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EROSION PROBLEMS AND THEIR IMPACTS IN ANAMBRA STATE OF NIGERIA: (A CASE OF NANKA COMMUNITY)

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ABSTRACT: *The purpose of this paper is to identify the erosion sites in the study area, to analyze its soil nature and to assess the overall effects. The researchers intend to create awareness and proffer possible local and engineering solutions to reduce, minimize or prevent further occurrences in the area. To achieve the stated objective, both primary and secondary data were adopted using both statistical and descriptive techniques. The study identified serious erosion problems some of which are the following: Existence of prominent gully erosion in the study area. Considerable loss of soil structure leading to loss of agricultural productivity and disruption of socio-economic activities in the area. Various measures proffered to check the menace of soil erosion in the study area include: vegetation establishment through massive aforestation (bamboo tress establishment), digging of catchment pits for flood waters in compounds and public open spaces, provision of adequate drainage channels for flood water control and environmental education through public enlightenment programmes.*

KEYWORDS: Engineering solutions; environmental education; gully erosion; Nanka Community; vegetation establishment.

INTRODUCTION

The highest concentration of severe gully erosion in Nigeria is found in five Eastern states of Anambra, Enugu, Abia, Imo, and Akwa Ibom. Anambra is famous with its Agulu-Nanka-Oko-Ekwulobia gullies.Gullies of about 120m depth and 2km width have been recorded in this area. Active gully erosion sites across the country are put at 2000 sites (Jaiyebo, 2002). Seasonally, figures put active erosion sites in Imo and Anambra states to about 1.9 percent of land mass. In these areas, soil erosion is due mainly to the action of flood or running waters (Nwafor, J.C., 2006). In Anambra State, Erosion is a peculiar environmental problem. Almost all communities in the state are affected by one form of erosion or the other. According to recent media reports, over 70 percent of the land of the state is ravaged by or threatened by erosion at various levels (Oranye, 2013). Available statistics indicates the presence of about 500 gully erosions spread across the rural communities. Notable areas include: Aguata/Orumba L.G.A's with about 78 gullies, Nnewi 60, Njikoka/Aniocha 50 gullies, Idemili 46, Ihiala 40, Awka 30, Onitsha 22, Anambra/Oyi 16 gullies. While these communities are under the threat of erosion menace, some notable erosion sites as noted in this study are however in the process of control by the state government. They include: erosion sites at Nimo, erosion sites at Umuchiana-Ekwulobia, Nnewi-Okigwe highway, Omagba, Inyaba Umudim Nnewi, Mbanabo-Nnewi-Ichi Nnewi, Utuh/Osumenyi, Umuchu-Uga-Igboukwu highway, Umueze-Uga, Nawfijah, Obieze, Ifite-Dunu and Ndiagu-Ogidi erosion sites. The Nanka erosion site is so terrifying that it has been declared a national disaster. This has

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prompted the authors to develop interest in this particular site with the aim of making an input as part of control measures to tackle the problems.

Aim and Objective of Study:
This study aims to have a cursory look into the problem of erosion menace affecting the socio-economic wellbeing of the Nanka community in Anambra State. The objective is to create awareness which will necessitate and assist those in authority to take precautionary measures to save life and property. It will also serve as a reference point for interest groups for further works on the subject. The objectives of this study can hence be summarized as follows:

- Identification of the gully erosion sites in order to determine their spatial extent.
- Analysis of the nature of soil in the area.
- Determination of the overall effects of the gully erosion in Nanka and their neighboring communities.
- Suggestions of possible solutions to enable the stakeholders reduce, and prevent soil erosion in the study area.

Area of Study
The study area lies within latitudes 6^0, 00'N and 6^0, 18'N and longitudes 6^0, 45'E covering an area of about 1709 km^2 within the Anambra Basin. The study area is a significant part of Anambra River Basin stratigraphy and is basically, a result of the paleohydrogy of the region (Durham *et al*, 2008). The main geologic units of the study area are the Nanka Sand (Ecocene), overlain by Ogwashi-Asaba, formation (Oligocene) and underlain by Imo
Shale (Paleocene). (Okoro *et al*, 2010).

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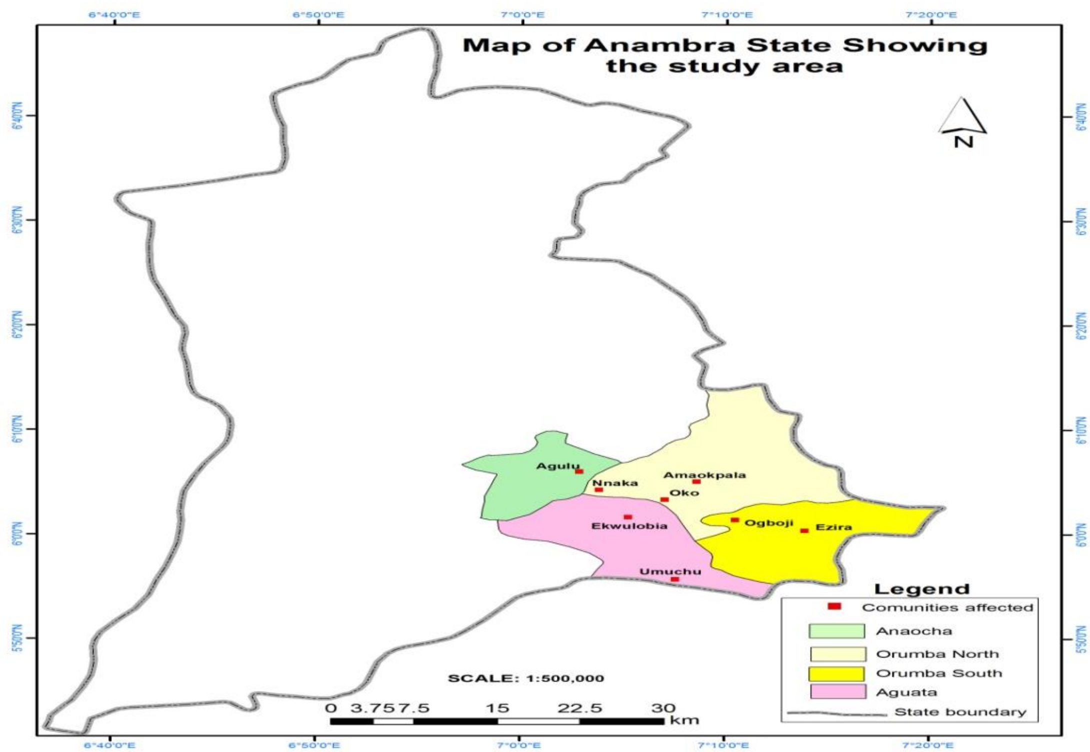

Fig.1 Map of Anambra State showing the Study Area

Vegetation

The vegetation of the area is within the West African rainforest belt but many parts have been subjected to severe deforestation due to anthropogenic activities thereby reducing the area to savannah vegetation in many parts.

Climate

The area is influenced by two climatic conditions namely, the rainy season and the dry season. The rainy season as the name implies is characterized by thunderstorm and lasts between the months of April to October while the dry season lasts between the months of November and March with high temperature and dusty atmosphere. The area records about 2000mm annual rainfall. This shows an indication of high rainfall intensity which results to large volume of runoff with resultant erosion actions in the area.

Conceptual Framework

The biosphere layer of the earth constitutes the layer where the activities of both micro and macro organisms take place. It is on this layer that the

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anthropogenic activities take place. These activities undertaken by man include mining, quarrying, agriculture, constructions, lumbering, etc. In all these activities, man does not put into consideration, their environmental implications such as soil degradation by erosion.

Soil erosion is defined as a process of general degradation of the land surfaces. Jimoh, (1994), defined soil erosion as the removal of soil materials and/or soil nutrients by surface run-off from different points of origin to other locations. The earth's landforms are closely inter-related and some of the observations made with the passing of time show that these landforms are acted upon by the processes of erosion causing the land forms to undergo a progressive change from initial forms sequentially to ultimate forms. This geomorphic event may degenerate into sheet, rill or gully types of erosion. Sheet erosion is essentially a process that involves the uniform removal of soil surface, which is when the soil surface is undergoing a uniform degradation. Rills are parallel grooves of little depth covering the land surface which can easily be filled through normal cultivation. Formation of rills is one of the consequences of flow of water.

Sheet and rill erosion are the forerunners of gully erosion representing the incipient stage of the development of gully erosion. Gully erosion is any erosion channel that is so deep that it cannot be crossed by a wheeled vehicle, unlike rills which can easily be filled through normal cultivation (Dictionary of Geologic terms).

The major agents of soil erosion in the tropics include rainfall, while some of the attributes of rainfall are intensity, duration, drop-size, amount and frequency. Other factors that contribute to the occurrence of soil erosion in the tropics include soil type and its characteristics, topography, geology, cultural practices carried out in the region and conservative practices applied to the land. However, it is the combined effects of these factors of soil erosion that make its operation and consequences hazardous and therefore of great relevance to man. The major factors influencing erosion are hereby listed below

Types of Erosion:

Water Erosion An off-site effect of downstream movement of sediment, causing flooding and the silting up of reservoirs.

Sheet Erosion is characterized by the down slope removal of soil particles within a thin sheet of water which occurs when the entire surface of the field is eroded in a uniform way.

Gully Erosion: This occurs when water running downhill cuts a channel deep into the soil resulting to the removal of soil and soft rock as a result of concentrated runoff that forms a deep channel or gully mainly on steep lands.

Rill Erosion (Channel Erosion)

Channel erosion occurs on steep land or on gently sloppy land. Due to the presence of irregularities always in the field, water settles inside hollows and low-lying channels through which it runs washing away soils and forming miniature gullies in the process.

Wind Erosion: Wind erosion occurs when land surface is left bare in regions that are arid due to low rainfall, leading to dryness and flat enough allowing the wind to carry the soil away. Land may become susceptible to wind erosion through grazing animals. Arable land that has been left bare is another factor that may lead to wind erosion.

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General Factors Influencing Soil Erosion

Slope: The steeper the slope, the greater the erosion as a result of the increased velocity of water flow. The greater the size of the slopping area, the greater the concentration of the flooding water.

Soil Texture: This is the size and distribution of soil particles. The three main particles are sand, silt and clay. The more sandy a soil is, the easier its erodibility.

Soil Structure: The term soil structure means the grouping and arrangement of soil particles. Over-cultivation and compaction cause the soil to lose its structure and cohesion leading to greater erodibility.

Organic Material: Organic material works like glue that binds soil particles together and plays a major role in soil erosion prevention. If influences the infiltration capacity of the soil, therefore reducing runoff.

Vegetation Cover: Absence of vegetation through overgrazing, over cultivation and fire make soil vulnerable to being swept away by wind and water. Plants slow down water as it flows over land allowing much rain to soak into the ground. Plants' roots hold the soil in position preventing it from being washed or blown away. Plants break the impacts of a raindrop before it hits the soil reducing the soils ability to erode.

RELEVANT LITERATURE ON SOIL EROSION

Okpala Okaka, (2009), identified soil erosion as the removal of soil particles from surface of the earth, transportation and deposition of the particles by the action of wind, heat and water.
Uchegbu,(2004), opined that human activities such as removal of vegetation cover, deforestation, and diversion of runoff into drainage channels, blockages of channels for housing developments, use of burrow pits for quarrying for building sands and stones and farming activities are factors that accelerated erosion in Anambra StateNwafor, J. C. (2006), stated that soil erosion involves the systematic removal and transport of soil, including nutrients, from soil surface by various agents of denudation particularly water, wind and by earth movement. That problem of soil erosion arises when anthropogenic i.e human activities speed up the process, resulting in accelerated soil erosion.Morgan, (2006), identified physical factors influencing soil erosion to include rainfall, wind speed, use and management of soil, topography and their properties. Soil Erosion occurs when soil is removed through the action of wind and water at a greater rate than it is formed.

Soil is seriously impacted upon or disturbed when rain falls on any part that is not protected by vegetation cover and where there are no roots to bind the soil together. Loosened soil particles are liable to be washed down from slopy land and either end up in valley or are washed away out to the sea by streams and rivers. Once topsoil is removed first by erosion action, the nutrient rich layer clears away reducing plant growth in the process. Without soil and plant cover, the land become desert and unable to support any life.

METHODOLOGY

The methodology adopted on this study includes:

- Composition of **primary data** from field investigations and photographs.

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- Collection of **secondary data** from similar works on the subject such as maps and other information from the local planning authority in the area including the internet.

Primary data include the following:

- Photographic images taken on the erosion site with digital camera Olumpus E- System DSLR model.
- Result of soil Test analysis from Vertical Electrical Sounding (VES) done at different spots on the site.

Secondary data include:

- Acquisition of secondary data from maps -Geological Map of Anambra State showing Nanka–Oko area.
- Acquisition from field observation and satellites images - The Geographic coordinates (θ, λ) obtained with GARMIN 12L hand held GPS received Spot 5 image data of 1986, Spot 5 image data of 1996 and Landsat image data of 2006. (Enemuoh, et al, 2012).

RESULTS AND DISCUSSIONS

Vertical Electrical Sounding (VES) was carried out by the authors assisted by Department of Geology, Nnamdi Azikiwe University, Awka.

Vertical Electrical Sounding (VES) was performed at different locations in the study area. This was used to determine apparent resistivity tests and the resultant data which was used to obtain different geoelectric units of the area (Okoro, et al, 2010). The geoelectric results were compared with lithologic data obtained from drilled sites and these were combined to identify subsurface lithology. The depth and resistivity values enabled the researchers to determine aquifer levels. Though these tests enabled geologists to determine aquifer levels in the area and help them in preparation of water table map and resistivity map, they are of less significant for the purpose of this study hence the figures were not included in this study. Lithologically, the result from tests indicates that Nanka soil consists mainly of sandy soil, sharp-siltstone and finely laminated shale. Sand submits comprised un-cemented medium to coarse grained and pebbly quartz sand, with thickness ranging from 50-90m (Nwajide and Hoque, 1979). Topographically, the Nanka sands form the North-South trending Awka-Umuchu-Orlu cuesta. The sandy units of the Nanka formation form thick viable aquifer (Egboka et al, 1985). The Imo shale consists of dark-grey shales, siltstone and mudstone and sandstone lenses. The main sandy facies is the Ebenebe sandstone. The eastern part of the area is drained by Idemili River and its tributaries while the western part is drained by Odo River. The other areas are drained by surface waters -river, streams and lakes.

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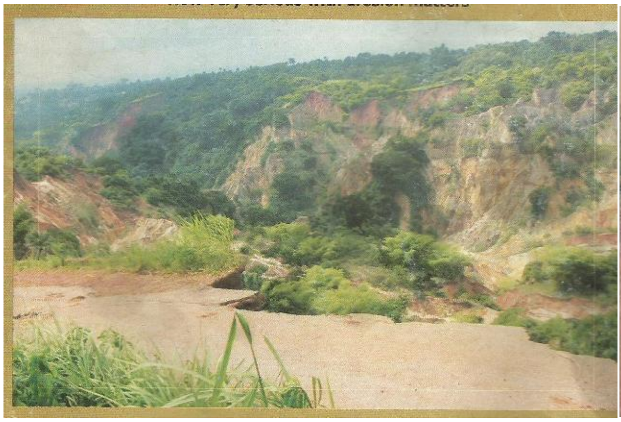
Plate 1: Erosion Site in Nanka. **Plate 2: Erosion Site in Amakor Village in Nanka.**



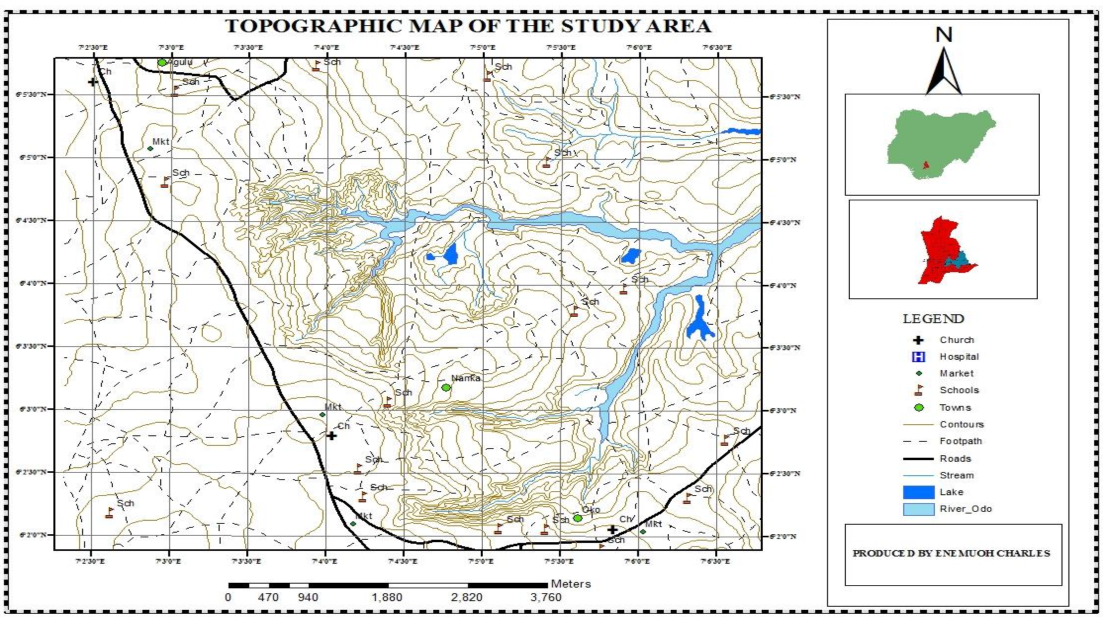


Figure 2: Overlay Map of the Study area showing the following features: Churches, Hospitals, Markets, Schools, Towns, Footpaths, Roads, Streams, Lake and River Odo.

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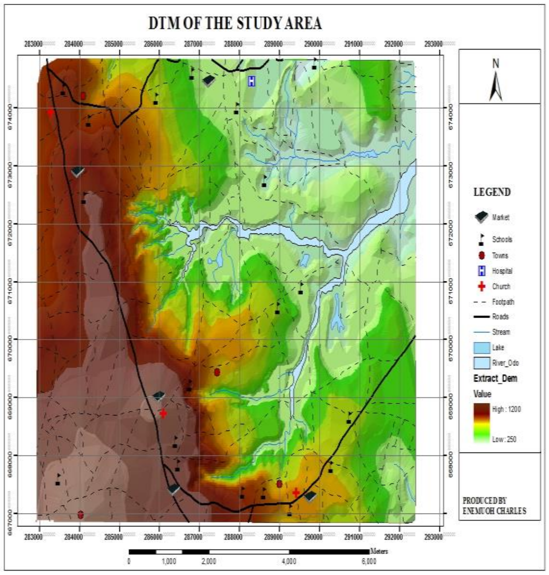

Figure 3a: Digital Terrain Model of the Study Area.

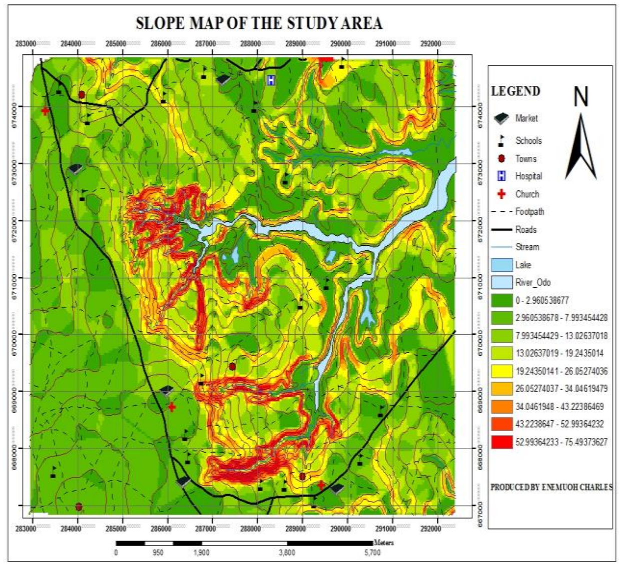

Figure 3b: Slope Map of the study Area.

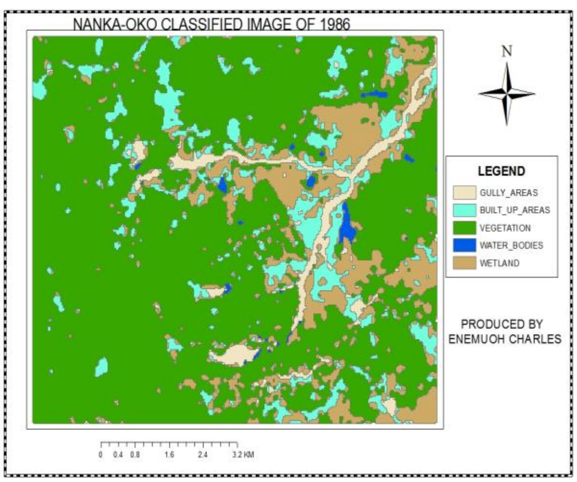

Figure 4a: Classified Spot 5 image of year 1986

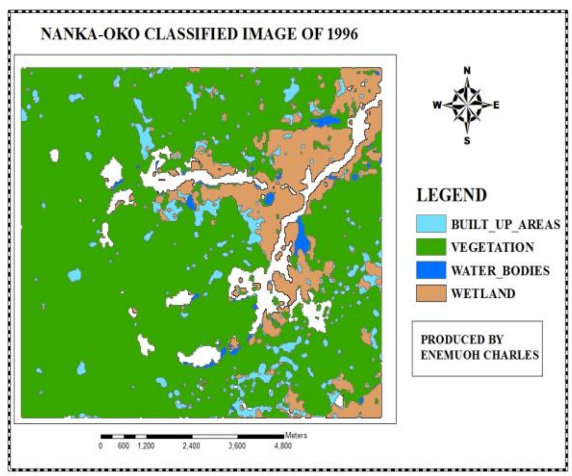

Figure 4b: Classified Spot 5 image of year 1996

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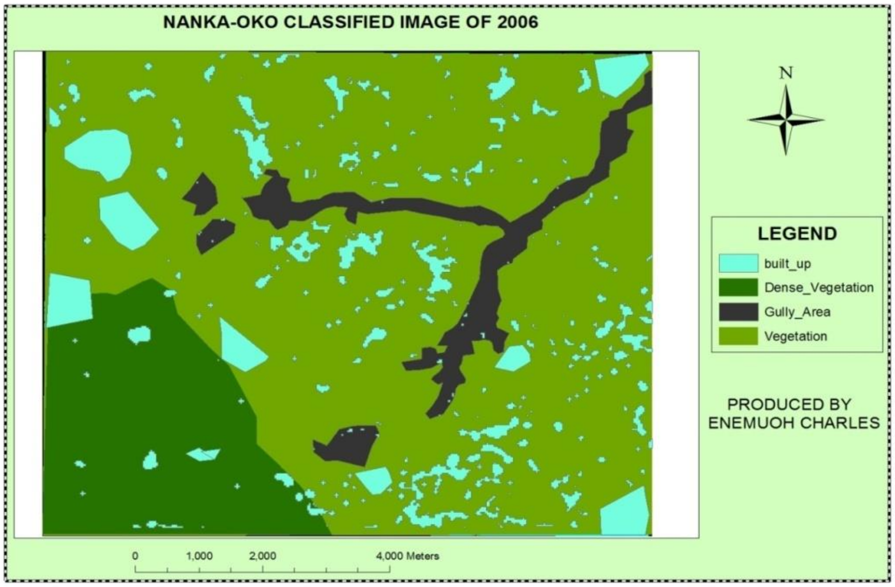

Figure 4c: Classified Landsat image of year 2006

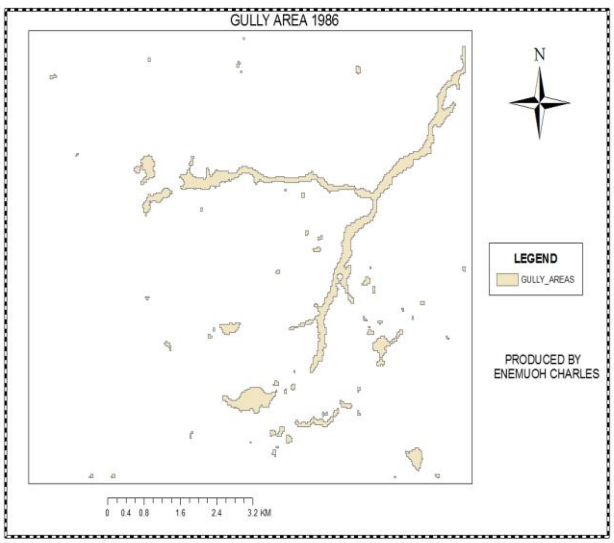

Figure 5a: Gully area of year 1986

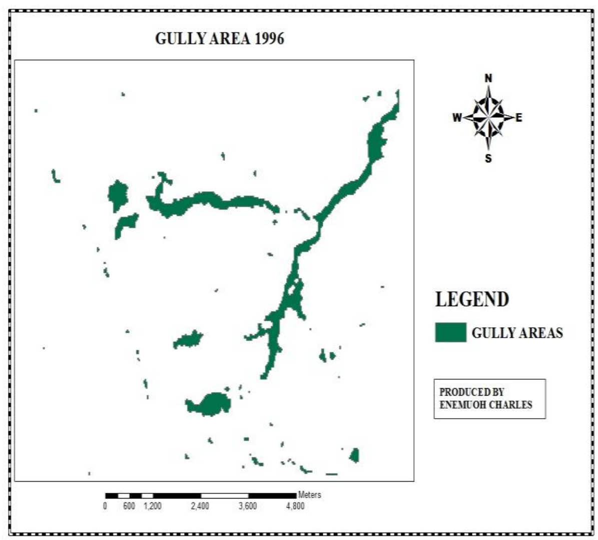

Figure 5b: Gully area of year 1996

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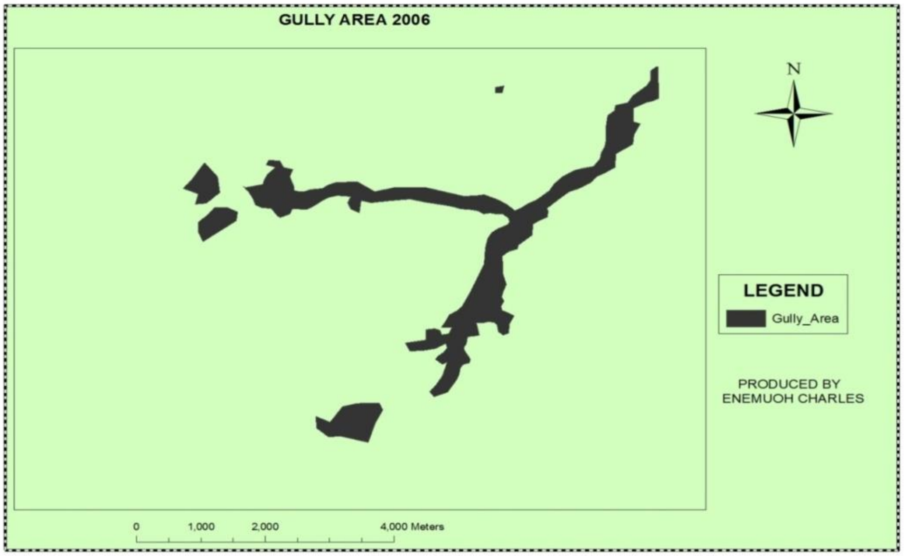

Figure 5c: Gully area of year 2006

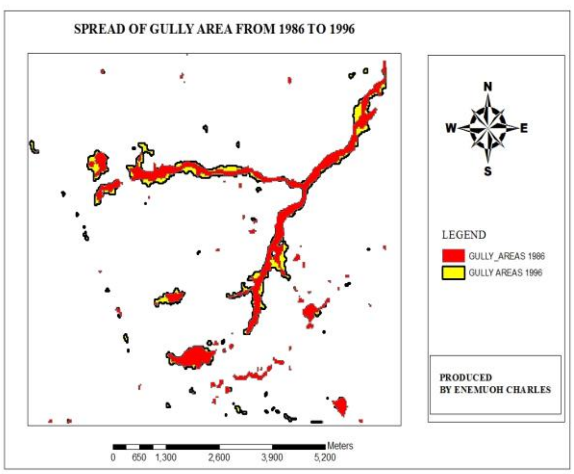

Figure 6a: Spread of gully erosion from year 1986 to 1996

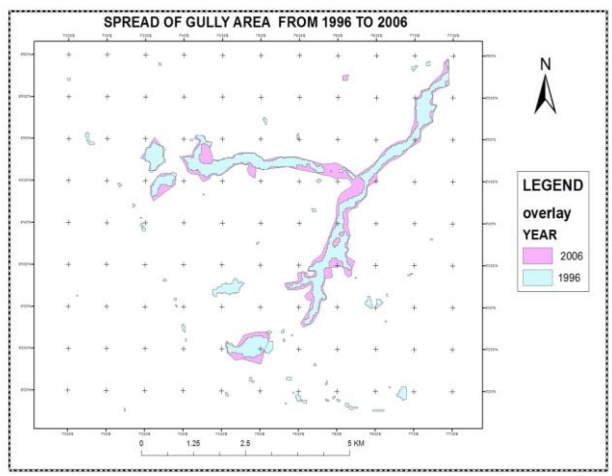

Figure 6b: Spread of gully erosion from year 1996 to 2006

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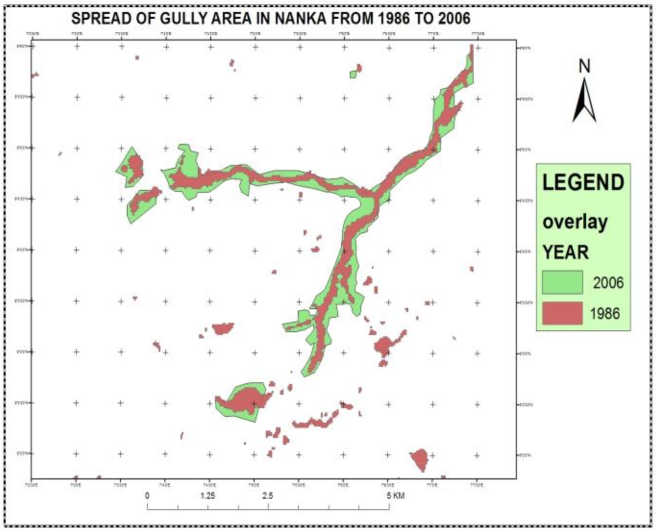


Figure 6c: Spread of gully erosion from year 1986 to 2006

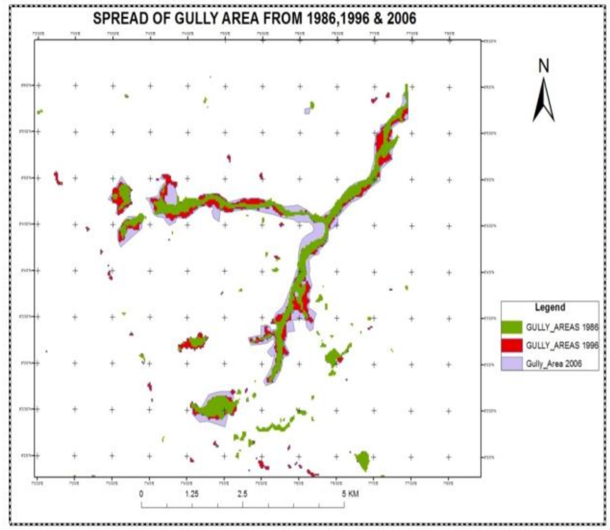
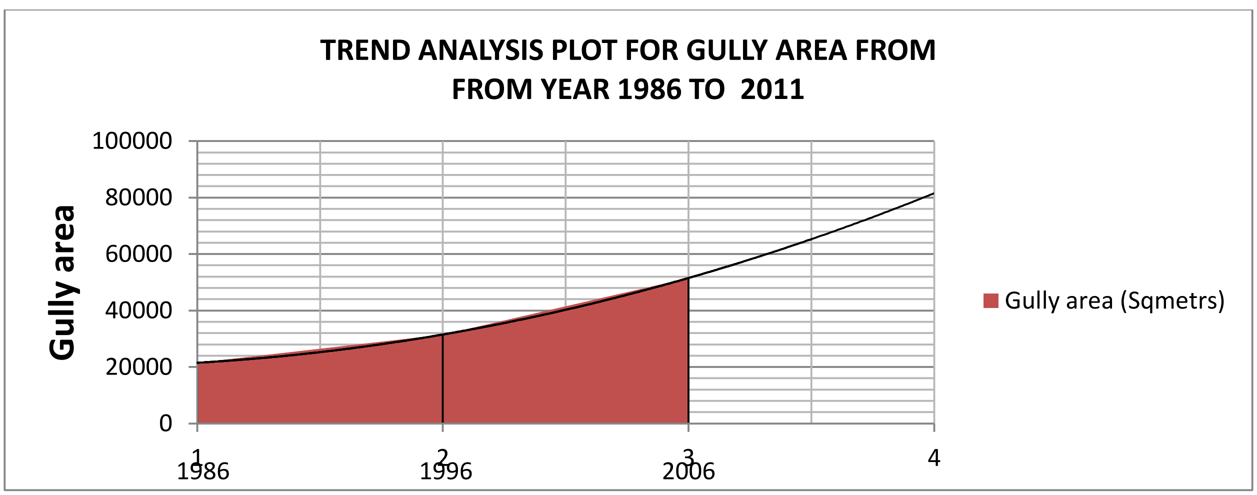


Figure 6d: Spread of gully erosion from year 1986 – 1996 - 2006



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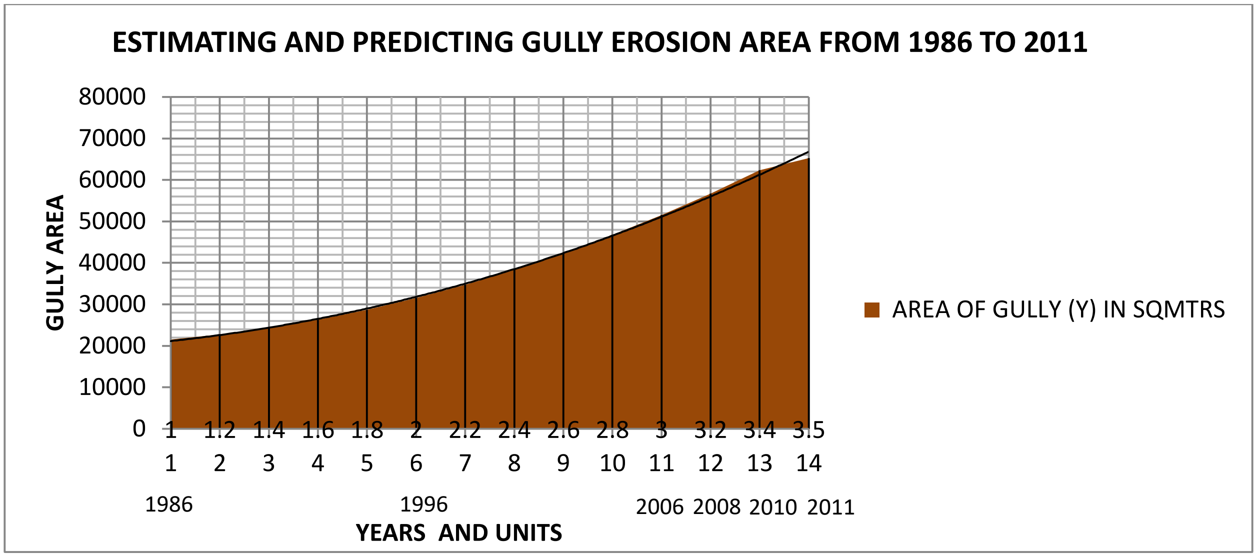

Source: Enemuoh et al, (2012).

Causes of Gully Erosion in Nanka:

- Overstocking or overgrazing
- Lack of crop rotation
- Planting vegetation down the contour instead of along it.
- Inappropriate farming techniques.
- Removal of vegetation cover due to farming activities
- Deforestation due to logging and construction activities
- Diversion of run-off into defective drainage channels
- Housing activities
- Burrow pits along highways
- Quarrying activities for building construction
- Population increase leading to high intensity of human pressure on land.

Effects/Impacts on Nanka

- Destruction and removal of trees and natural vegetation.
- Removal of fertile agricultural top soil and other parts of upper top layers of soil.
- Loss of lives of rural population in Nanka, Oko and Ekwulobia.
- Loss of hectares of valuable land and priceless ancestral properties e.g. loss of lives and ancestral land and homes at Umuachiana, Ekwulobia communities.
- Nanka community is at the verge of losing about 50 homes which is approximately 23256 square meters of land.
- Reduces the limited land resources, renders some of the rural communities homeless.
- Leads to destruction of farmlands and economic trees as well as collapsing of buildings due to high rainfall and high soil erodibility.

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RECOMMENDATIONS

- Rehabilitation of access road to Amako village and proper channeling of flood water en-route established flood plains.
- Flood waters into the gullies at Isiakpuenu and similar gullies should be properly checked controlled and abated using local available measures.
- Regulations, monitoring and supervision of flood and erosion control measures already put in place in the villages, schools and homes to be a continuous exercise.
- Regular monitoring, regulation and supervision of visits to the erosion, gullies and landslide sites in Nanka with a view to converting such site into tourists' attraction for economic gains.
- Each household in the study area to ensure adequate flood water control by proper channeling of the flood water that comes in contact with their compounds to designated flood plains or artificial lakes, shallow wells or catchment pits.
- Vegetation establishment, made up of grassing, tree planting and composting inside the gullies to be a continuous exercise in Nanka and the surrounding communities as means of checking the erosion menace.
- Soil excavation for laterite, stones, sand and other solid minerals exploration and exploitation should continue to be prohibited in the study area.
- Farming and other human activities should be prohibited from 30 meters from the mouth of the gullies.
- Catchment pits should be sunk at strategic locations beside roads, pathways, farmlands, church premises, schools to control flood water from erosion actions.
- Prohibition of indiscriminate cutting of trees and bush burning during farming and hunting seasons, because deforestation aids water velocity during rainy season.
- Establishment of local works committee/task force on erosion to monitor the movement of flood waters from upland villages to lowland villages with a view of checking indiscriminate human activities that aid erosion.
- Sensitization and awareness campaign programmes through regular workshops, electronic and print media billboards and local town criers to enlighten the people of Nanka community and their neighbours on the dangers associated with erosion problems, which have been declared by the governments in power as "National Disaster".

CONCLUSION

From the study, the authors observed that the problems of soil erosion in Nanka-Oko area are readily increasing. This means that the erosion problems don't receive adequate attention. In this study , various aspects of erosion problems have been highlighted, and all necessary data carefully spelt out. Also both analytical and theoretical framework were discussed. It is therefore hoped the soil erosion menace in the study area may soon be halted or reduced to minimal level through government intervention and other interest groups.

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