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Depletion of Forested Area: Geidam Perspective

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ABSTRACT: *Land cover maps provide best understanding of current landscape change over time. One can evaluate past land cover maps for several different years for management decisions as well as gain insight into the possible effects on decisions making. One of the key monitoring areas is how the environment keeps degrading resulting from increased anthropogenic activities such as the removal of the forest covers. This study monitors the pattern changes of the Geidam Yobe state Nigeria, using Landsat images of two different periods from Enhanced Thematic Mapper (ETM+) image of data of 1988 and 2018. The images were geometrically and atmospherically pre-processed then classified, using maximum likelihood (MLC) algorithm to produce land cover maps of the Geidam. The accuracy of the classification was assessed with confusion matrices giving results morethan the minimum 85% required. The results revealed that the built-up and tree area increase by (+30.97%), water body reduced by (-5.06%) and forest reduce by (-23.48%) within the study period. This shows a rapid decrease in the forest, which is partly attributed to deforestation activities and partly to climate change impact.*

KEYWORDS: change detection, remote sensing, classification, Landsat data

INTRODUCTION

Land cover change detection provides baseline information for assessing change impacts on habitats and biodiversity, as well as natural resources, in the target areas. It is key component of interdisciplinary aspect of science, which determines the consequences of land change. Land cover generally refers to the categorization or classification of human activities and natural elements within a specific time frame. It provides better understanding of impacts of natural phenomena and assesses growth, quality issues, predict and assess impacts of natural disaster in connections to socioeconomic environment. Forests play important role in ecosystem services by keeping the Earth's atmosphere functioning smoothly and regulating the climate through the process of photosynthesis. The forest keeps human safe by keeping out carbon dioxide (CO_2) and release of more oxygen into the atmosphere. The economic, ecological and social values of forest land is vital to human survival, however, rapid urbanization, construction, agriculture and tourist activity interferes with the status and use of land. This gradually depletes the forest drastically and has become global environmental issues therefore; the detection of forest changes in association with climate change can be very beneficial. The impact in forest may result in longer growing seasons for plants, insects and diseases, forest

fires, precipitation changes and loss of wetlands. Several international concerns have been targeting at decreasing emissions via human activities on forest (Blum, 2016). The changes in forest have impacts on carbon stocks through both natural and anthropogenic occurrences that could affect land-cover (Arneth *et al.*, 2017).

Classification algorithm provides representation of the situation in the field by grouping objects into sets and their relationships. The classes are used to distinguish land cover types and boundaries that quantify the precise cover in a giving area. Identifying, delineating and mapping land cover is important for global monitoring studies, resource management, and planning activities (Minal and Patil, 2017). It establishes the baseline from which monitoring activities can be performed. Sustainable management of the land, land cover and use are used for planning, monitoring, and evaluation of development, industrial activity, or reclamation. Detecting changes in land cover over long term may reveal a how effective measures are applied in response to a negative shift in countering the changes. This is required in local or regional level to quell such effects in monitoring land use change. Geidam is a Local Government Area in Yobe State, Nigeria. It is located at 12°53′49″N 11°55′49″E approximately in the Sahel savannah region. It has a total area of 4,357 km2 (1,682 sq mi) with a total population of 157,295 (2006 census). Figure 1.0 indicates Geidam local area in map of Nigeria.

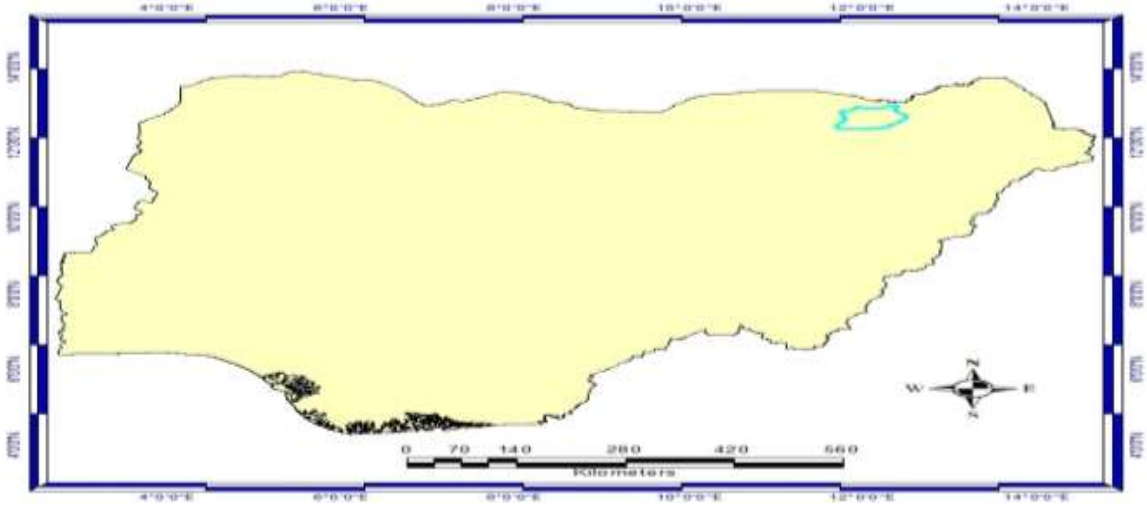

Figure 1.0 Geidam local government in Nigeria.

METHODOLOGY

Lansat satellite imageries for a span of 30 years from 1988 and 2018 were used to classify Land cover types into five classes viz: built up and trees, sand dunes, water body, forest and vegetation. Supervised classification approach was employed to classify the images using maximum likelihood classifier, known to be widely used as a classification algorithm (Richards and Jia, 1999; Otukei and Blaschke, 2010). Training samples were created from ArcGIS software using bands 123 for 1988, and bands 543 as equivalent for 2018. This follows the

methodology applied by Mallupattu et al. 2013. Land cover changes within the context of environmental problems determine from 20 to 30 years is comprehensive enough for understanding of changes in land cover that are critical to biogeochemical cycling functional ecosystem. This dynamics are essential for respond effectively to environmental changes and to manage human impacts on environmental systems. Measures Performance on condition for investigations of the complex relationships between the land cover by the two periods are presented by the land cover map Figure 1.1 and 1.2 representing the identified land cover in the area.

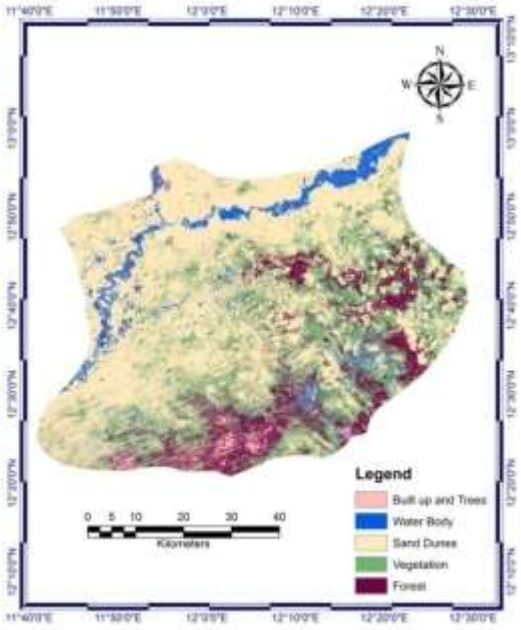

Figure 1.1

Figure 1.2

Figure 1.1: Land Cover map of Geidam Local Government Area Yobe State 1988

Figure 1.2: Land Cover map of Geidam Local Government Area Yobe State 2018

The accuracies of the classified map were done using Arc GIS software using confusion matrix and the result was presented in Table 1.1.

Table 1.1: Images classified with their overall accuracies and Kappa indexes

Image	Overall accuracy (%)	Kappa index
Landsat TM of 1988	92.32	0.90
Landsat OLI of 2018	96.74	0.95

The classified images for 1988 showed an overall accuracy of 92.32% with Kappa index of 0.90 while 2018 showed 96.74 and a Kappa index of 0.95. It can be seen that all the classified images have satisfied the acceptable classification accuracy of not less than 85%.

RESULT AND DISCUSSION

Land Cover Change Analysis

To analyze the land cover change, straightforward technique for detecting change is the comparison of land cover classifications from two dates. Table 1.2, and 1.3 presents the land cover classes derived from the classified images of the study area from 1998 to 2018changes from the satellite imageries respectively. Table 1.4 shows the differences in Land cover accrued over the period of 30 years. The variation produce so far shows that there is land cover change by the various identified classes. From the classified map covering an area of 429586.7206 hectares, the classified image of 1988 shows Built-up and trees area took 13813.56761 hectares and 146882.0929 hectares in 2018, these shows an increment of 133068.525242073 hectares of the cover. This implies that built up area has increase by proximally 133069 hectares of land amounting to 30.97594% of the total land within the study area. Looking at Water Body, it recorded decrease from a total of 22890.30641 hectares of Land in 1988 to 1162.221354 hectares in 2018, amounting to -5.0579% of the total land. Forest which is the main consideration in this research also witness massive change, from a total of 53259.1433969173 hectares of land in 1988 to a total of 998.374167645255 hectares of land in 2018, amounting to -23.4755% of the total land decrease. For forest decreasing by -23.5 % of the total land over a period of 30 years is very alarming and can lead to total destruction of the forest zones if this rate continues without any appropriate measures.

Table 1.2: Land cover for 1988

Land cover classes	Area in Hectares	Areas of the cover (%)
Built up and Trees	13813.56761	3.215548
Water Body	22890.30641	5.328448
Sand Dunes	237617.6336	55.31308
Vegetation	102006.0696	23.74516
Forest	53259.1434	12.39776
Total	429586.7206	100

Table 1.3: Land cover for 2018

Land cover classes	Area in Hectares	Areas of the cover (%)
Built up and Trees	146882.0929	34.19149
Water Body	1162.221354	0.270544
Sand Dunes	139942.164	32.576
Vegetation	140441.7121	32.69228
Forest	1158.530333	0.269685
Total	429586.7206	100

Table 1.4: Land cover differnce between 1988 to 2018

Land cover classes	Area in Hectares	Percentage Increase (%)
Built up and Trees	133068.5	30.97594
Water Body	-21728.1	-5.0579
Sand Dunes	-97675.5	-22.7371
Vegetation	87182.57	8.94712
Forest	-100848	-12.12808

The land cover changes occurred successfully in various behaviors, however investigations, including assessing deforestation, urbanization, sand dune changes, and the conversion of forest areas into semi natural vegetation or agricultural grassland would be catastrophic. The change estimates are used to determine the predominant types of conversions occurring within the region, the estimated rates of change for these conversions, and whether the types and rates of change are constant or variable across time. This corresponds to analysis by Mallupattu, and Sreenivasula, 2013. They looked at the correlations between conversion types and selected environmental factors, such as terrain characteristics, proximity to urban development, economic conditions, etc., in order to improve our understanding of potential drivers of change. To Otukei, and Blaschke, 2010, the spatial boundaries should be developed by synthesizing information on climate, geology, physiographic, soils, vegetation, hydrology, and human factors, such that it reflect the patterns of land-cover change. This will tell regional stories of change, disturbance types and frequencies, environmental issues of concern, and management

practices for consequences that one may come across. Land Cover Trends framework will provide a means to localize estimates of the rates and driving forces of change, the significant role of the changes and the trajectories of land cover that may take place in the future. For this region in question, massive deforestation is as a result of cutting down of threes as bio-fuel for domestic cooking, most of the settlement relied on firewood for domestic cooking. Some can be attributed to conversion of forest areas into built-ups, road network and agricultural land.

SUMMARY AND CONCLUSION

The study has been conducted using multi-temporal Landsat satellite images of two different years; 1988 and 2018 to examine the land cover changes in study area. The results of the analysis revealed that a rapid decrease in the natural forest while built up and trees increase. The growth of a society totally depends on its social and economical development. Land cover maps play a significant and prime role in planning, management and monitoring programmes at local, regional and national levels. It provides a better understanding of land utilization aspects and on the other hand, it plays an important role in the formation of policies and programme required for development planning. For ensuring sustainable development, it is necessary to monitor the ongoing process on land cover pattern over a period of time. It requires the present and past land cover information of the area for the changes that are happening in our ecosystem and environment.

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