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Overexploitation of Forest Resources and Its Impact on Environment: A Case Study of ITU Local Government Area of Akwa Ibom States

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Abstract

Forest provides many products on which the population subsists. However, these resources are depleting due to a variety of factors including agricultural expansion and over exploitation of forest resources. This paper seeks to present overexploitation of forest resource and its impact on the environment. And outline the causes of continuing deforestation of forest cover in the studied region from the perspective of the rural community and discusses what role they could play in addressing the problem. The aim of this work is to assess the overexploitation of forest cover, assess magnitude of change between 1986, 2008 and 2015 and make suggestions for improved forest management practices that could help to reduce deforestation. Secondary data were collected from remotely sensed data of Landsat TM 1986, 2003 and NigerieSat-1 2013 of the study area. The image was processed using unsupervised classification algorithm technique in GIS. Results indicated that between the period of 1986 and 2013, the overall forest cover change for water body accounted for -18.19% and annual rate of -30.06%, while the dense area annual rate accounted for -54.2%, followed by sparsely area with 55.93% and bare/built up of 25.06% of the area. From the results, the most highly causes of deforestation are poverty driven agriculture, increase population and intensity of traditional land practices. Given the reasons above, much emphasis needs to go into agro forestry practices in effort to reduce deforestation which are currently less promoted. Therefore, ecological restoration should be conducted and should be sustainable and environmentally friendly.

Keywords:
Overexploitation, Forest resource, Integrated Landsat, Land cover, Change rate

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Background to the Study

Forest provides a variety of products and services (multi-functional). The raw materials for housing and wood products are extracted from the forest. In many parts of the world, forest provides shelter and sanctuary for wildlife and they play a key role in maintaining the watersheds that supply much of the drinking water and irrigation. They directly enhance timber, fuelwood, food, stocks of genetic resources, and other forest products. Moreover, as ecosystems, forests also provide a wide variety of services, including removal of air pollution, regulation of atmospheric quality, nutrient cycling, soil creation, recreational facilities and aesthetic and other amenities. Because of the multifunction's that forests perform, timber managed for any single purpose generates a large number of important external effects. Woodlands are capital assets that are intrinsically productive. However, all forests – even pure plantation forests – provide a wide variety of other, non-timber, benefits. Forestry policy in many countries is giving increasing weight to non-timber values in forest management choices.

The extinction of natural (or primary) forests is a major cause for concern. In its Global Forest Resources Assessment 2000, the Food and Agricultural Organization of the United Nations reports that natural forests continue to be lost or converted to other uses at high rates and between the 1990s/ 2000, 4.2% of the world's total natural forest area (16.1 million hectares) was lost, with most of this occurring in the tropics (15.2 million hectares). However, it does appear that the net loss of forest land was slower in the 1990s than in the 1980s. This seems to be due to the more rapid expansion of secondary natural forests in the later period, with forest returning to land in which agriculture has been discontinued. Whether the services currently being lost from disappearing primary forests are replaced by the services of maturing secondary natural forests is a moot, but highly important, point.

During the same time period, the world gained 1.8 percent of natural forests through reforestation (including plantations), a forestation (the conversion of un-forested land to forest), and the natural expansion of forests.

While timber shares many characteristics with other living resources, it also has some unique aspects. Timber shares with many other animate resources the characteristic that it is both an output and a capital good. Trees, when harvested, provide a saleable commodity, but left standing they are a capital good, providing for increased growth the following year. Each year, the forest manager must decide whether or not to harvest a particular stand of trees or to wait for the additional growth. In contrast to many other living resources, however, the time period between initial investment (planting) and recovery of that investment (harvesting) is especially long. Intervals of 25 years or more are common in forestry, but not in many other industries. Finally, forestry is subject to an unusually large variety of externalities, which are associated with either the standing timber or the act of harvesting timber. These externalities not only make it difficult to define the efficient allocation, but also they play havoc with incentives, making it harder for institutions to manage efficiently.

In Nigeria, the frequent forest exploitation for agricultural development, urbanization, uncontrolled harvesting, fuelwood collection, sand excavation, mining, mineral exploitation, and the inadequate awareness of the significant of forest by the populace and population growth in rural community are factors resulting in the continued shrinkage of Nigerian's forest estate (Boucher *et al.,* 2011).

Nigeria has lost more than 50% of its forest and less than 10% of the country is forested recently. Deforestation is estimated to be at a rate of 3.5% to 3.7% per annum (Akingbogun *et al.*, 2012). The forest cover has been in the state of flux in Akwa Ibom State, due to the high deforestation rate also. This is as a result of unsustainable farming practices which account for over 80% of the deforestation rates (Ndoho *et al.*, 2009). They argued that de-reservation as a result of farming, logging, fuelwood exploitation, bush burning, fuelwood gathering, environmental pollution and urban and industrial expansion among others are the proximate causes of deforestation.

Most of the forests of the state are located outside conservation/ protected areas thus, resulting in uncontrolled exploitation. The situation is not different at the SCFR, one of the reserves of Akwa Ibom State where indiscriminate land-use practices in the area have led to the destruction of a sizeable portion of the reserve (Amubode, 1992). The original area of the SCFR at the time it was gazetted was 310.80km2 but presently, it has reduced greatly (Akpan-Ebe, 2014).

Coastal regions are vital biodiversity spots that are extremely utilized globally (Jacob *et al.*, 2015). These areas are known to possess fragile ecosystems with valuable fauna and flora species utilized for food, medicine, fuel, construction and other uses (Onojeghuo and Blackburn, 2011). In addition to providing valuable fauna and flora species, coastal areas are usually locations of rich mineral deposits such as crude oil, making them prone to degradation rate of deforestation in the country

Statement of the Problem

Deforestation of the mangrove, which is a product of the interaction of the many environmental, economic, social and political forces in the region, is one of the environmental and economic problems of Akwa Ibom State. Consequent upon this deforestation is the rapid loss to biodiversity in the region. The growing awareness and concern about the rate of biodiversity loss in the tropics generally has resulted to several biodiversity conservation strategies, such as the designation of protected areas (Parks & reserves,) listing and protection of species among other legislations and regulations.

Nigeria is recorded to have the third largest mangrove forest in the world, and the largest in Africa, covering an area of approximately 105,000 hectares (Anon, 1995 and Ndukwu and Edwin-Nwosu, (2007) Some examples of such protected areas are the: Okwangwo Rainforest Reserve in Boki area of Cross River State; Oban Group Rainforest Reserve Cross River State; Stubbs Creek Rainforest Reserve of Akwa Ibom State, to mention but a few. However, most of these protected areas contain either agricultural land or sources of livelihood to the local people. Thus formal protection does not guarantee protection of biodiversity. More so, not all biodiversity rich or sensitive areas are under any form of protection as in the case of the mangrove forest of the Niger Delta. In fact, most conservation efforts have ignored traditional knowledge system and practices that reflect many generations of experience in the conservation of their natural resources, thereby exposing the protected areas to external influences (Poaching) as well as depriving the people access to their natural resources.

The resultant effect of this is the failure of the conservation strategies and depletion of the forest resources. In the case of the mangrove forest, there is no known form of protection thus leading to rapid decimation of these resources and biodiversity in general.

In light of this, this paper seeks to share more light on the current causes of deforestation, examining the rate of exploitation of resources in the area, as well as make suggestions for improved rural base forest management practices that could help to reduce deforestation.

Objectives of the Study

1. To assess forest cover change through the analysis of time series of satellite imageries, using the Geographic Information System between 1986, 2003 and 2013
2. Rate and magnitude of overexploitation of forest resources
3. Impacts on the environment

Findings

Findings from the research have potentials to help determine the extent of ecological restoration and increased surveillance required for the area. Also, understanding the rate of deforestation in the reserve could improve managerial actions towards conservation of the area. It is necessary to quantify the forest resources in this study location for improved carbon accounting and climate change modelling. To have a full understanding of the changes in the forest cover, a proper assessment of the estate is required. This will aid its delineation from non-forest and the calculation of the extent of forest cover (Boyd and Danson, 2005). Remote sensing and GIS offers a solution to these challenges.

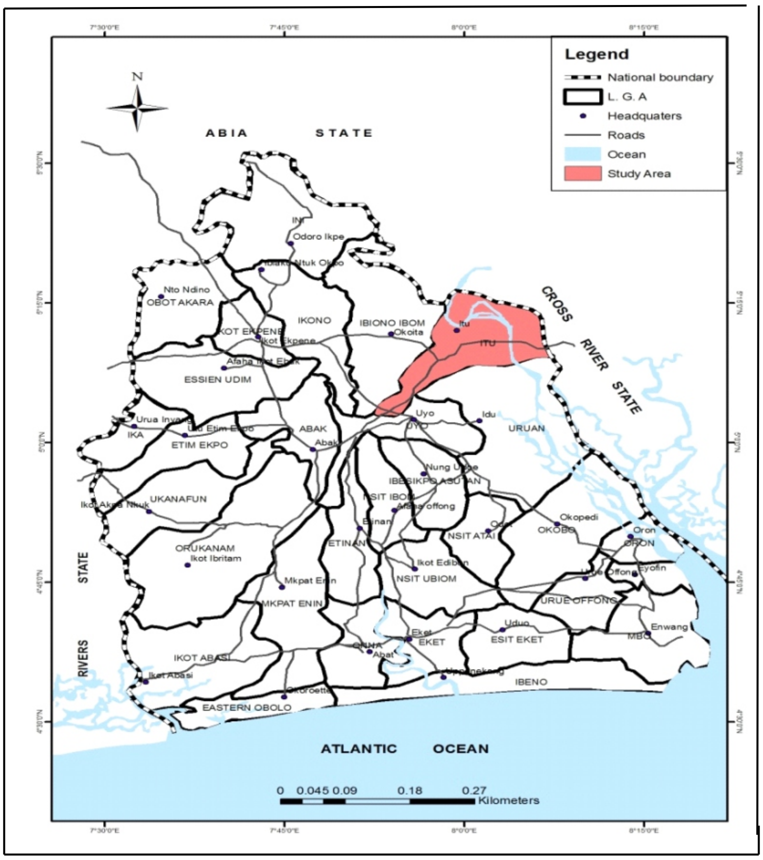
Materials and Methods

Study Area

The study area for this work is Itu L.G.A of Akwa Ibom State. The area is approximately located between latitudes 5'0° and 5'5^{0}North of the equator and longitudes 8'0^{0} and 8'5^{0} East of the Greenwich meridian. The area lies to the western bank of the cross River state. It is bounded in the Northeast by Odukpani L.G.A of Cross River State, Southeast by Uruan and Uyo L.G.A, and west by Ibiono L.G.A. The local government area occupies a total landmass of approximately 606.10 square kilometers. The population of the area is 127,033 inhabitants.

Itu has a gently undulating relief. The climate within the study area varies due to the two major local winds {Tropical maritime and tropical continental air masses} Raining period starts in March and ends to October, Itu records heavy amount of rainfall in most months of the year, with a mean annual rainfall of more than 3,000 mm, mean annual temperature of between 26°C and 30.5°C and relative humidity varying from 60% to 95% with highest values recorded in July and the lowest in January (Werre, 2001 in: Jacob *et al.*, 2015). This heavy rainfall supports ever-green luxuriant vegetation throughout the year. The vegetation is made up of Mangrove swamp which developed in the coastal and estuarine areas in the state**.** Forest are mainly close to watercourse. It is made up of a mosaic of grass plains, palm swamps, scrub and forest on waterlogged and seasonally flooded soils. Riperran vegetation type also form part of this broad group. Plants include Elaeis, Leea, Raphia palm and Mitragyna it occupies tidal flats, laced with tidal channels and winding waterways of above twenty meters wide. Small creeks that meander strongly develop as branches of the main channels.

Location of Itu on the map of Akwa Ibom State



Source: Akwa Ibom State Ministry of Lands and Town Planning

Data Collection

To achieve the objectives of the study, a combination of datasets from secondary sources were collected and utilized. The characteristics of these datasets are summarized on table 3.1.

Three sets (1986, 2003 and 2015) of satellite imageries were obtained; LANDSAT TM Imagery of 1993 and 2003 where downloaded from the Global Land Cover facility (GLCF) an Earth Science Data Interface, while the 2013 images were obtained from the National Centre for Remote Sensing (NCRS), Jos. A Vegetation and land use/cover map of the study area was also acquired from the Cross River Basin Development Authority (CRBDA). This was used as ancillary data for training sets and accuracy assessment of the 1986 classified image.

Table 1: Datasets, Sources and Characteristics

S/N	Data	Identification	Scale/Resolution	Year	Sources	Format
1.	Political Map	Akwa Ibom State	1:250,000	2007	Ministry of Lands and Town planning	Analogue
2.	Thematic Map (veg. and Land Use	Akwa Ibom Sate	1:250,000	1988	Cross River Development Authority (CRBDA)	Analogue
3.	Satellite images	Akwa Ibom State	28.5m	1986/2003 and 2013	GLCF and NCRS	Digital

Source: Researchers Analysis

Method of Vegetation Change Detection

GIS/ Remote sensing software for both vector and raster processing, were used for image enhancement and classification. ARCGIS version 9.2 was use for digitization and classification of areas. The three imageries were geo-referenced in ARCGIS environment for a common coordinate and pixel size. Unsupervised classification was used to group the area into four classes. Dense area, Sparse/ degraded area, Bare soil and Water body.

The areas identified and classified were digitized in ARCGIS 9.2 to provide the land cover maps of the three periods using projected coordinate system. The area in square kilometre covered by each land cover were calculated using the numeric field of the attribute table in ARCGIS while annual and percentage changes were calculated between 1986 to 2013 using Area Differencing Approach.

The changes were estimated with the formula given as (eqn. 1):

Change = Final Area–Initial Area Initial Area x 100 ... (1)

The annual change was estimated with formula given as (eqn. 2):

Annual change = Change in Area No of years .... (2)

Note: Positive values from this calculation will indicate an increase in area of land cover while negative values will indicate a decrease in area of the land cover (Jacob *et al.*, 2015)

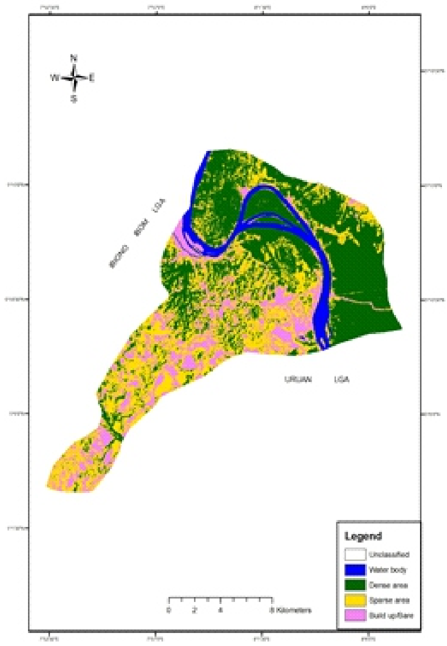


Figure 1: Land Cover Map of the study area as of 1986

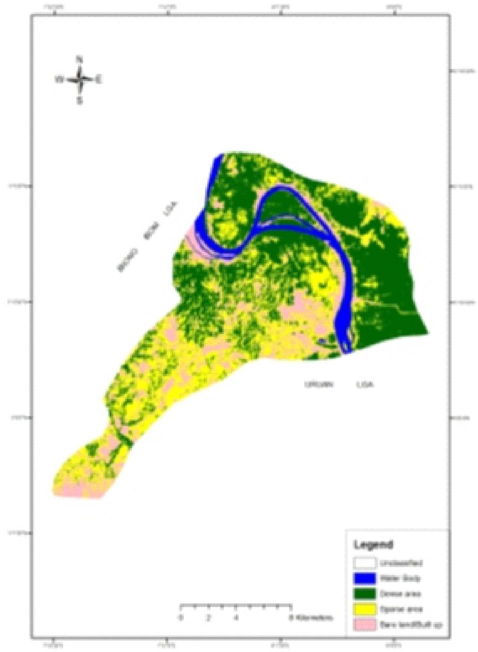


Figure 2: Land Cover Map of the study area as of 2003

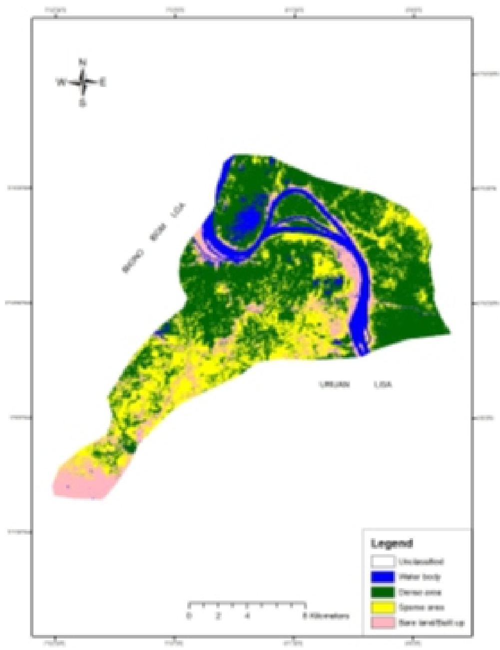


Figure 3: Land Cover Map of the study area as at 2013

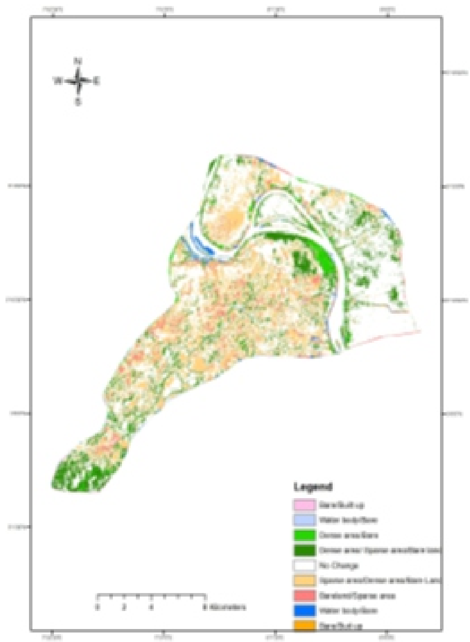


Figure 4: Land Cover Status of the area between1986-2013

Source: Researchers and Analysis

Results and Discussion

Table 2: Land Cover Status of the study area for 1986, 2003 and 2013

EÃAČ	1986		2003		2013	
LAND CLASES	AREA(KM2)	% COVER	AČÃA AÉч"	% COVER	AREA(KM^2)	%COVER
Water body	1707.69	6.5	1671.69	6.3	2519.48	9.5
Dense area	11498.2	43.7	11450.6	43.5	12961.6	49.1
Sparse area	9122.21	34.7	8772.33	33.3	7612.05	29.05
Bare land/Built up	3990.69	15.2	4436.54	16.8	3313.95	12.5
Total	26318.79		26331.16		26407.08	

Source: Researchers Analysis (2018)

Table 3: Rate of land Cover changes between 1986 and 2003 in the study area

Land cover classes	1986(km)	2003 (km2)	Change(km)	Change (%)	ARC
Water body	1707.69	1671.69	36	4.09	2.12
Dense area	11498.2	11450.6	47.6	5.41	2.8
Sparse area	9122.21	8772.33	349.9	39.79	20.6
Bare land/Buit up	3990.69	4436.54	-445.9	-50.71	-26.2
Total	26318.79	26331.16	879.4	100	

Source: Researchers Analysis (2018)

Table 4: Rate of land Cover changes between 2003 and 2013 in the study area

ÆBÂ ÁCĎÃČÁÆĊĊÃĊ	2003 (km2)	2013 (km2)	Change(km2)	Change(%)	ARC
Water body	1671.69	2519.48	-847.79	-18.3	-84.8
Dense area	11450.6	12961.6	-1511	-32.6	-151.1
Sparse area	8772.33	7612.05	1160.28	24.9	116
Bare land/Buit up	4436.54	3313.95	1122.59	24.2	112.3
Total	26331.16	26407.08	4641.66	100	

Source: Researchers Analysis (2018)

Table 5: Rate of land Cover changes between 1986 and 2013 in the study area

ÆBÂ ÁCĎÃČÁÆĊĊÃĊ	1986(km)	2013 (km2)	Change(km2)	Change(%)	ARC
Water body	1707.69	2519.48	-811.79	-18.19	-30.06
Dense area	11498.2	12961.6	-1463.4	-32.79	-54.2
Sparse area	9122.21	7612.05	1510.16	33.84	55.92
Bare land/Buit up	3990.69	3313.95	676.74	15.16	25.06
Total	26318.79	26407.08	-88.29	100	

Source: Researchers Analysis (2018)

From the table;

ARC = Annual Rate of Change

From the table computed above, the forest cover statistics between the base years 1986, 2003 and 2018 were properly processed. That within table 1, the water body accounted for 6.5% of the study area as at 1986, while the dense area accounted for 43.7%, followed be sparsely area with 34.7% and bare/built up of 15.2% of the area. By 2003, the water body has increased by 6.3%, dense area accounted for 43.5%, with sparsely area by 33.8% and bare land had increased by 16.8% of the study area. Also, by 2013, the water body accounted with an increase of 9.5%, while dense area increased to 49.1%, further by sparsely of 29.05% reduction and as well reduced with bare land by 12.5%. Table 3 to 5 shows the result of the vegetation changed with positive values indicating increased in area of land cover, while the negative values indicated decreased in the area of the land cover.

The water body showed from the table revealed that, in 1986 there was an increase of 4.09% change with the annual rate of 2.12% and a decreased of 18.3% with annual rate of 84.8%. it also further decreased by 18.19% and decreased with 30.06%. The dense area increased by 5.41% with the annual change rate of 2.8% per annum in 2003, they further decreased by 32.6% with change rate of 151.1 per annum in 2013. Between 1986 and 2013, there was an overall decreased in the dense vegetation area at a rate of 54.2% per annum. Sparsely area had increased by 39.79% at change rate of 20.6% in (table two) further increased by 24.9% at annual rate of 116.0 per annum (table 3) and also increased by 33.84% by annual rate of 55.93% per annum (table 4). Bare land reduced by 50.71% at the annual rate of 26.2 in 1986, further increases to 24.2% at the rate of 112.3% in 2003. By 2013, the bare land reduced by 15.16% at the rate of 25.06%.

Conclusion

Base on the above result, forest cover has been in the state of flux due to an anthropogenic activities attributed to farming, mining, intensive and extensive farming etc. and pointed out the underlying causes of deforestation to include the ever increasing population growth and economic development, demand for food, fuel and forest products etc. not just only because of population but due to higher incomes and changing pattern of consumption among the majority of the population. As due to increase amount of fuel prices, kerosene and diesels has put or led to more pressure of firewood as source of fuel and most household.

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