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SPATIAL VARIATION OF VEGETATION COVER IN ILARO FOREST RESERVE, IPAKE OGUN STATE

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ABSTRACT

The study assessed the vegetation of Ilaro Forest Reserve through remote sensing approach for years, 2015, 2019 and 2022. Satellite images of the corresponding years were downloaded and analyzed to compute the Normalized Difference Vegetative Index (NDVI) and to produce an NDVI map. The result showed that in 2015, there were four land covers which are; Builtup Areas, Shrubs and Grasslands, Sparse vegetation and Dense Vegetation while in 2019 and 2023, five land covers were observed which include Builtup Areas, Shrubs and Grasslands, Sparse vegetation, Dense vegetation and Barren Land. Furthermore, each of the land covers varied from 2015 through 2022. There was increase in barren land (0.01%), dense vegetation (0.72%) and sparse vegetation (5.35%) while builtup areas and shrubs and grasslands decreased by 0.08% and 5.99% respectively between 2015 and 2019. However, from 2019 to 2022, shrubs and grasslands decreased further by 3.66% while barren land, built-up areas, dense vegetation, and sparse vegetation increased by 0.02%, 0.06%, 0.03% and 3.53% respectively. The overall coverage of the land showed that from 2015 to 2022, there was a general increase in barren land (0.03%), dense vegetation (0.75%) and sparse vegetation (9.12%) while a decline in built-up areas (0.02%) and shrubs and grasslands were observed. The study showed that there was vegetation gain in the forest reserve due to reforestation project sponsored by the State government in 2017. The project impacted positively on the forest reserve and more of these projects should be encouraged by government.

KEYWORDS: Vegetation, NDVI, Variation, Forest Reserve

INTRODUCTION

Over history, forests add value to the world's human population and their value is by each day increasing as people still use forest to protect themselves to shelter and for fuel wood. According to Misir (1997), beside raw material for wood processing industry that forest provides, forest provide habitat for wildlife, reserves for water and soil conservation, oxygen and food chain. However, our forest is facing so many problems. Most of the world's vegetation is in a constant state of flux at a variety of spatial and temporal scale, deforestation of our tropical forest is a result of many pressures (Lambin,1996). As people tried to meet their daily needs, they are subjecting forest, woodland and grassland to the highest rate of change (Pomery, 2004).

Also as noted by Tudunwada (2012), our forest today is faced with all sorts of anthropogenic activities, such as, illegal felling of trees for firewood and roofing, illegal cultivation and conversion of parts of the forest for residential by nomads.

Ottu, Joseph and Eja, (2011) reported that FAO's Global Forest Resource Assessment estimated that the global forest area currently covers about 4.033 billion hectares and it also report that between 2000 and 2010, the world has lost about 130 million hectares of its forest. FAO, (2011c) reported that global forests area will continue to decline. However, about one half of the forest that covers the earth is gone. A positive sign is that, the estimated loss of forests area at global level decline from 16 million hectares per year between 2000 and 2010 that is each year 16 million hectares disappear. The World

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Resource Institute estimates that only about 22 percent of the world original forest cover remain intact-most of this, is in three large areas: The Canadian and Alaska boreal forest, the boreal forest of Russia, and the tropical forest of the Northwestern Amazon Basin and the Guyana shield.

Forests in Africa are extremely diverse. Deforestation and urban population growth have gradually increased together, with heaviest forest losses coming in the area where wood is needed for fuel, construction purposes or where forest land is needed for growing crops (Mortimore, 1970). The forest in Africa currently covers about 23 percent of the land; it was reported that 75 million hectares of forest land (10 percent of the total forest area) was converted into other land uses between 1990 and 2010 (Turner, et. al., 2017).

In the loss of biodiversity, Nigeria was identified as one of the countries with the highest rate of forest loss (3.3 percent) in the world. Since 1990, the country has lost 6.1 million hectares or 35.7 percent of its forest covers. It also recorded that Nigerian most biodiversity ecosystem is fast depleting at an unbelievable rate. For example, between 1990 and 2005, Nigeria lost an average of 409,700 hectares of forest every year equal to an average deforestation rate of 2.38 percent. As of 2005, Nigeria has the highest rate of deforestation in the world according to Food Agriculture Organization of the United Nations (FAO, 2010b). The significant effect of loss of forest/vegetation is the exposure of bare surfaces to disaster such as erosion, pollution and consequently climatic change with an adverse effect on both physical and human environment (Zubair, 2016). In a world with an increasing population and also increased pressure on our natural and man-made forest resources, there is a greater demand for up-to-date and accurate spatial information. Geographic Information System (GIS) and Remote Sensing (RS) are now providing new tools for advance ecosystem management. Lunette (1999) stated that; the use of RS and GIS techniques allows the extent of change in our vegetation to be easily analyzed.

METHODOLOGY

Study Area

The presented study was conducted in Ilaro Forest Reserve, a forest body which is situated nearby to the villages Ilugboro and Ipake, in Ogun State, a part of South-western Nigeria. It is located approximately between Latitude 6.78323° to the north and Longitude 3.0625° to the east. The area is part of the western plains and ranges of Nigeria with much of it lying approximately between 300 and 600 metres above the sea level (Iloeje, 1981).

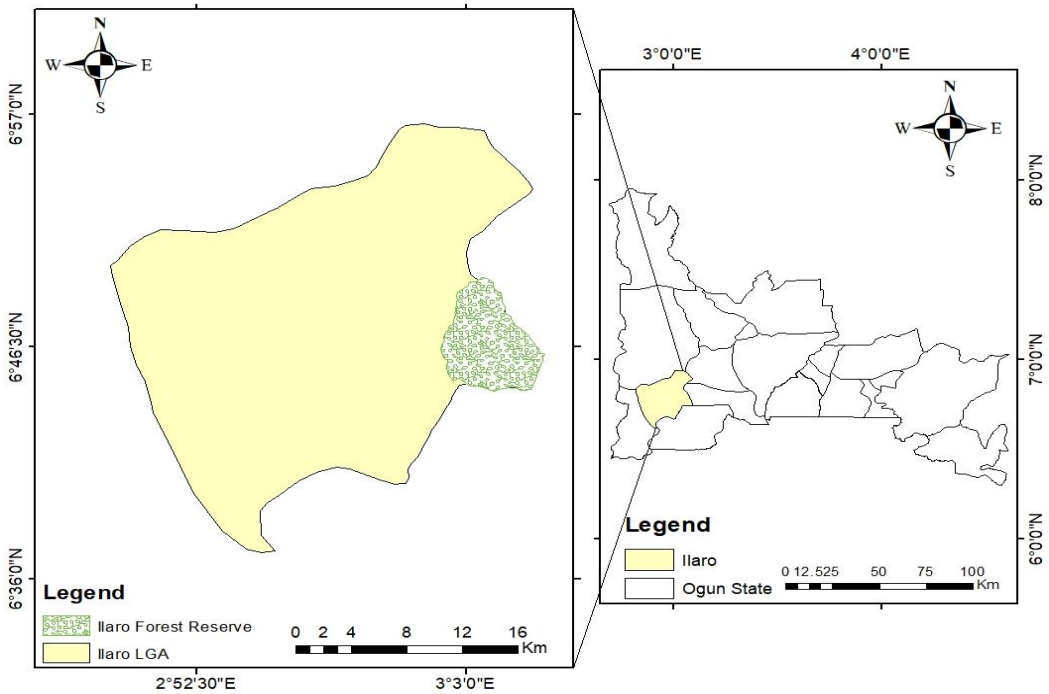

Figure 3.1: Map of Ilaro Forest Reserve

RELIEF AND GEOLOGY

Most rivers and streams draining this area rise from the southern part of the study area. Notable among the rivers are the Oni, Oluwa, Ominla and Owena. The climate of the study area can be described as humid tropical one (Fosberg, et al, 1961; Garnier 1961). Mean annual rainfall ranges from 1,200mm to 1,450mm and temperatures are high throughout the year with a mean of about 27^0C and an annual range of about 30^0C. The natural vegetation of the area is the tropical rainforest characterized by emergents with multiple canopies and lianas. Some of the most commonly found trees in the area include Melicia excelsa, Afzelia bipindensis, Antiaris africana, Brachystegia nigerica, Lophira alata, Lovoa trichiliodes, Terminalia ivorensis, T. superba, Triplochiton scleroxylon, etc. However, the natural vegetation of the area with the exception of the areas devoted to forest reserve has now been reduced to secondary regrowth, forest thickets and fallow regrowth at varying stages of development or replaced by perennial and annual crops (Osunade, 1991). These perennial crops include cocoa, kola and citrus.

Method of Data Collection

A total of 3 Land-sat 8 images of the study area were collected from the earth explorer website (www.earthexplorer.usgs.gov) for the year 2015, 2019 and 2023.

Data Analysis

Analysis was conducted on the satellite images to see the spatial variation of the vegetation across the years in the study area using ARCGIS 10.5. NDVI was computed for the period of the years studied which are 2015, 2019 and 2023 in order to see the variation of vegetation across those years. NDVI was computed for the study area using the formula

NDVI = (NIR-RED/NIR+RED) ----------eq 1

Spatial vegetation map of Ilaro Forest Reserve for the years analyzed were produced.

Result and Discussion

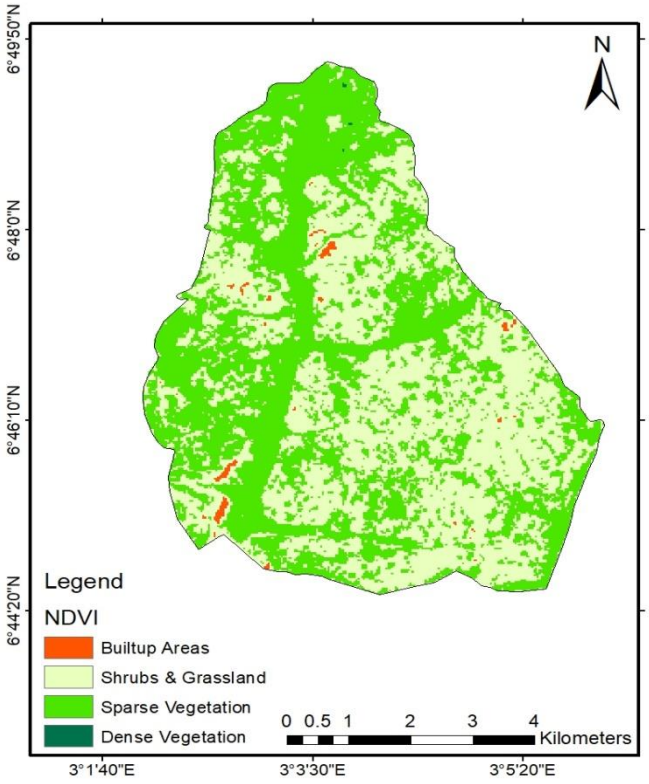

Figure 4.1: Forest Cover Map of Ilaro Forest Reserve in 2015

Figure 4.1 showed the spatial forest cover map of the study area with their respective land uses in 2015. These land uses are Built-up areas, Shrubs and Grasslands, Sparse Vegetation and Dense Vegetation and are represented with Red, Olivine Yellow, Lemon Green and Deep Green colours respectively. The map showed that two land uses dominated the study area which are sparse vegetation and shrubs and grasslands while the other two (that is, Built-up Areas and Dense vegetation) had lower cover coverage.

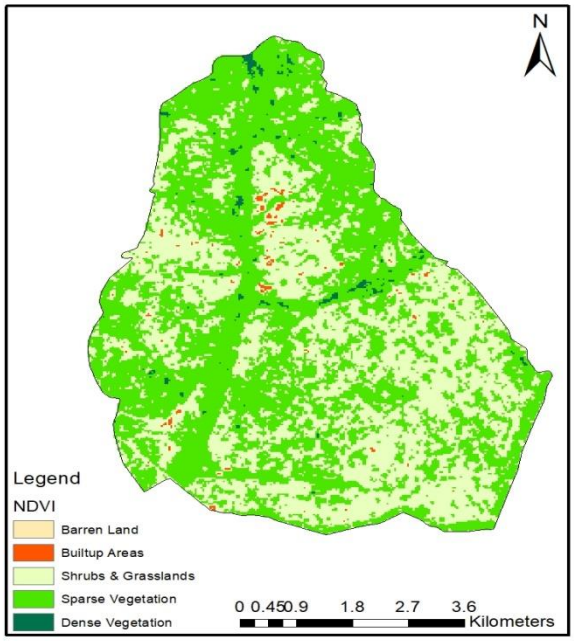

Figure 4.2 showed the vegetation cover map in 2019 where there were five classes of land use which indicated that the reserve had vegetation, built-up areas, barren land, shrubs and grasslands. Sparse vegetation and shrubs and grasslands covered much of the forest reserve while the widespread of dense vegetation was also observed whereas built-up areas reduced.

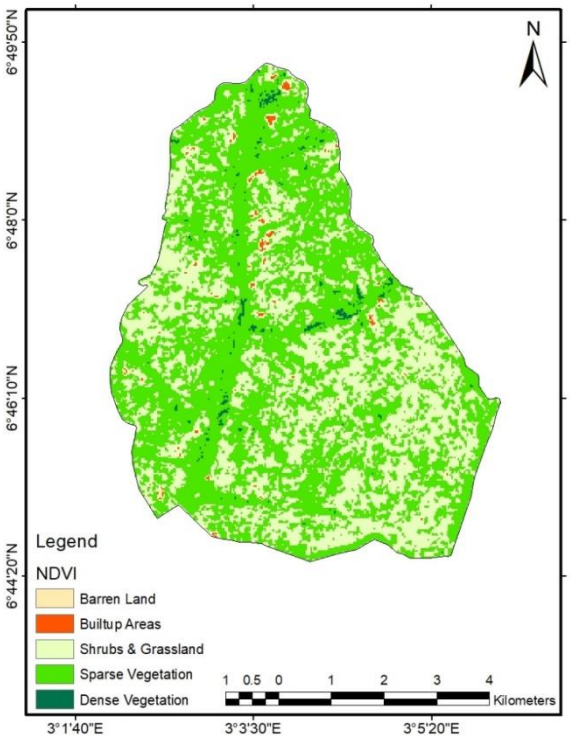

Figure 4.3: Forest Cover Map of Ilaro Forest Reserve in 2022

Figure 3 also showed that the forest reserve had 5 land use types just as it was in 2019. Sparse vegetation (represented with lemon green colour) increased more indicating vegetation gain in the forest reserve. Also, Dense vegetation (represented with deep green colour) also covered more portions on the map while shrubs and grasslands (represented with olivine yellow colour) coverage decreased.

Table 4.1: Table showing the percentage coverage of Land Use Class for 2015, 2019 and 2022

Forest Cover Classes	2015 (% Coverage)	2019 (% Coverage)	2022 (% Coverage)
Barren Land	0	0.01	0.03
Builtup Areas	0.47	0.39	0.45
Dense Vegetation	0.01	0.73	0.76
Shrubs & Grassland	49.98	43.99	40.33
Sparse Vegetation	49.54	54.89	58.42
Grand Total	100	100	100

Table 4.1 showed the percentage land use coverage over the period of eight years and it showed that between 2015 and 2019, barren land which was not present in 2015 emerged 4yrs after while the coverage of built-up areas decreased by 0.08%. Dense vegetation also increased significantly by gaining additional coverage of 0.72% as well as sparse vegetation which increased by 5.35% whereas shrubs and grasslands decreased significantly by 5.99%. Warner et al., (2016) confirmed that NDVI method of assessing and quantifying vegetal cover gives a higher validation accuracy. The implication of this result is that massive afforestation took place in the forest between 2015 and 2019. This was confirmed from the Forest Guards that participated in the reforestation process in 2017 which was an Ogun State Government initiative. Ibrahim and Muhammad (2015) noted that afforestation is very important in areas where trees have been felled and where forests are fast degenerating.

Between 2019 and 2022, barren land, built-up areas, dense vegetation and sparse vegetation increased by 0.02%, 0.06%, 0.03% and 3.53% respectively while only shrubs and grasslands reduced from 43.99% to 40.33%. This also showed a vegetation gain in the forest reserve. This implied that the effect of the reforestation practiced in 2017 is still felt 7yrs after. The reforestation that took place in the reserve also improved biodiversity, primary production as well as ecological resistance to climate change pressure which was confirmed by Hooper (2005).

CONCLUSION

The study assessed the spatial variation of vegetation cover of Ilaro Forest Reserve for three different years which are 2015, 2019 and 2022. It adopted the remote sensing and GIS approach to analyze satellite data for the three years considered. The Normalized Difference Vegetative Index (NDVI) were computed and used to estimate vegetation coverage. It showed that there were different land covers in the forest and each of them varied significantly as the years go by. The study further showed that there was significant increase in vegetation from 2015 to 2022. It also showed that the forest is improving and that illegal activities within the forest is reducing.

RECOMMENDATIONS

The study recommends that

1. More afforestation projects should be practiced to ensure more vegetal cover over the forest.
2. GIS and Remote Sensing approach should be deployed in assessing the state of forest reserves in Nigeria and using the feedback to make decisions that will enhance the performance of the reserve.

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