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Assessing the Effect of Sand Excavation in Kusotachin and its Environ Using Remote Sensing in Bida Local Government Area Niger State, Nigeria

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Abstract

This study examines the effects of sand excavation using remote sensing on the environment of Kusotachin, Bida Local Government Area of Niger State, Nigeria. Global Positioning System (GPS) was used to obtained coordinates of sand excavated areas, Google earth map was imported in Arc GIS and Geo-referenced then XY data was added and plot on map. From the analysis it was revealed that excavation points are treats to the village which will lead to disaster in the nearest future if excavation activities continue due to expansion of already pits that accumulate water especially during the raining seasoning making the area susceptible to flood and mass movement that will be destructive to lives and properties. From the results, Bear Surface 48%, Excavated Land 27%, River 15%, Farm Land 7%, and Settlements 3%. It is then concluded that sand excavation is highly subjected to land being flooded with mass movement in potential areas. Sand mining activities offers employment opportunities, and therefore means of livelihood to some working

population of the community. Among the recommendation given in order to reduce the effects of sand excavation activities on the environment includes: Government agencies should ensure public enlightenment and by approving special land for sand miners.

Introduction

Sand excavation refers to the process of removing sand from a place of its occurrence. Sand occurs in a variety of natural settings and is commonly used in the construction industries worldwide. Sand occurs on land, oceans, rivers, streams and flood plains. An increase demand of sand for construction purposes has placed immense pressure on sand resources. Therefore, the extraction of sand is bound to have considerable negative effect on the place where it occurs. Rivers and their floodplains are most economical source of sand. The excavation of sand on the flood plain can affect the water table and alter the land-use for agricultural purposes. Rivers flow and shift their courses from time to time, resulting in natural cycles of erosion and deposition of sand. The extraction of sand from rivers and floodplains channels conflict with the functionality of river ecosystems. The most common environmental impact is the alteration of land use, most likely from underdeveloped or natural land to excavations in the ground. Sand excavation has been one of the serious environmental problems around the globe in recent years. Soil is a cheap natural resource made up of gravel, sand, clay, loam which constitutes the different types. Pit sand, river sand and gravel are components of soil which take years to be formed but extracted in a matter of days. Sand and gravel are underground geological resources formed from eroding mountain rocks carried by streams and rivers. According to Mwangi (2007), soil has many uses, it is needed for agriculture, as a habitat and in construction but the genesis of cash economy brought many profit driven companies to be involved in its excavation both legally and illegally with some having no regard for the environment. Sand excavation has both positive and negative environmental impacts.

Many states are well developed with advanced infrastructure which is a positive effect of soil extraction. However, excessive extraction of soil lead to excavation, destruction of ecosystems and exposure of buried pipelines.

Lawal (2011) discussed sand excavation in Nigeria and highlighted that the activity is rapidly becoming an ecological problem as demand for sand increases. The resources are used in construction of strong structures which improves the socio economic lives of most Nigerians though with notable negative environmental impacts. Demand for soil in the country has increased today which has led to the excessive stream and land extraction of pit sand and river sand causing land degradation, riverbank deepening and loss of ecosystems (Mbaiwa, 2008). An article in the Daily News (2011) reported a case involving residents of Gaba, a village about 15km to Bida who were up in arms due to continuous extraction of sand from the nearby river. They complained of deep pits left on bare land, air and noise pollution caused by tipper trucks transporting sand to Bida town. The article noted that a lot of land is required for extracting the abundant resource. As more impacts are felt, there is need for immediate environmental control and restoration. Soil extraction is an environmental issue worldwide. There is need to consider sustainable use of natural resources in project development through sound sand extraction. The activity is of great concern to environmentalists as it has more negative effects than positive. Rapid urbanization is a major cause for sand demand and is responsible for unsustainable extraction of sand from many illegal inland sand mining pits found in many parts of the country. The interaction between sand extracting operators, citizen, neighbors, and government becomes more confrontational as result of more sand excavation sites located in urban and rural areas. Struggle have centered on environmental and social issues such as noise, truck traffic, dust, stream-water quality, reclamation, biodegradation, pollution and visually unpleasant landscapes. Geographic information systems (GIS) can play major role in the management of mapped or spatial data prior to, during, and after sand mining activities (Chindo, 2011). It can provide maps of sand mining sites showing the level of degradation and help or serve as a decision support capability (Heywood *et al*., 2006; Chandra and Ghosh, 2009). Geographic information systems (GIS) are one of the most popular tools utilized in decision making concerning resource utilization. It has had a profound effect

on decision support system development, especially environmental modeling and model development, because it can supply functionality for dealing with spatial information that is required in most decision-making processes. GIS make mapped information available to decision makers and field personnel in real time. Although, site requirements for sand excavation activities vary, as do their site-specific impacts on the environment, however, with GIS, we can make significant effort in the analysis or screening of potential sites by considering the requirements of sand excavation and identifying and mapping locations within a region that meet these criteria. It is important to identify the sand excavation areas and find how to monitor and control the activities so that environmental degradation can be slowed down. The main objective of the study was to map inland sand excavation sites and their environmental impacts parts in Kusotachin village. The community contains many rivers where most of them are seasonal and are endowed with rich deposits of sand. Sand excavation in Kusotachin River has been ongoing for a long period of time. Bida town have benefited from the sand being excavated at Kusotachin River. The extraction of sand from the river also damages the aquatic ecosystem with other resources such as fisheries, recreational functions and with the stability of the river channels. This study investigates both the positive and negative effects of sand excavation. Positive in terms of financial gain and negative in terms of environmental impacts associated with potential sand extracting operations and to outlines the best management practices in order to minimize the adverse impacts.

Area of Study

Kusotachin is located along Bida Local Government Area of Niger State, Nigeria. Its absolute and relative location is Latitude 9°14'00" N to 9°10'30" E and Longitude 6°39'00" N to 6°24'30" E. It has a land mass of 11Sq/Km with population of 2,825 according to 2006 census. Geographically, Kusotachin is located at the southern part of Bida. It is bounded in the north by Lavun and Edati Local Government areas, in the south by River Katcha, Gbako and Gurara. The river sand is from nearby Ndeji River which is the main source and tributary. The river contains lots of sand which is being exploited.

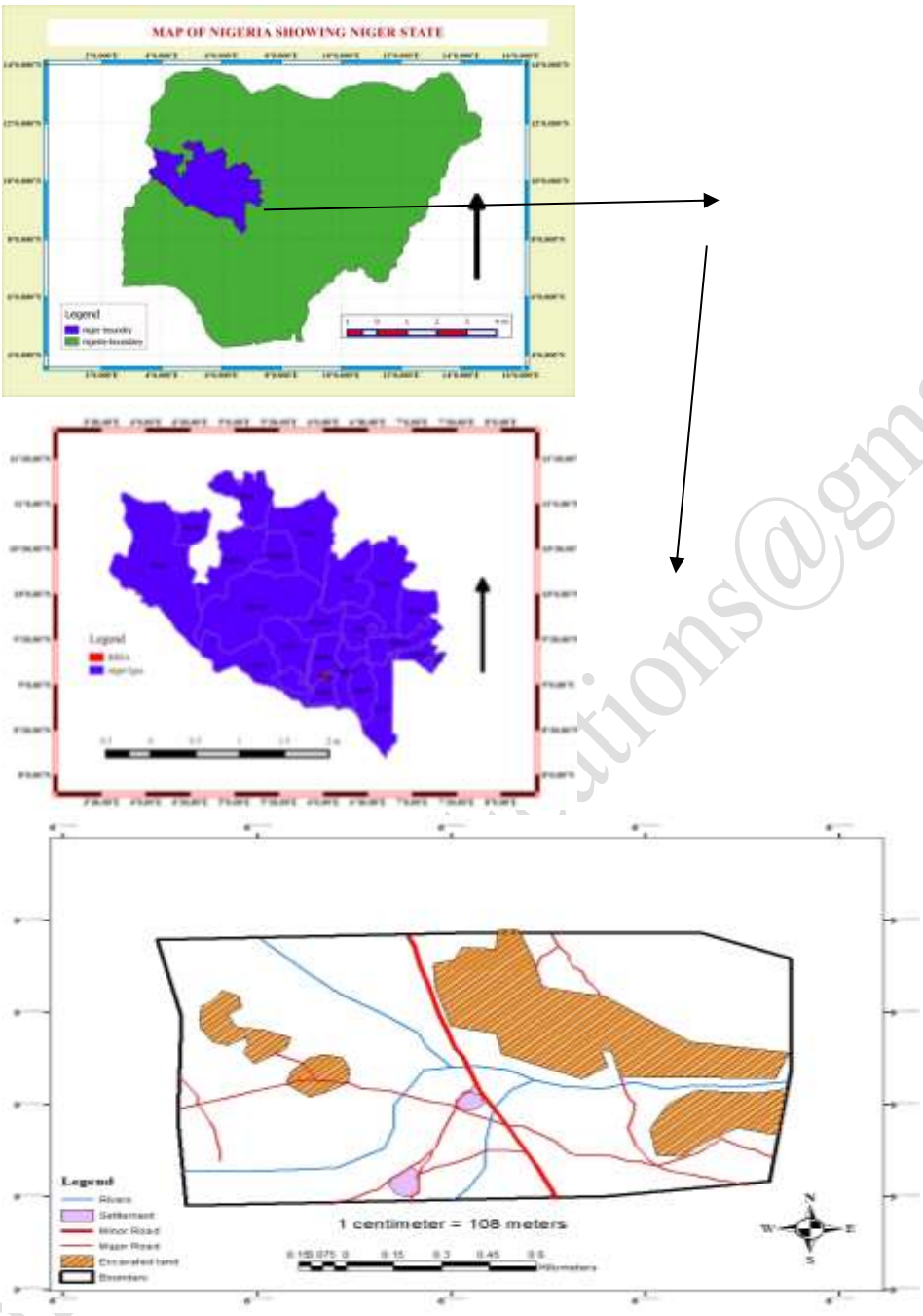


Figure 1: Nigeria Insert Niger State Insert Study Area

Materials and Methods

A research design is a systematic plan to describe, record, analyze and report the conditions that exist or have existed, it enabled the researcher to report on the socio-economic and environmental impacts of sand excavation and

identified any knowledge gaps and propose measures to strengthen proper way of excavating sand in Kusotachin village. Data collected is presented in form of maps and photos. The study is descriptive survey research as opinions were sampled with the use of questions. The respondents were given the opportunity to express their opinions in the questionnaires. The study was also relied on field survey, direct observations and identification of excavation areas.

Method of Data Analysis

GPS was used to obtain the coordinates of excavated areas; Google earth map was imported in Arc GIS and Geo-referenced then XY data was added and plotted as a map. The generated map is being subjected to 3dimentional view to show clearly the potential vulnerable areas due to excavation activities

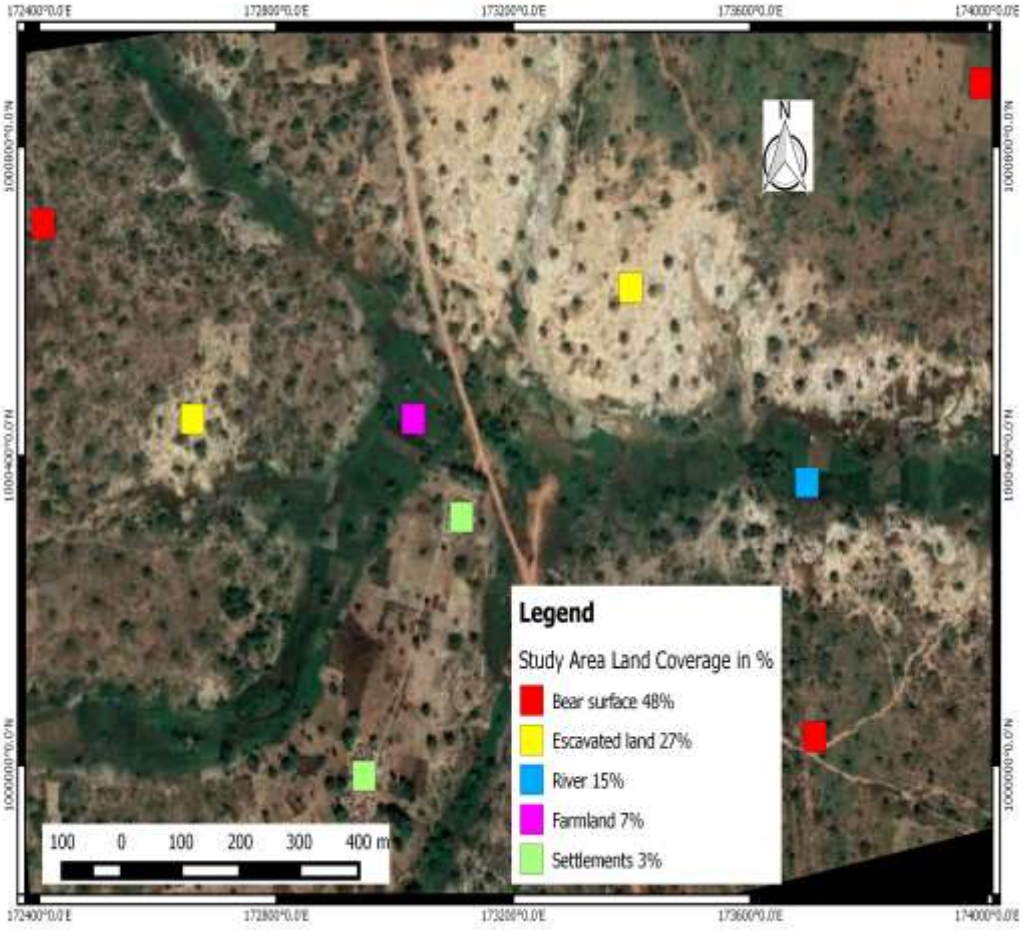
DATA ANALYSIS, RESULTS AND DISCUSSION

The different excavation areas of the study area and its environs are identified by field survey with the aid of using hand held GPS to take the coordinates. On taking the coordinates settlements, farmlands, rivers and bear surface were captured to be able to determine the prevalent effect of the activities in concern.

Geographical coordinates of excavated area in Kusotachin village

S/NO	*Latitude*	*Longitude*	*ID*
1	9.03717187	6.02672095	Settlements
2	9.03771023	6.02632057	Farmlands
3	9.03939159	6.02810373	Excavated Lands
4	9.03833677	6.02692443	River
5	9.03794958	6.02711215	Bear lands

The land coverage of Kusotachin village captured from Land satellite global facility. The image shows the nature and typical setting of the area in percentage. Housing density and road network of the area were seen on the imagery. Sophisticated remote sensing data cannot supersede field survey. The field survey was carried out to obtain geographical coordinates (Latitudes and Longitudes) of each identified excavation area, recorded and subjected to geo-referencing using ArcGIS.



Land coverage of Kusotachin village

Three Dimensional (3d) View of The Area

Developed from GIS techniques showing the elevation, slope, aspect and flow direction of fluid, it is noticed that the excavated areas have low elevation compared to that of settlement and bared surface indicating the fact that these areas are highly susceptible to agent of mass movement such as mud flow and land slide. From the same figure it is noticed that the farmlands close to the excavated areas are not been productive as such because erosion have been passing through these dug pits washing away the available nutrient, the 3D view revealed that the sand excavation areas fall in a region whose elevation is above the sea level but constant and often mining subjected the area to below the sea level

Figure The 3D view of the study Area

Extent of the Excavated Lands

There are three major sand excavated lands in the study area. Excavation activities started in Kusotachin village for about 15 years ago. It started at one part and later expanded to other discovered area that are characterized by good sand which keep creating a lot of big pits on the study area and its environs without considering it wide implications on the environment, human and properties. Since the dominance population before now depends on agricultural practices and the land has been taken over by excavators leaving land unproductive and less economical value. All the three excavated areas are currently operational but have big abandoned areas that are of no economic value.

The rate at which the excavated lands are been expanding and digging or mining is still going on up this moment and some are dormant excavated area, the north eastern part of the area are been taking over by the excavation activities leading to disappearance of farmlands, vegetation cover, reduction in bare surface and limiting the chance of developing infrastructure facilities such as road, water, hospital and electricity in such areas that have been taking over by excavation. The already existing social facilities on ground are been endangered because in the northern part of the area where the excavation site is very close to the major road which if not giving proper attention it will damage the facilities on ground. New excavated areas are spotted in the north west region which is already damaging the minor road in the village and make the land less productive agriculture wise.

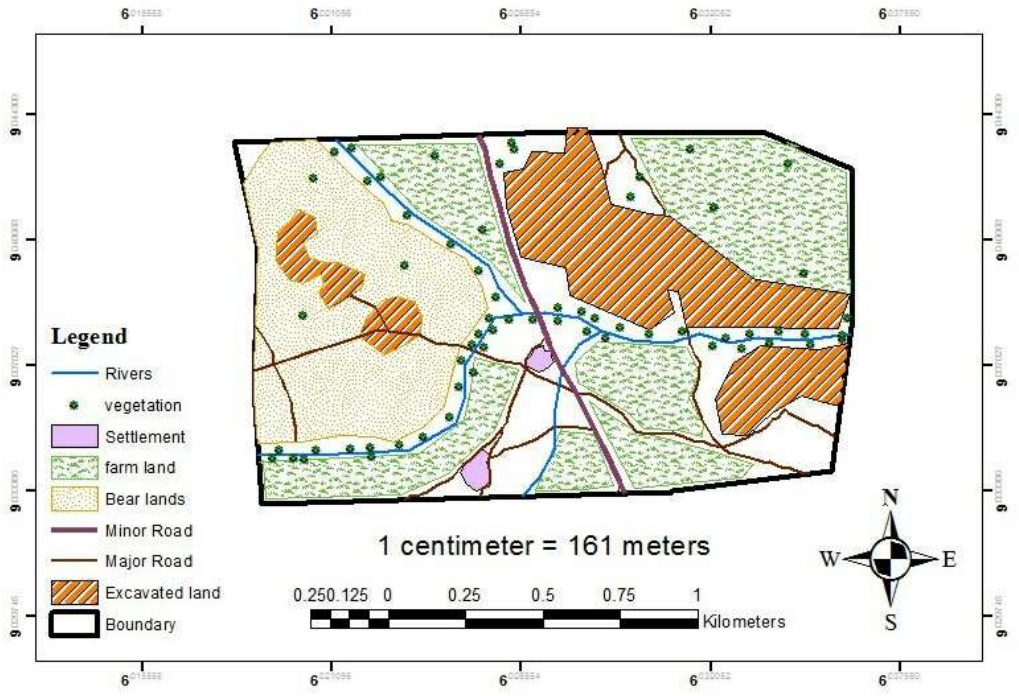


Figure The Extent of the Sand Mines

Summary, Conclusion and Recommendation

Sand excavation refers to the process of removing sand from a place of its occurrence. Sand occurs in a variety of natural settings and is commonly used in the construction industries worldwide. Sand occurs on land, oceans, rivers, streams and flood plains. An increase demand of sand for construction purposes has placed immense pressure on sand resources. Therefore, the extraction of sand is bound to have considerable negative effect on the place where it occurs. It started at one part and later expanded to other discovered area that are characterized by good sand which keep creating a lot of big pits on the study area and its environs without considering it wide implications on the environment, human and properties. Since the dominance population before now depends on agricultural practices and the land has been taken over by excavators leaving land unproductive and less economical value. All the three excavated areas are currently operational but have big abandoned areas that are of no economic value

Conclusion

From the findings of the research it is been concluded that sand excavation has it economic important but it leave a long time effect on the environment, life

and properties therefore GIS and remote sensing as a tool give the decision makers and policy implementers an insight and guild to attain a sustainable development state to achieve environmental stability.

Recommendation

From the gravity of long time effect of excavation perceived it is recommended to revive the vegetation and green environment in order to reduce the climate warming actions on the environment.

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