vegetation	Light green
Open spaces	Bare soil, rocks, hills and exposed soil	Dark brown
Dense Forest	Thick forest, deciduous forest.	Dark green
Farmland	Cultivated land and exposed land.	Pale green
Waterbodies	River, stream, Dam and lake	Blue
Settlement	Houses, factories	Red

Source: Author's Fieldwork (2025)

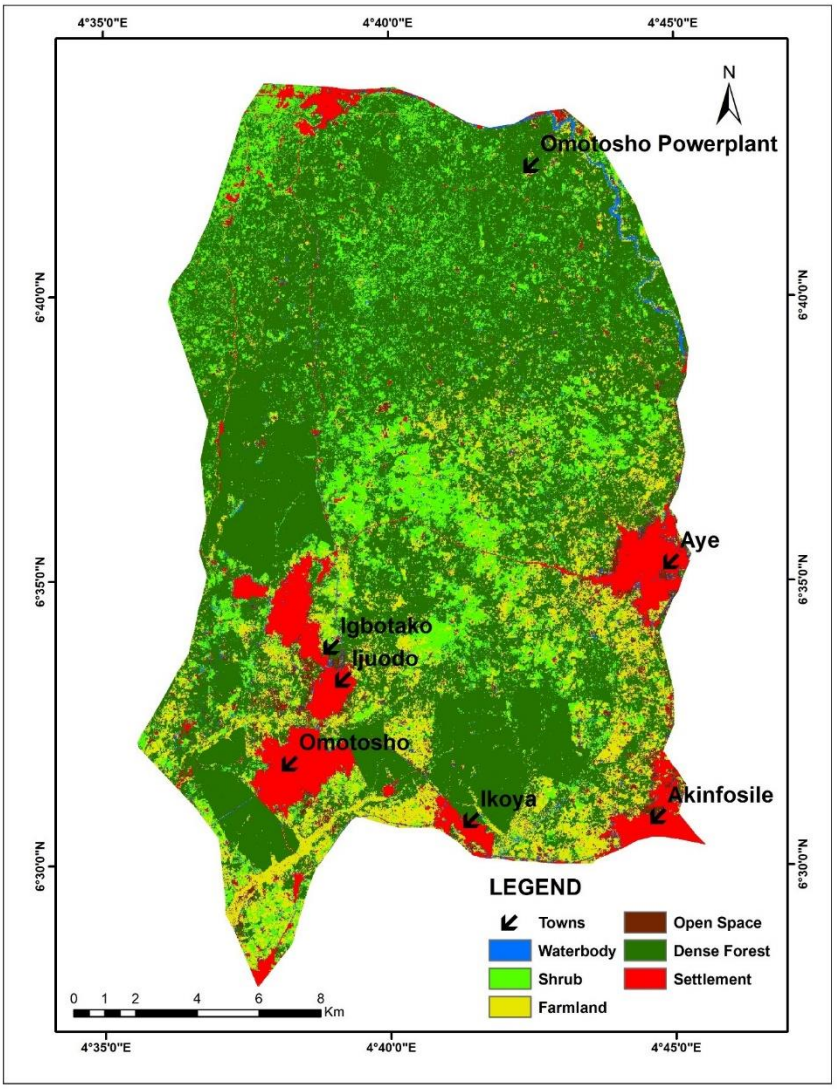

Figure 3: *General landuse/cover classification of the Study Area |* ***Source:*** *Author's fieldwork, 2025*

Method of Data Analysis

The non-spatial data (responses gathered from the respondents) were analysed using content analysis approach in which the responses of the interviewees were expressed in simple sentences and inference were drawn from them. However, area analysis which involved the calculation of the area in hectares and percentage was used to analyse the change in the area cover by the various landuse/cover categories across the years. This was done using cross tabulation analysis and the equations:

Percentage change $= \frac{Area\ in\ Hectares\ for\ each\ land\ use\ category}{Total\ Area} \times 100\%$ ---------(1)

Change per interval of year $= = \frac{Land\ cover\ Area\ in\ Year\ A - Land\ cover\ Area\ in\ Year\ B}{Total\ interval\ of\ Year}$ -----(2)

%Change per interval of Year for each LULC $= \frac{Change\ per\ interval\ of\ Year}{Total\ Change\ per\ interval\ of\ Year} \times 100\%$ ----(3)

Annual change $= \frac{Change\ \ per\ interval\ of\ Year}{Intervl\ of\ Year}$ ----------(4)

Percentage Change per Year $= \frac{Change\ per\ Year}{Total\ change\ per\ Year} \times 100\%$ ---------(5)

Change per interval of Year $= [Changes\ in\ Land\ cover\ category\ in\ Year\ A -$

$Changes\ in\ Land\ cover\ category\ in\ Year\ B]$ ---------(6)

Area in in Square Kilometers $= \frac{Area\ in\ Hectares}{100}$ -------- (7)

Total Area Cover$= = \sum[df + sb + fl + wb + os + st]$ $\boldsymbol{where\ df = area\ covered\ by\ dende\ forest, sb = area\ covered\ by\ shrubs, fl = area\ covered\ by\ farmland, wb = area\ covered\ by\ water\ body, os = area\ covered\ by\ open\ space\ and\ st = area\ covered\ by\ settlement.}$ **----------(8)**

RESULTS AND DISCUSSION

The result is a table and chart showing the extent of land secession in the study area from 2000 to 2020.

Table 3: *General extent of land Secession from 2000 to 2020 in Hectares and Percentage.*

Land use/cover classes	2000	% change in 2000	2010	% change in 2010	% change 2000-2010	2015	% change in 2015	%change 2010-2015	2020	% change in 2020	% change 2015-2020
	Ha	%	Ha	%		Ha	%		Ha	%	
Dense forest	29726.78	53.2	27810.56	49.7	-14.03	24065.3	43.1	-27.4	16071.43	28.7	-58.5
Shrubs	10107.71	18.1	11136.65	19.9	+24.3	12668.14	22.7	+36.1	14348.34	25.7	+39.6
Farmland	9246.82	16.5	9827.80	17.5	+13.8	10886.2	19.5	+25.1	13462.16	24.1	+61.1
Water body	1064.22	1.9	968.78	1.7	-26.1	812.15	1.5	-42.9	698.96	1.3	-31.0
Open space	983.60	1.8	1071.60	2.1	+4.3	1403.24	2.5	+16.3	3014.21	5.4	+79.3
Settlement	4717.51	8.5	5031.25	9.1	+8.9	6011.61	10.7	+27.7	8251.54	14.8	+63.4

Author's Fieldwork, (2025)

In 2000, the highest proportion of the land use/cover in the study area was dense forest, 29,726.78 hectares constituting 53.2% , followed in that other by shrubs area 10,107.71 hectares (18.1%), farmland 9,246.82 hectares (16.5%), settlement, 4717.51 hectares (8.5%), Open space 983.60 hectares (1.8%) and water body 1,064.22 hectares (1.9%).

Similarly, in 2010 the third predominant land use/cover in the study area was farmland covering 9,827.80 hectares (17.5%) indicating the heavy rate of secession and encroachment by human activities in the forest through the practice of agriculture and farming activities. This was followed by shrubs with 11,136.65 hectares (19.9%), Settlement 5,031.25 hectares (9.1%), Open spaces 1071.60 hectares (2.1%), water body 968.78 hectares representing (1.7%) and dense forest 27,810.56 hectares (49.7%) representing the largest land use/cover class of the total forest area in the year.

In 2015 however, water body recorded the smallest cover area with 812.15 hectares representing 1.5% of the total land cover area in the year. This in that order was followed by open space which recorded 1,403.24 hectares (2.5%), settlement occupied 6,011.61 hectares (10.7%), farmland with 10,886.2 hectares which was 19.5%, shrubs occupied a total of 12,668.14 hectares representing (22.7%) of the total land cover in the year.

However, dense forest though getting degraded still dominated the study area in the year by occupying a total of 24,065.3 hectares bearing (43.1%) which was less than the previous year. This further confirmed the extent degradation and encroachment by anthropogenic factors through agricultural and other farming activities that were practiced progressively in the forest reserve.

Finally, in 2020 it was discovered that the forest reserve has been seceded to agricultural practices with farmland occupying 13,462.16 hectares representing (24.1%) of the total forest area. This was followed in that sequence by shrubs covering a total land area of 14348.34 hectares representing 25.7% and being the second largest land use/cover classes in the study area for the year. Similarly, settlement occupied the fourth largest cover area with 8,251.54 hectares representing (14.8%). This was consequent upon the establishment of Omotosho Power plant (Phase 1 and 2) ethanol factory, Cassava plant, Omo wood processing factory and other sawmills around the forest. Open space 3,014.21 hectares (5.4%), water body 698.96 hectares representing (1.3%) and dense forest covered 16,071.43 hectares (28.7%) being the largest land use/cover class for the year 2020 under this study. Given the above it can be established that the various land use/cover classes assumed both an increasing and degreasing pattern and portion of the forest land is been loss to those inherent prevalent activities in the study area with dense forest reducing in size over the period of investigation and other land uses/cover such as shrubs, farmland and settlement increasing area from 2000 to 2020.Water body also reduced in cover area all through the period of study. This however showed that the Omotosho forest reserve was witnessing a continuous exploitative utilization without making any provision for the forest regeneration and sustainability.

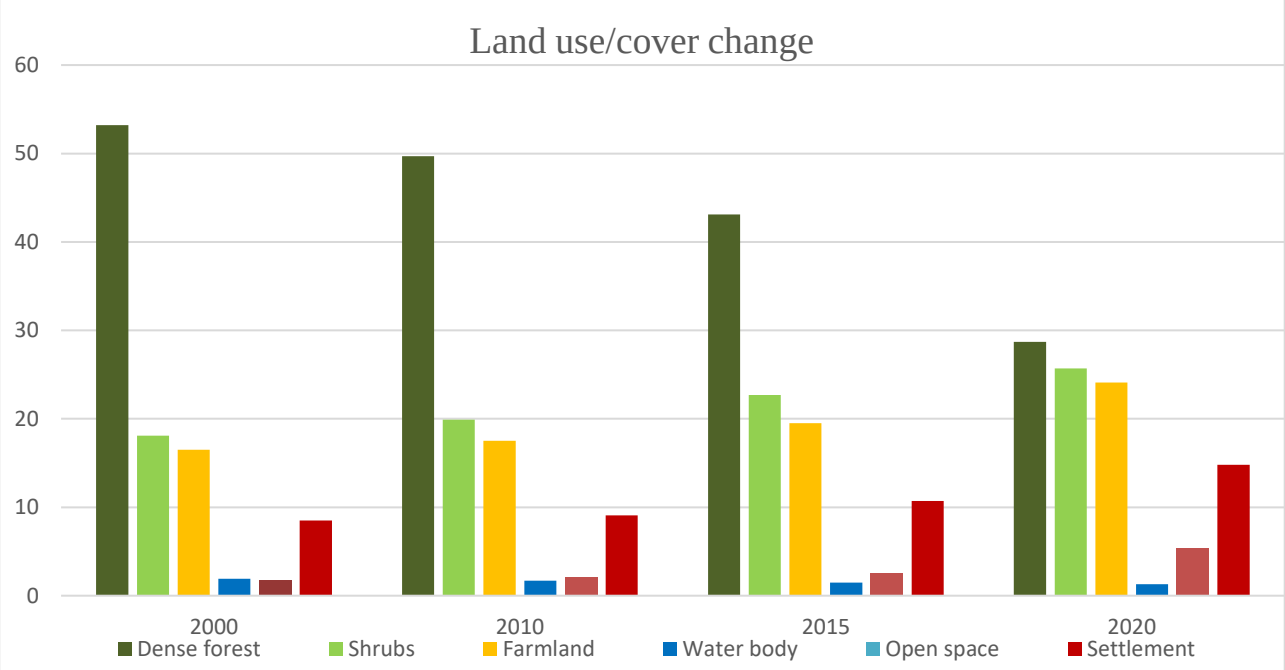

Figure 4: *Pattern of Land use/cover change from 2000 to 2020 |* ***Source:*** *Authors work, (2025)*

CONCLUSION AND RECOMMENDATION

The findings from this study have established that the Omotosho forest reserve still undergoing serious disturbances consequent upon the prevalent human activities which form the various land-uses in the study area. The study therefore ascertained that the loss in the forest and the secession in the forest land were driven by continuous agricultural practices, lumbering, industrial concentration, settlement expansion, and the encroachment of the forest by hunters killing animals through bush burning with agricultural activities accounting for the highest loss in the forest. Unless concerted efforts are geared and the interest of the communities' settlers are adequately captured, exploitative use of the forest will persist for a long term and the primary purpose of the forest reserve will be further compromised.

The study therefore recommends that the practices of agriculture within and around the forest reserved should

be strictly controlled to arable farming, tree farming and in which case allow for agro-forestry to enhance sustainability of the forest species and other biodiversity and still retain the tourism attraction function of the forest. The community settlers should be incorporated in the protection security and maintenance of the forest. Moreover, this study has established flora loss in the forest and land secession is driven by human activities therefore the government should employ effective forest monitoring techniques and inventory using remote sensing and satellite sensors.

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