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LAND USE LAND COVER CHANGE AND HAZARD OCCURRENCE ALONG COASTLINE OF NIGERIA

Adetunji Michael A.[1] and Oyeleye Oyewale I.[2]

[1]Department of Urban and Regional Planning, Faculty of Environmental Sciences
[2]Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Oyo State Nigeria

ABSTRACT: *The human modification and interference with landscape globally has increased incidence of hazards and disaster most especially in the coastal areas with particular reference to Nigeria. The aim of this study and how it trigger occurrence of hazards at the coastal areas of Nigeria between 2005 to 2015, using landsat 7 thermatic mapper from 1995 to 2005 and landsat 8 enhanced thematic mapper data from 2005 to 2015. From the study bare land and mangrove vegetation shrinked while coastal mud and water (ocean) increased in size. The study recommends mapping of hazard prone areas along the coast of Nigeria the coastal with a view to reduce human inference with Nigeria coastal landscape.*

KEYWORDS: Land Use, Land Cover, Land Hazard, Mapping of Hazard, Nigeria

INTRODUCTION

Hazard is a thing or condition that might operate against success or safety; possible source of peril, danger, distress or difficulty (Blaikie et al, 1994). It relates often to human life and property. Strictly conceived, there is no hazard unless humans' possession and activities are involved. Hazards are potential danger or a source of danger which threatens human safety. Hazards are thus potentially damaging physical event or disaster triggers, that can cause harm or risk, such as earthquakes, flood, drought, storms, fires, lightning, volcanic eruptions, hurricanes and tornadoes. These physical triggers are referred to as natural hazards. They can wipe out years of urban development by destroying infrastructure, weaken urban support or service institutions and kill people (Smith et al, 2002). Hazards occur when the above listed phenomena occur and claim one or two persons' lives and/ or when one to nine persons are injured (Table 1.1)

Table 1.1: Comparing disasters, "small disasters" and everyday hazards in a community

Nature of event	Disaster	Small disaster	Everyday hazard
Frequency	Generally frequent	Frequent (often seasonal)	Everyday
Scale	Large or has potential to be large (e.g. 10 or more killed, 100 or more seriously injured, need for external assistance)	3-9 person killed, 10 or more injured	1-2 persons killed, 1-9 injured

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Total Impact	Can be catastrophic for particular place and time in most low and middle-income nations but generally a low overall contribution to premature death and serious injury.	Probably significant and considerable, underestimated contribution to premature death and serious illness or injury	In most African communities, these remain the main cause of premature death and serious injury
An integrated framework incorporating risk from disaster events	Very large impact for a city. Low frequency	Continuum of risk	Small impact for city, very high frequency

Source: Adapted from Bul Kamangal et al., (2003)

The coastlines have been subjected to hazards over the years in Nigeria. Nigerian Institute for Oceanography and Marine Research (NIOMR) reported widespread erosion and flooding of the Barrier Islands in the Niger Delta (Awosika, 1993). Nigeria's 853 km coastline is prone to coastal hazards such as flood, erosion, ocean surge and pollution. This is of grave ecological concern because over 25 million Nigerians reside in the coastal area, engaging in different economic activities, such as oil and gas exploitation, banking and finance, agriculture, fishing, aquaculture, shipping industries, tourism as well as other commercial activities.

Vulnerability to hazards in the coastal zone is increasing as more people migrated to the coast. Consequently, the natural buffers such as wetlands and mangrove forest are lost to development and coastal hazards. High coastal population density coupled with projected increase in storm frequency and severity may exacerbate the impacts of coastal hazards as well as slow subsequent recovery and community rebuilding efforts (NEMA, 2012). With the likelihood of such events, private citizens and public officials are questioning how coastal communities can better prepare for potential hazards. While most hazards are outside the community's control, proactive measures must be taken to reduce vulnerability and increase community's capacity to absorb and bounce back from coastal hazards.

According to Dimyati et al (1996) land use / land cover is two separate terminologies which are often used interchangeably. Land use / land cover change (LULCC), is a general term for the human modification of Earth's terrestrial surface (Erle Ellis, 2007). Though humans have been modifying land to obtain food and other essentials for thousands of years, current rates, extents and intensities of LULCC at the coastal area of Nigeria are greater than ever in history, driving unprecedented changes in ecosystems and environmental processes at local, regional and global scales. These changes encompass the greatest environmental concerns of human populations today including climate change, biodiversity loss as well as the pollution of water, soil and air. Monitoring and mitigating the negative consequences of LULCC while sustaining the production of essential resources has therefore become a major priority of researchers and policy makers around the world.

Study Area

The Nigerian coastal zones are found in nine States (out of the 36 States of the Federation), namely Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Lagos, Ogun, Ondo and Rivers. The coastal States are estimated to account for 25 percent of the national population (Mmon and

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Chukwu Okeah, 2011). The coastal areas stretch inland for a distance of approximately 15km in Lagos in the west to 150 km in the Niger Delta and 25 km east of the Niger Delta (Adati, 2012). The coastline stretches for 853km comprising inshore waters, coastal lagoons, estuaries and mangrove especially in the Niger Delta (Ibe, 1982).

METHODOLOGY

Google Earth pro was used for visual assessment of area coverage of Atlantic Ocean water coverage along Nigeria coast to delineate area of interest. The area of interest (AOI) was delineated using polygon tool in Google earth by 10km from the coastline into the ocean and 10km into the coastal land. The polygon of the AOI was saved as KMZ (GIS format) file and converted to shape line in ArcGIS to mask out the AOI from the landsat images collected. The land use / land cover (LULC) classification for all the Nigerian coastal areas was based primarily on Landsat 7 thematic mapper (TM) from 1995 to 2005 and landsat 8 enhanced thematic mapper (ETM) data from 2005 to 2015. The Landsat imageries used was downloaded from USGS (GIS platform) in sections to cover the delineated areas, mosaic in ArcGIS, enhanced and classified in Erdas. All Landsat data were geo-registered to a customized transverse Mercator projection for the Nigerian coastal areas using a common set of ground control points, with a resultant root mean square error (RMSE) of less than 9 meters (less than 0.33 pixel).

The primary LULC classification scheme used for this project was derived from the Anderson (1976) classification system for a level one classification. The classification scheme utilised four LULC classes representing water, mud land, bare land (Settlement included) and mangrove vegetation. Data collected were enhanced and classified using Erdas imagine software and processed in ArcGIS

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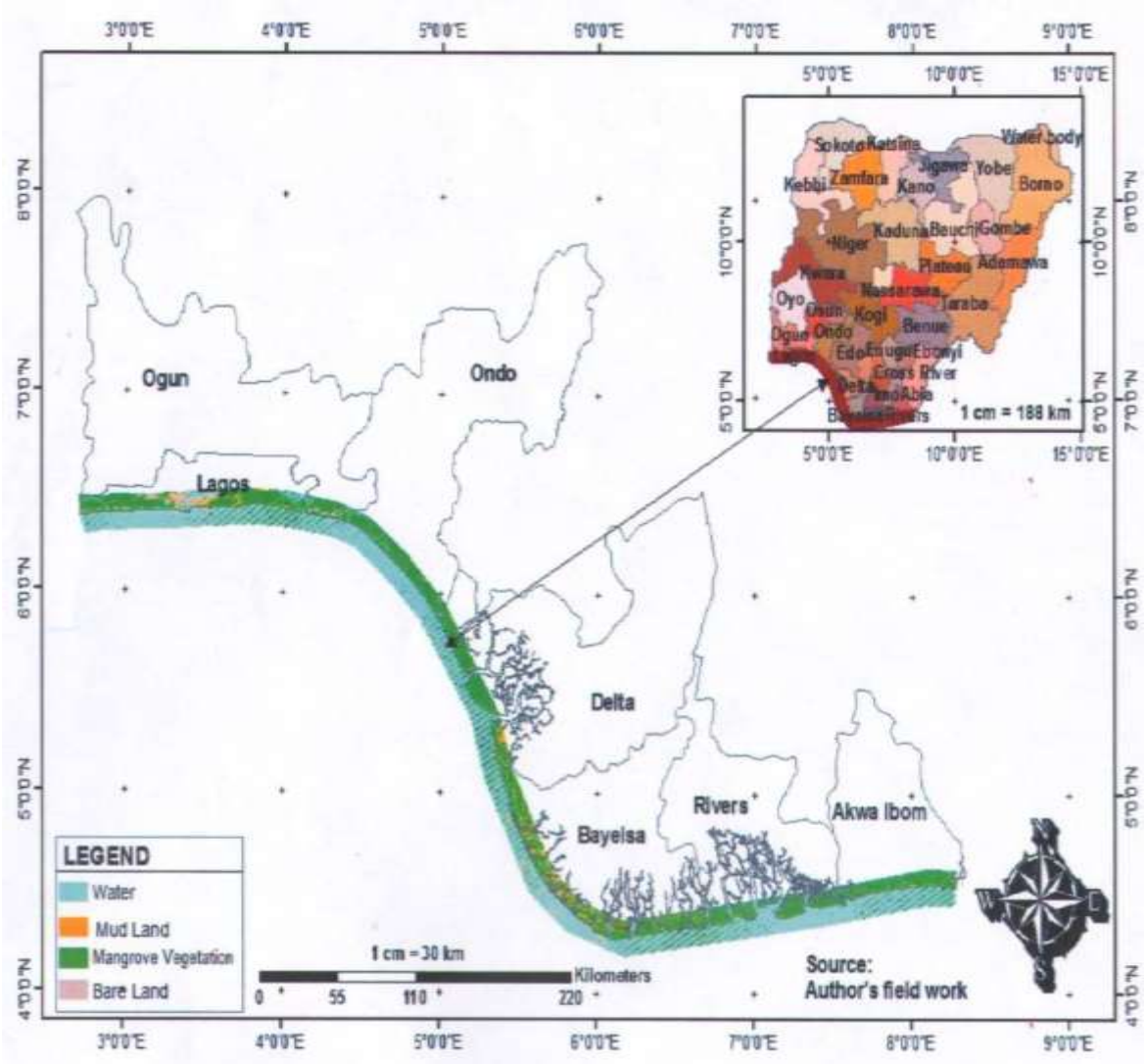

Figure 1.1: Land Cover Classification of Nigeria Coastal Areas 2005

Source: Authors' field survey, 2015

Land Use Studies versus Land Use Changes

In some hundreds of years ago when man was nomadic in nature, and the major occupation of everyone was either farming or trading; undoubtedly there was no need for any study of the use of land (Ayedun, et al., 2011). Basically, the use of land at this period revolved round satisfying the basic of needs of man which were shelter (now known as residential use of land); food (now known as agricultural use of land); and clothing (which could be associated to trading). There was little or no competition for the use of land, as the total number of population at each geographical space across the globe could be easily counted and recognized (Oyeleye et al., 2015). Harvey (2000) believes land was with little or no economic value at this period of Stone Age, as land was usually allocated by the community heads to the new comers, mainly for shelter and farming.

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However, as population of people was increasing, there was emergence of competition among individuals in acquiring land; and several activities of man started vying for prospective locations in the communities (Oyeleye et al., 2015). This paradigm-shift in land-human relationship that results from population bomb necessitates the need to ensure fair balance in the allocation of land to various human activities which is thus referred to as "*Land Use Studies*" (George, 2002). Consequently, large expanse of land primarily meant for forest gradually changed to farming; farm lands changed to rural communities; rural communities changed to sub-urban or urban area; while competitions among different land uses in both rural and urban areas are attributed to the incessant changes of land from one use to another use (e.g. residential-commercial, agricultural-industrial etc.). However, urban expansion due to population bomb in urbanization process, and land use changes necessitates good land records to ensure tenure securities and harmonious uses of land in urban centres which are the basis of land use studies (McLaughlin, 1987).

Impacts of Land use Changes

The impacts of changes in the uses of land are enormous and could be grouped under socioeconomic and environmental implications (Junjie, 2008):

a) Conversion of farmland and forests to urban development reduces the amount of land available for food and timber production, which poses a serious threat to human continuity as more agricultural land is giving way for urban growth.

b) Soil erosion, salinization, desertification, and other soil degradations associated with agricultural production and deforestation reduce land quality and agricultural productivity which make efforts of many farmers to yield little results, and thereby discourage the virile youths to engage in agriculture.

c) Conversions of farmland and forests to urban development reduce the amount of open space and environmental amenities for local residents.

d) Urban development reduces the "critical mass" of farmland necessary for the economic survival of local agricultural economies, which has contributed to the hike of poverty among the residents of the countryside and hunger among proletariat in the urban centres.

e) Urban development patterns not only affect the lives of individuals, but also the ways in which society is organized. There is evidence of haphazard developments in many Nigerian cities especially at the coastal areas where urban growth is uncontrolled with poor planning measures like zoning, land use ordinance, and master plans among other factors.

f) Suburbanization intensifies income segregation and economic disparities among communities. This makes some communities to be depressed and some buoyant.

g) Land use and land management practices have a major impact on natural resources including water, soil, air, nutrients, plants, and animals. These aforementioned natural resources usually gradually reduce in terms of quality and quantity, while some animals are facing extinction.

h) Runoff from agriculture is a leading source of water pollution both in inland and coastal waters. This also has serious health implications especially on the residents around coastal regions and also the suburb communities where their sources of drinking water are mainly on rivers.

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i) Draining wetlands for crop production and irrigation water diversions also have negative impact on many wildlife species. These could kill some species that could not cope in a drained land or altered milieu.

j) Irrigated agriculture has changed the water cycle and caused groundwater levels to decline in many parts of the world.

k) Deforestation adds to the greenhouse effect, destroys habitats that support biodiversity, reduces the quality of air that human breathes in which eventually results to many pulmonary diseases (cough, tuberculosis, lung cancer, fibrosis, and sarcoidosis *inter alia*) especially in the cities, affects the hydrological cycle and increases soil erosion, runoff, flooding and landslides.

l) Urban development causes air pollution, water pollution, land pollution, visual pollution and urban runoff and flooding.

m) Habitat destruction, fragmentation, and alteration associated with urban development are a leading cause of biodiversity decline and species extinctions

n) Urban development and intensive agriculture in coastal areas and further inland is a major threat to the health, productivity, and biodiversity of the marine environment throughout the world.

SUMMARY OF FINDINGS

Table 1.2 shows land use / land cover of the delineated coastal area of Nigeria (10km to the ocean and 10km to the hinterland from the coastline). From the table, the total area of interest delineated is 1,497,454.105 hectares. From this it can be seen that bare land that was 4.1% in 2005 decreased to 2.9% (Table 1.2) in the year 2015. Bare land according to this study include built up area and vacant coastal land. The implication of this is that bare land shrinked as a result of change in coastline. Part of the bare land where settlements are located along the coast has been inundated by the ocean thereby exposing the residents to risk of coastal hazards such as flood, ocean surge, erosion and pollution among others. Sometimes communities had to relocate as a result of change in coastline due to increase in water body (ocean). In the year 2005, mangrove vegetation that was 38.8% drastically reduced to 30.4% (Table 1.2). The major reasons for this reduction are excessive removal of mangrove vegetation along the coast, activities of multinational companies and intrusion of salt water where canals were constructed. Mangrove forest plays significant roles in coastal ecosystem. One of the roles of mangrove vegetation is that it reduces the effect of coastal hazard on coastal ecosystem. Reduction in mangrove vegetation suggests that coastal area will be exposed to serious coastal hazards such as flood and erosion. Coastal mud in the year 2005 had a percentage of 5.0 while this increased to 8.9% in the year 2015 (Table 1.2). Coastal mud is associated with coast land. Coastal mud is regarded as the marshy area that surrounds the coastline. In this study, deposition of sediments as a result of erosional activities of water along the coast led to increase in coastal mud that exposes coastal areas to risk of coastal hazards.

Water (ocean) was 52.0% in the year 2005, this increased to 57.8% in the year 2015 (Table 1.2). Increase in the area occupied by ocean water means that the bare land of the coastal area has been inundated by ocean water thereby exposing the coastal areas to different coastal hazards. In Ugborodo (Niger Delta geomorphological zone), part of the settlement has been

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inundated by the ocean. Relics of buildings can be seen in the ocean. The story is pathetic in Awoye (Mahin mud coast geomorphological zone). The former site of Awoye has been taken over by ocean water; the entire settlement had to relocate to a new site which is still affected by coastal hazards that will eventually force the settlement to relocate in the nearest future. Relocation exercises of the coastal dwellers of Nigeria as a result of hazards force the residents to live at the mercy of coastal phenomenon through adoption of different coping strategies.

In Strand coast, buildings of the sampled communities (Mkpanank, Idua Edor, Atabrikang, Itak Abasi, and Okoro Utip) are arranged in straight lines along the coast. These are fishing communities. Residents of first building block facing the ocean relocated to the back of the last block in the settlement when their buildings were covered with water as a result of change in coast-line. This is the constant practice of the residents.

From Table 1.2, the differences in hectares of bare land and mangrove vegetation from 2005 to 2015 are –71089.7 and -492713 respectively. The negative sign of the differences indicate progressive decrease in bare land area and mangrove vegetation. On yearly basis, 7,108.97 hectares of bare land is lost to ocean water and mud land while 49, 271.1 hectares of mangrove is lost to ocean water and mud land. Mud land and ocean water keep increasing. For mud land the difference between 2005 and 2015 is 227,641.1 hectares while for water the difference is 336,261.2 hectares. On yearly basis, mud land and ocean water increased by 22,764.11 and 33,626 hectares respectively. The implication of this is that coastal dwellers will be faced with so many hazards from flood, erosion, ocean surge and pollution.

Table 1.2: Land use / land cover change of Nigeria coastal areas in 2005 and 2015

Land cover	2005 Area (hectare)	%	2015 Area (hectare)	%	Remark *-ve loss* +ve gain
Bare Land	61,885.06845	4.1	43,701.46334	2.9	18,183.60511
Mangrove vegetation	580,877.8458	38.8	454,847.3519	30.4	126,030.4939
Mud land	75,260.2235	5.0	133,483.2167	8.9	*-58,222.9932*
Water	779,430.2235	52.0	865,422.0735	57.8	*-58,991.85*
Total	1,497,454.105	100	1,497,454.105	100	

Source: Authors' field survey, 2015

CONCLUSION

The study has shown occurrence of hazards as a result of land use and land cover change along the coastal area of Nigeria covering 853km coastline. Mapping of all hazards prone areas in the coastal communities should be carried out and continuously updated. The maps should contain detailed information on different coastal hazards. Accurate and reliable data can be obtained by actively involving the residents as partners in data collection. Photographs and other illustrations could be used. The maps and other materials should be widely disseminated in all the coastal communities of Nigeria.

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