

The Agulu-Nanka gully erosion menace in Nigeria : what does the future hold for population at risk?

by

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Abstract.

The incidence of gully erosion in Agulu-Nanka area of Anambra State has assumed alarming proportions thereby gaining national recognition as an ecological disaster zone. The aim of this work is therefore to examine the impact of this menace on the population of the area as well as the management and coping strategies adopted by individuals, community and the government. Data used in this study were derived from questionnaire survey, key informant interviews, government and published sources. The analyses and presentation of the data and results utilized combination of complimentary qualitative and quantitative techniques. From our findings, the menace has over the years been responsible for the losses of houses and land of the people thereby rendering them homeless for varying periods of time. Also, it has led to the loss of lives of people and livestock as well as the destruction of farms on which majority of the population depend on for survival. Consequently, the local people have been employing indigenous management strategies while the government of Nigeria has established institutions saddled with the responsibility of managing ecological hazards. However, not much progress has been recorded with regards to combating the menace as both the local people and government carry out intervention measure almost exclusive of each other. The paper therefore recommends among other things, that the management strategies of government should be harmonized with that of the local people with regard to the unique environmental and social features of the area if the menace is to be sustainably tackled. Subsequently, it will minimize and even halt the displacement of the population as well as the perennial loss of lives and properties associated with the hazard.

Keywords: Population displacement; gully erosion; impact of erosion; management strategies; Agulu-Nanka.

Introduction

Disasters have been defined and categorized in diverse ways by various scholars. See for instance, Bates(2002), Keane(2004), Hugo(2009) and Naik (2009). Disasters which may occur from natural or man-made processes often involve large scale alterations of the areas they occur and the suffering of a sizeable number of persons. Human responses to disasters vary according to the nature of the disaster. Advances in science and technology have aided the human race to stop the events, to predict the events, and move out of the ways of such disasters or discover ways of recovery after the events had taken place. However, some notable disasters which when they occur, deaths and loss of property usually result include; oil spills, gas escapes, forest fires, chemical spills, earthquakes, coastal floods and floods generally, droughts, volcanic eruptions, and landslides. Landslides cause death, loss of property and population displacement when they occur in densely – settled areas of the world. Within Nigeria, landslides occur as follow-ups from deep gully incisions (Mozie 2010).

The most devastating gully erosion in Nigeria are found in south eastern Nigeria in the densely populated Anambra, Imo, Enugu, and Abia states. The other lesser area is in Auchi in Edo State of Nigeria. This paper discusses the Agulu-Nanka gully erosion area in Anaocha Local Government Area of Anambra state, Nigeria. The Agulu-Nanka gully erosion area represents a wide area being eaten away gradually and continuously by the landslide cum gully advancement processes covering all of the Aghomili basin. It covers the following communities; Agulu, Nanka, Ekwulobia, Oko, Amaokpala, Ezira and Ogboji.

Methodology.

Questionnaires were used to elicit information from 300 randomly selected respondents across the communities within the gully erosion area under study. The questionnaire contained nineteen (19) structured questions which were administered on the selected respondents. The questions bothered on the different aspects of the gully erosion menace in the study area such as the trend ,regularity , causes , impacts and coping cum management strategies utilized by the affected population. In addition, the authors conducted key informant interviews on some notable stakeholders or leaders of thought in the communities such as traditional leaders, town union leaders, and some retired civil servants. The research also utilized personal observation methods and took pictures of the menace. Finally, the study made extensive use of published

literature from different relevant sources. The analysis of the data was with simple descriptive statistics and the use of logistic regression technique to estimate the influence of impacts of the gully erosion on the migratory tendencies of the population of the study area. Finally, the authors modeled the gully erosion menace in the study area based on existing knowledge of the menace.

Formation of the gully erosion menace.

According to Nwajide and Hoque(1979) and Egboka and Okpoko(1984), the genesis of the present erosion menace in the study area covering Agulu, Nanka, Oko, Ekwulobia, Amaokpala, Ezira and Ogboji communities is traceable to around the year 1850 (about 160 years ago). It started as narrow channels of rill erosion and metamorphosed into gully erosion. By the year 1983, the gully covered an area of about 1100km² and was estimated to grow at a rate of 20-50m per year. Udo(1971) further reported that the problem of gully erosion had been recognized by the British colonial government in 1920s. This claim was later repeated in a radio programme of the Federal Radio Cooperation of Nigeria, Enugu zone in 2008 by one Chief Okoye (Mbuze I of Nanka).(Available at www.frcn.radionigeria.net). Chief Okoye (¹Mbuze 1 Nanka) also noted that the present day gully erosion menace was created with the politicization of the disaster in the early 1930s. According to him,

the gully erosion in Nanka and Ekwulobia started from the flood waters that flow down from Isuofia some seven kilometers and seventy five meters higher to the west of Nanka, Oko and Ekwulobia. The people had wanted to tackle the problem, but were told to wait for the government. In Agulu, the surface flood incidence was also the genesis of the erosion problem and was left unattended to, thus were the gullies created

Presently, the gully is estimated to have a mean advance rate of 150 metres every 3-5 years. The years are often years of exceptionally heavy rainfall and the slides' events take place between June and early October. Exceptional cases of slides occurring in late October and early November are rare, but when they occur, have devastating effects because they are generally atypical and so unexpected. (Okoye, 2009).From the results of our fieldwork, 55.6% of

¹ Mbuze means "gully" in the Igbo language of the people of southeastern Nigeria. That the chieftaincy title of the traditional ruler of the community is Mbuze, is an acknowledgement by the people that the gully erosion has become their unavoidable nearest neighbour environmental disaster. Consequently, they have come to see the menace as part and parcel of the various affected communities.

the respondents are of the view that there is an increase in the incidence of the gully in the past ten years while 22.2% are of the view that there is a decrease in the incidence of the menace and another 22.2% believe that in the last ten years, the trend of occurrence of the gully has shown no significant variation.

Causes of erosion in the study area.

Numerous scholars have written on the causes of the gully advance in Agulu-Nanka erosion zone (Egboka and Okpoko 1984; Egboka and Nwankwor 1985). The incidence and existence of the menace have also been explained in terms of the fragile geological formations, the high intensity tropical rainstorms that last up to eight months in the year, the long history of settlement deforestation, geotechnical and hydro geochemical characteristics of the area as well as with regards to poor land use practices (Egboka and Nwankwor 1985, Igbokwe et. al 2009). Interestingly, traditional ruler of Agulu community while speaking to the study team led by the authors in October 2009 even made allusion to “the land being devastated by the “gods” of the community”. Egboka and Nwankwor (1985) had earlier discovered from their interaction with the natives that the fragile soils were much earlier in time protected by dense forest cover which the people have removed thus exposing the fragile soils to the heavy downpours and concentrated runoffs. The runoffs created the gullies which have blossomed into the badland topography of today and the continuous back wearing (advancement) of the gully heads via sliding processes. Mozie (2010) also identified a further mechanism of the gully advance exacerbation to be *tapping*.

Figure 1 shows a model developed for the humid tropics showing the major factors of soil erosion in southeastern Nigeria where our study area is situated (Ofomata, 1985, 2002).

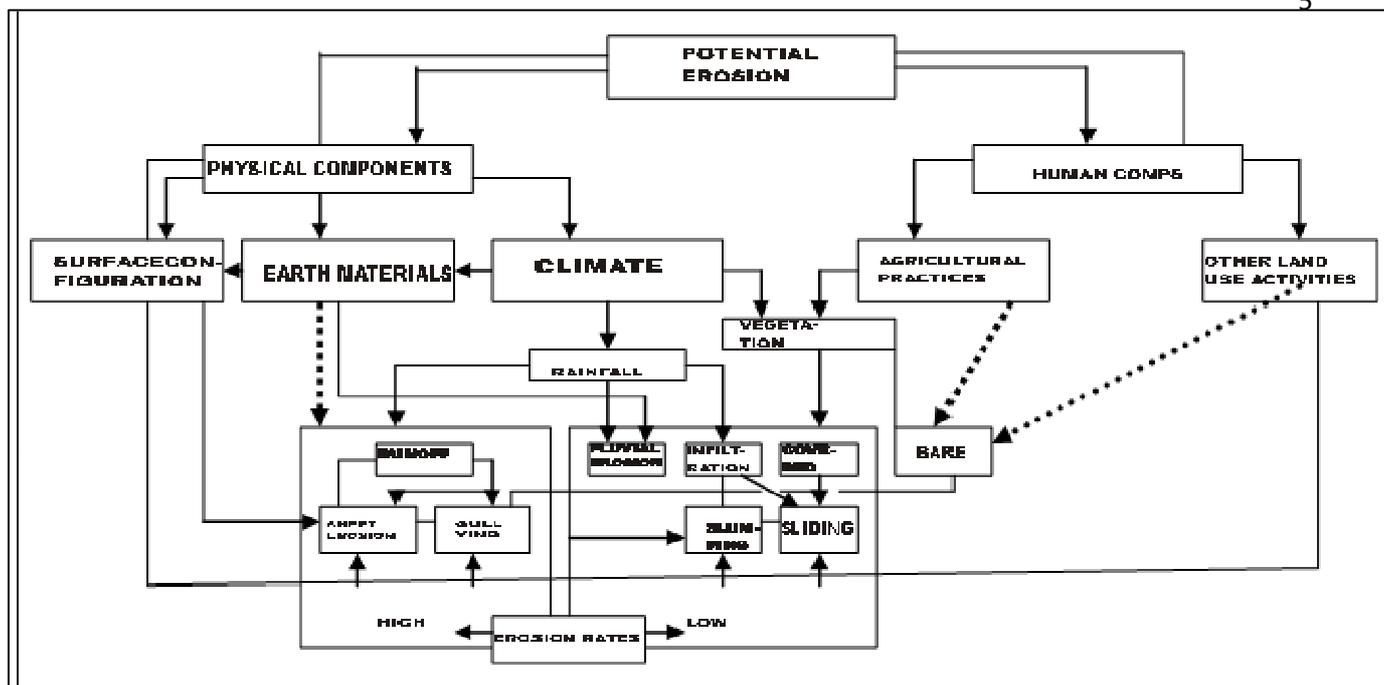


Fig 1: Soil Erosion model (Humid Tropical Areas)
Source: Ofomata(2002)

The model was developed using anthropogenic factors, relief, rainfall, vegetation and surface materials as the most critical prevailing parameters in the development of erosion in the southeast of Nigeria as at the time of the development of the model. The solid lines depict direct relationships while the dotted/pecked lines show indirect relationships. From fieldwork which relied much on the model by Ofomata(1985; 2002), as well as the views of the populations concerning the menace, it was possible to elicit from the villagers who are in direct contact with the menace, what in their own view are responsible for the proliferation of the gully. Table.1 reflects their responses about what causes the erosion in the study area.

Table 1: Responses to the various major causes of gully erosion in the study area(%) Source: Authors fieldwork	
Causes of gully erosion	Proportion of responses by villagers(%)
Deforestation	48.6
Types of soil	33.3
Bush burning	9.7
Continuous cropping	16.7
Excavation of soil	31.9
Topography/ relief	61.1
High rainfall	66.7
Lack of good drainage system	54.2
Road building	9.7

From the table above, more than 67% of the respondents identified relief and high rainfall to be the major causes of the menace in the study area. The emphasis on these factors may be attributed to the high rainfall experienced in the humid tropics while the steep slopes existing in the area may also have aided the high speed of surface run-off culminating in rapid washing away of the soil surface and the weakening of soil strata. Other factors which the respondents attributed high importance with regards to the causes of erosion are lack of good drainage systems and deforestation.

Impacts of the gully erosion in the study area.

The gully erosion has led to the loss of agricultural and residential lands estimated from aerial photographs mosaic and topographic map to be in excess of 500,000 hectares of land. According to Okoye(2009), estimates of losses of lives in Agulu and Nanka which are pressed hardest are in excess of 200 persons since he became an adult. Table 2 shows the trend in occurrence of the impacts of the gully erosion in the last ten years. It can be seen that there have been increases in the loss of farms, forests, pasture, houses, soil fertility, displacement of population and the creation of badlands. On the other hand there have been decreases in the loss of human lives and livestock.

In terms of the regularity of the occurrence of these impacts of the menace on the communities, creation of badlands, loss of forests, loss of pasture, loss of houses, and loss of soil fertility seem to occur very often while displacement of population, loss of farms and houses seem to be the

Table 2: Responses to the trend of occurrence of impacts of erosion in the last ten years by respondents from the study area (%)			
Source: Authors fieldwork			
Impacts of erosion	Increasing	Decreasing	The same
Loss of Human Lives	19.4	59.7	19.4
Loss of Farms	72.2	23.6	4.2
Loss of Houses	58.3	27.8	27.8
Loss of Livestock	33.3	44.4	20.8
Loss of Forests	59.7	27.8	12.5
Loss of pasture	47.2	41.7	11.1
Displacement of populations	56.9	26.4	16.7
Establishment of badlands	59.7	29.2	11.1
Loss of fertility	65.3	18.1	16.7

major impacts that occur often in the study area. Of note is the fact that loss of human life seems to occur rarely within the past ten years and this may be due to the ability of affected population to move out of severely affected areas as environmental refugees to safer locations within and outside their communities.

Table 3: Responses to the regularity of the occurrence of impacts of erosion in the last ten years by respondents from the study area(%)
Source: Authors fieldwork

Regularity of occurrence of impacts of erosion	Very often	often	Sometimes	Rarely
Loss of Human Lives	22.2	11.1	31.9	34.7
Loss of Farms	25	34.7	27.8	12.5
Loss of Houses	27.8	36.1	22.2	13.9
Loss of Livestock	23.6	26.4	29.2	20.8
Loss of Forests	36.1	26.4	25.4	12.5
Loss of pasture	34.7	31.9	22.2	11.2
Displacement of populations	26.4	34.7	31.9	6.9
Establishment of badlands	54.2	23.6	11.1	11.1
Loss of fertility	48.6	30.6	8.3	12.5

Responses to, prevention and management strategies of the erosion in the study area.

This section appraises the responses by government, community members and the out-migrants over the years to the menace. These responses to the vulnerability of the population of the study area are seen to be in the form of prevention, management/coping strategies, and mitigation. However, due to the fact that these responses by the above mentioned stakeholders has been carried out almost exclusive of one another, the menace has continued to assume even more alarming proportions.

❖ Measures by Governments in Nigeria to prevent and manage the gully erosion menace

Udo (1971) showed that first attempts at containing the menace by government in the study area was via the establishment of a soil conservation scheme financed by the Colonial Welfare and Development Fund. The project if successful was to serve as a model for checking gully growth and as an antierosion demonstration for other agencies working in areas suffering similar problems. By 1950, the erosion control unit had worked on some 134 gullies, built 805

dams, 24 miles (384 kms) of contour ridges and 33 miles (53 kms) of path with 4336 sumps. Villagers were also trained on gully checking methods.

The Eastern Region of Nigeria Government in 1964 also declared its intention to fight the gully expansion. The government was just about to come to grips with the problem when the pogrom and the Nigeria-Biafra civil war stopped every plan on the project. The gully expansion continued all through the war years until after the war in 1970. Attempts to meaningfully combat the erosion problem was resuscitated after the civil war in a manner that grossly under estimated the size of the efforts required to achieve any meaningful results. The populations of the gully erosion area were left with minimal support from the Federal and State governments until 1974 when the Federal Government of Nigeria focused its attention once more on the problem. In 1974, the Federal Government awarded a multi-million naira contract to an Italian firm, Technosynthesis S.P.A to study the erosion phenomenon in Nigeria, produce a soil erosion map of the country and present a battery of measures required to check erosion in each of gully erosion zones (Eze Uzoamaka et. Al 1979; Niger-Techno 1978). The result of the survey by Technosynthesis as sourced from Ofomata (2002) is contained in table 4.below.

In November 1983, the President of Nigeria awarded an interim contract for the construction of drainage channels with a promise to design and award a contract for a comprehensive management of the menace on his return to Lagos, then capital of Nigeria. His administration was however toppled in a military coup the next month and his plans got abandoned. That drainage channel he instructed to be constructed up till today seems to be the only visible sign of government's intervention measure to the menace even though the channel was not properly completed. In all, 51% of the respondents are of the view that government measures has contributed to a little extent in management of the menace, 40% believe that government measures contributed to no extent in managing the menace while 9% insist that government measures have contributed to a great extent in the management of the menace.

Table 4: Characteristics of major gullies in prominent erosion areas in Omambala, Imo and Abia states.
Source: Based partly on NIGER-TECHNO (1978, p. 26), and partly on field work. (Ofomata, 2002)

Location		Area of Basin km ²	Area of Gullies (active and inactive) km ²	Area of Active Gullies km ²	Length of Gullies (active and inactive) km	Width of Gullies (active and inactive) Km	Perimeter (active and inactive) km
State	Area						
OMAMBALA	Alo	16.3	1.25	0.5	6.6	1.6	4
	Nnobi	32.0	2.5	1.5	3.6	1.5	30
	Nnewi	33.5	2.5	0.01	6.0	1.5	19.5
	Adazi	21.0	1.3	0.3	3.7	1.3	10.5
	Agulū **	5.0	0.4	0.11	1.8	0.5	4.5
	Agulū (Main)**	12.0	3.25	1.5	3.2	2.0	7.5
	Nanka **	11.2	2.85	1.4	4.0	1.3	6.0
	Oko **	2.7	0.3	0.01	0.7	0.8	5.8
	Ekwulobia **	7.5	1.15	0.03	3.8	0.4	13.6
IMO & ABIA	Okohja	41.9	28.61	0.03	12.5	5.6	45.0
	Uruala	21.6	1.30	0.07	1.7	1.0	22.5
	Ọlụ	16.5	3.60	—	3.8	1.7	12.5
	Amucha	38.2	1.20	0.06	5.2	1.3	15.6
	Okwudọ	—	0.05	0.05	0.7	0.071	—
	Abiriba	13.4	1,15	0.07	4.6	2.4	26.2
	Ọhafja	8.0	0.7	0.15	1.0	0.4	18.4

** The study area.

Over the subsequent years, different Acts, policies and programmes have been mounted by the federal government of Nigeria to manage the different components of the environment in the country. Mozie (on-going) discussed these Acts, policies and programmes some of which are;

- ❖ The Land Use Act of 1978.

- ❖ ²The Ecological Disaster Relief Programme which seeks to render assistance to areas prone to disasters such as soil erosion, flooding, desertification, oil spillage and general pollution. The programme is financed by the National Ecological Fund established in 1989.
- ❖ The Federal Environmental Protection Agency (FEPA) Act of 1988.
- ❖ The Federal Environmental Protection Act of 1992.
- ❖ Establishment of the Federal Ministry of Environment in 1999.
- ❖ Section 20 of the 1999 constitution of Nigeria which enjoins the Federal Government of Nigeria to “protect and improve the environment and safeguard the water, air, land and wildlife of Nigeria”
- ❖ The National Emergency Management Agency (NEMA) Act of 2000.
- ❖ The National Environmental Standards and Regulations Enforcement Agency Act of 2007.
- ❖ The National Climate Change Commission Act of 2009.

From the above, it is clear that there is yet no Act or Law in Nigeria targeted specifically to the management of soil erosion. In some of the above mentioned Acts and policies, soil erosion is treated as an integral component of environmental problems despite the fact that it has now assumed alarming proportions especially in the southeastern parts of Nigeria. Maybe, in recognition of this anomaly, FEPA commissioned Prof. Adegoke et.al to prepare a **Draft Objectives and Strategies for Nigeria, Agenda 21**. The draft noted that in Nigeria;

the environment is indeed at risk due to a number of interdependent issues, which include soil degradation, water contamination, deforestation, soil erosion, biodiversity losses, air pollution and water hyacinth menace (p.3)

Consequently, section 2.3 of the draft contains the erosion control programme mission statement which seeks to;

Arrest all major active erosional gullies and sites and enforce management practices aimed at preventing/controlling activities which provoke the incidence of erosion and gullyng (pp12)

- ❖ *Measures by the population to prevent/ manage the menace.*

² Extracted from Adegoke et.al.

From 1950 to 1980, the people were left to battle the menace practically on their own with little government assistance. Udo (1971) reported that the problem which bedeviled the soil conservation scheme was finding alternative plots for those whose farm plots were taken over for purpose of construction of anti-erosion structures due to the regulation made by the Aguata Native Authority (equivalent of present drop local Government council). The view of the Authority was that the community should find new land for those whose lands had been taken up on the principle of collective responsibility. The problem was exacerbated by the insistence of the ex-servicemen who had just returned from duty tours in oversea countries during the Second World War that it was the duty of the native administration, to reclaim and restore the land. This state of quarrelling continued until independence. Our fieldwork also revealed that all the civilian governors of Anambra State have visited the site over the years, especially when the menace had claimed lives and or properties, and yet no significant government intervention have been instituted to manage the situation.

In all, the plans presented all through the history of the Agulu gully erosion control, very little attention has been given to the plight of displaced person. It has always been the case of “find another abode for yourself if your house is swallowed by the gully”. This attitude arose from the 1950 situation and has been maintained ever since then. This is not unexpected because the African is practically identified with his land. The field study was therefore designed to cover as large a vista as was possible to enable an in-depth understanding of the gully erosion problem from the perception of the inhabitants (indigenes) of Agulu. Specially, the field visit decidedly investigated into the aspects of the vulnerability, impact and adaptation (residence) of the indigenes of Agulu to the gully erosion problem that has been with them for over one hundred and fifty years. The situation in the study area seem to agree with the postulations noted in Hunter (2005) cited in Bilsborrow(2009) about the dispositions of most poor rural settlement which experience disasters in any of the ways listed below;

- They are not aware of the hazard.
- They are aware, but do not expect a disaster.
- They expect a disaster , but do not anticipate loss.
- They expect a loss, but not a serious one.
- They expect a serious loss and have taken, or are planning to take, actions to mitigate such loss.
- They expect a loss, but have accepted it as the price they pay for locational benefits.

- They have nowhere to go.

Table 5 below shows the responses by the villagers on the methods they employ to prevent and or manage the menace in order to forestall or mitigate the impacts noted in preceding section of this paper. The major measures utilized by the villagers seem to be afforestation, construction of drainage channels, and planting of cover crops.

Table 5: Responses to the measures used by villagers to prevent/ manage erosion in the last ten years by respondents from the study area(%).	
Source: Authors Fieldwork	
Measures used by villagers to prevent/manage erosion	Proportion of responses (%)
Afforestation	70.8
Contour planting of crop	48.6
Use of sums	41.7
Construction of drainage channels	77.8
Mulching	12.5
Planting of cover crops/carpet grasses	80.6
control of bush burning	30.6
Use of crop rotation	6.9
Multiple cropping	15.3
Zoning/controlling of use of pasture	15.3
Erection of sand banks	40.3

In addition to these measures in table 5, we also found out that the community also help out victims of the menace to recover from, and cope with any losses incurred from a disastrous incident. Most of our respondents(70.8%) stated that the community helps victims to rebuild houses, mainly through the supply of free human labour. On the other hand, 48.6% of respondents stated that the community helps out through donation of relief materials while 37.5% of respondents agree that the community may contribute and give money to victims to help them weather the impacts of the menace.

Furthermore Bell (2000) is of the view that responses to dangers presented by disaster are of the varying nature as noted below. While some of the responses are in agreement with those outlined by Hunter (2005) fourth dimension i.e (d) below which recognizes the tendency of affected population to move out of disaster- prone areas as environmental refugees was included. The responses identified are that the affected population;

- a) Understand the mechanism of the disaster and obviate it.

- b) Anticipate and obviate the disaster from preventive land use and land use planning
- c) Suffer the disaster and plan for post- disaster risk weaves which include management of land and physical infrastructure and human victims and or
- d) Understand the mechanism of the disaster and move away from disaster – prone zones.

In the study area, about 81% of respondents have people in their households who have migrated because of the erosion in the last ten years . Another 85% of respondents are also aware of people who have moved out of their village in the past ten years because of the menace. Subsequently, the tendency to migrate due to erosion was regressed against the impacts of the erosion in the study area so as to estimate the relative influences of the impacts on migration out of the study area. Table 6 shows the results the regression analysis. Loss of houses, displacement of populations, loss of farmlands and loss of forests have significantly influence gully-affected populations to move out of the disaster areas. These four impacts are central to the existence and livelihoods of the people and when they are lost, since the population affected may have no other thing to fall back to. To make matters worse, the area is densely populated and the people attach much importance to ³land which is consequently very expensive, hence no one is willing to release his land to another as noted earlier in this paper. Moreover, loss of forest means lack of means of livelihood as the population depend on agriculture for their sustenance. Forest products are also of high medicinal value and may serve as a means of checking the spread of the menace.(see table 4 above). About 45.8% of the respondents stated that their local measures have contributed to a great extent in mitigating the impacts of the erosion, 44.4% of respondent are of the view their local measures have contributed to a little extent in mitigating the menace while 9.7% of respondents stated that their local measures have contributed in no significant way in mitigating the menace.

³ Land in the area is gotten by inheritance and the people believe that disposing of land may spell doom to them. In fact, some of them worship land as “god”. Therefore, despite the Land Use Act of 1978 with vest ownership of all lands in Nigeria on the government, it is still difficult for government to access land in these area.

Table 6: Regression analysis of the impact of erosion on out-migration in the study area.
Source: Authors Fieldwork

Impacts of erosion	Regression coefficients
Loss of lives	-0.297
Loss of houses	0.588**
Loss of farmlands	0.424**
Loss of livestock	-1.056
Loss of forest	1.804**
Displacement of populations	0.630**
Damage of road	0.031
Loss of soil fertility	-0.238
Creation of badlands	0.202

** significant at 0.05 confidence level.

This study also found out that the erosion-induced out-migrants also help their relatives and other members of the community who may be affected by the gully. Most of the respondents(65.3%) agree that the migrants help them out with expertise and skills learnt in their various places of destination. These ideas are passed over to people left behind to replicate in the study area on the premise that it will help control the menace. The migrants according to our respondents also bring over displaced relatives to live with them in their places of destination(33.3% of respondents), send money to victims (22.2% of respondents), send building materials for rehabilitation of damaged houses or building of new houses to replace lost ones(20% of respondents), send food to victims (19.4% of respondents) and donate relief materials in times of occurrence of disaster(16.7% of respondents).

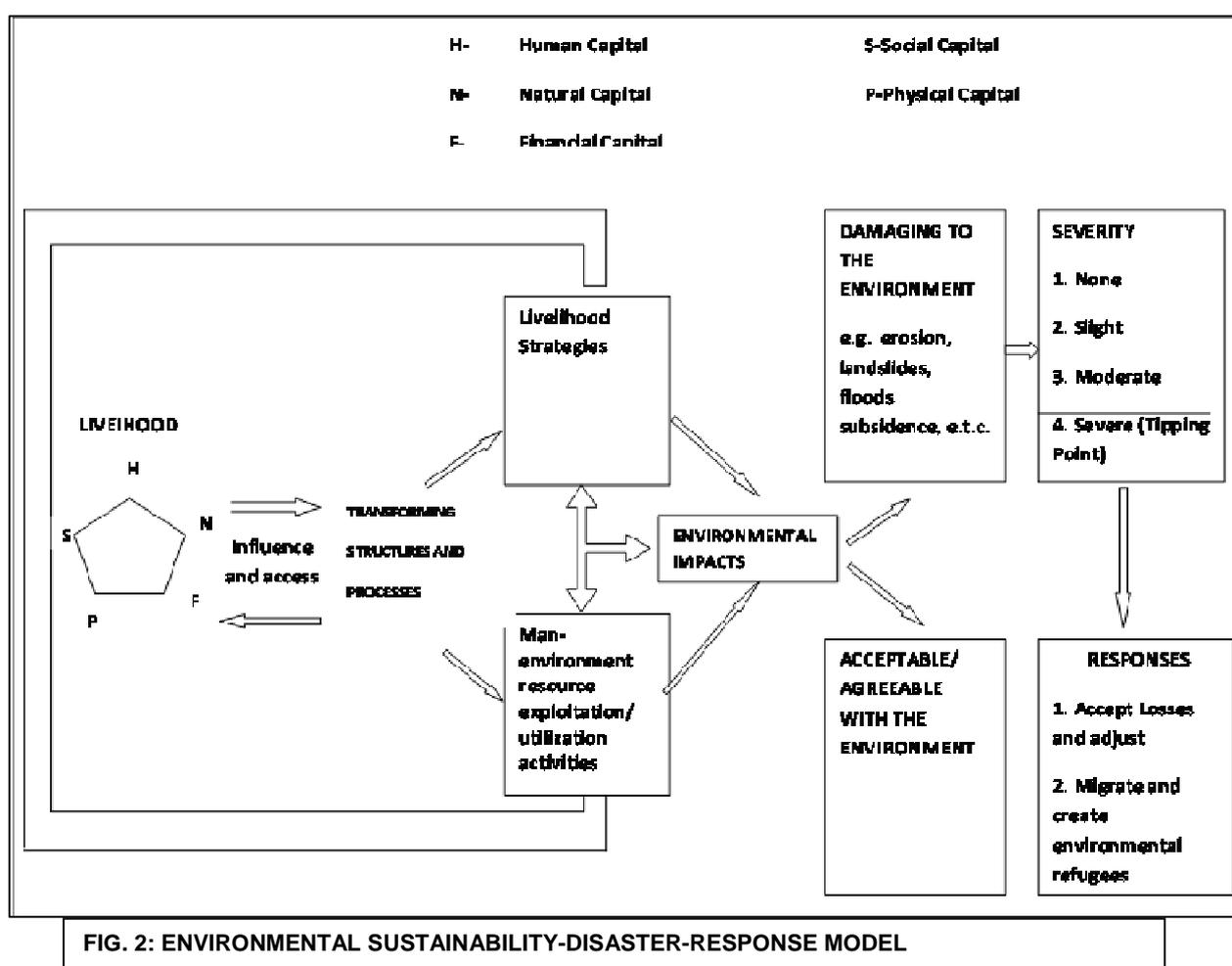
MODELING THE AGULU-NANKA SITUATION

Having assayed information from literature and the field work respondents, the authors here try to formulate and present a model of the typical situation in the Agulu-Nanka gully erosion area. The authors accept as a first line of information the knowledge and ability of man to damage or preserve his environment. This fact is attested to by the findings and assertion of Fussel and Klein (2006); Leary et. al. (2007); and Agrawal (2008) that adaptation to hazards is a function of the local knowledge of the people about the hazard in question and their relationships in their environments. Biermann (2009) in line with earlier writers advocates that adaptation strategies are successful when they are democratic or as stated in their exact views

“bottom-up and community-based “(Fabricius et. al., 2007; Huq and Reid 2007; and Thomalla et.al., 2005).

The authors argue with conviction that hazards and disasters have no meaning or value, except in the context of damages and injuries suffered by man whether they occur by natural processes or by the deliberate acts or omission of man (Ziervogel et. al. 2006). Responses by way of vulnerability, and adaptation are subject to assessment even if the outcome of the exercise are guided, and intelligent guesses. They achieve one and which is a formal and replicable estimation of the outcome of any attitude adopted on response to hazards and disasters. Whichever the impacts of hazards or disasters are looked at, any model would be designed with regards to seeing the events as “likely to occur in the near of far future” or “having occurred”. Some hazards which eventually graduate to disasters creep upon mankind, (Ofomata 2001). Given the fact that some hazards graduate up to certain points called “thresholds” , Biermann (2009) called this point the “tipping point”.Such tipping can lead to the experience on the affected victim population of irreversible economic, social, political or environmental collapse - in short a humanitarian crisis. In view of this, threshold (tipping) points must be identified, anticipated and avoided. Hitherto, hazard and disaster impact assessment were retrospective and outcome oriented. This approach meant that man could only do a post disaster response. The advance in the science and technology have however caused a remarkable shift in disaster response paradigm to being pro-active and anticipatory, from the proactive and anticipatory paradigm, we have moved to a new frontier of the installation and assurance of adaptive capacity in vulnerable groups (Fussel and Klein 2006). Mozie (2010) argue that the governments within any political unit have the primary and major capacity and resources whether by way of legislative or coercion to shape the adaptive capacity and capacity for resilience in any political system. Thus hazard and disaster management has a direct relationship to the performance and philosophy of the governments of the groups at the international, national and sub-national level.

Hazards and disaster have scales. We can look at the dimensions of disasters from points of magnitude as in earthquakes, area affected and number of people injured; displaced or killed. The nature, time, scale and vulnerability, adaptive capacity and residence of a people combine to determine the scale of damage of any hazard or disaster (USGS, 2010). Our traverse of existing literature on man environment (environmental sustainability) relationship commends to us in our attempt at formulating a model for the Agulu-Nanka gully erosion/landslide-gully advance zone, the DFID (1999) model as a preliminary tool. The model is shown as figure 2.



The man-environment relationship rests on the sustainability of human livelihood and the environment even as man takes from the environment. The man-environment relationship is driven by certain factors here referred to as capitals represented in the Asset Pentagon. The stocks of capital may be natural, human, financial, social and physical. They are utilized directly

is indirectly to assure the sustenance of the material well-being of the people. The natural resources are the environmental resources such as water, rocks, relief, vegetation, climate which provide the materials utilized or exploited by the people in the area. The physical resources enable the environmental resources to be utilized according to the techno-economic endowment of the people, transferred to create roads, buildings, tools, machines, and communications, e.t.c which enable man to master and control the dynamics of his environment. The more advanced the people, the greater the control and mastery over their environmental resources. This leads us to the human capital which interacts with the environmental capital to create the other capitals. The financial capital is the stocks of money in a society and how they are channeled or distributed within the economic sub-sectors of the national economy. In countries with balanced –up distribution of wealth, the environmental resources system are less abused and stressed than where there is bottom-down distribution. In this vein, in countries where poverty pervades, environmental resources are seen more as bioresources than biodiversity and the environment bears the full weight of providing means of livelihood for the people.

The effect of the financial, human and physical capital on the natural capital creates the social capital. This capital has been described by Ajaero (2008) as the fabric of the society- its nature, strength, variety amongst the various units of the society. It mirrors the responsiveness and resilience existing and capable of being exhibited by a society. In economically stressed and depressed society where the other capitals are badly stressed the social fabric is weak and tensed to the limit disabling the people to give appropriate and adequate responses to emergencies, hazards or disasters whether in the pre or post –disaster, assumes gargantuan dimensions. It may be correct to say that where the resources are used harmoniously with the social, economic and sustainability factors in mind and sight, the environment is better preserved and the people better presented.

The state of the environment and the presence or absence/ control of hazards is a function of the operation of the system of capitals through transforming processes and structures. The relationship comprises the native attitudes, values and strategies of resource utilization and exploitation activities. The nature and intensities of resource utilization/ exploitation hold and dictate consequences for the environment. In some areas, there is a deliberately installed and sustained harmony between resources exploitation/ utilization and the environment. The words installed and sustained are very deliberately used because the state of

the environment system and sub-systems depends on the degree of care shown by man for his environment (Nir,1984). In some other environments, the consequences are very damaging to the environment. Examples of severe damage exist globally such as the dust bowl of Arizona, the Badlands of Dakota and in the Agulu-Nanka-Okoko-Ekwulobia badlands.

If the issue of environmental damage is viewed in degrees of damage, it can be scaled from (none) no damage at least at the outset when the damage has not manifested itself; (slight) at the incipient stage of the damage, through moderate until it reaches the severe stage where the damage reaches disaster proportions requiring prohibitive costs and efforts for it to be mitigated which governments are unwilling to provide. This is the Tipping Point as the irreversibility of the disaster causes the inhabitants of the affected regions to migrate. This was the case in the Dust Bowl as families of farmers who had farmed the soil to exhaustion migrated from the region to other places. The area remains as a global reminder of bad land use practice and management till date.

The Agulu area appears to be adequately explained by its model as follows.

- (1) The people live in any of the land/soil and are not wealthy in any case despite the deception that the houses of a few well-to-do persons present.
- (2) The history of the problem shows that the area became distressed from land use activities.
- (3) The ugly consequences of today resulted from about One hundred and Sixty years of deliberate abuse of the biosystem though in initial ignorance. The abuses followed further from lack of knowledge, will and capital to address the problem adequately. Between 1930 and 1950 the creation of environment refugees had commenced and continues till date because the disaster has assumed gargantuan proportion due to the huge amount of money estimated for the restoration of the land/ soil complex in the study area.

Conclusion

From the discourse above, the following conclusions are made;

- The gully erosion has over the years contributed to loss of lives, loss of properties and displacement of population(environmental refugees).

- There exist no significant structure of protection instituted by government for victims of the menace. The affected population are almost left to cope with and manage the disaster on their own.
- In Nigeria, some environmental laws exist but none is specifically directed at soil erosion, which various governments have acknowledged as a disaster affecting almost all parts of the country.
- Despite the existence of various environmental laws in Nigeria, there is a glaring gap between formulation environmental policies/laws and their implementation in Nigeria. Specifically, despite the existence of various commissions, ministries and policies, little or nothing has been done to prevent, manage or mitigate the gully erosion menace in the study area within the last 15 years at least. As a matter of fact, the erosion site is gradually being converted into a “tourist center” even as the inhabitants are gradually being pushed out of their abode and denied their primary source of livelihood.
- There also exist a lacuna between efforts by government and efforts by the communities with regards to management of the menace with the result that it seems as if nothing has been done to manage the menace.

In view of the above, we recommend that participatory management strategies/policies be developed by government and the population at risk. Secondly, government should enact laws and implement programmes specifically directed at solving erosion-related problems. Furthermore, the population should be educated on the sustainable use of their natural resources/capital in order to minimize stress on the environment.

References

- Adegoke, O.S.; Imevbore, A.M.A.; Ezenwe, U.; Awogbade, O.O.; Bashir, D.; *Draft objectives and strategies for Nigeria's agenda 21*. Paper prepared for the Nigeria Federal Environmental Protection Agency(FEPA), Abuja
- Adger, W.N.; Brown, K.; Fairbrass, J.; Jordan, A.; Paavola, J.; Rosendo, S.; Seyfang, G. (2003): Governance for Sustainability: towards a 'thick' analysis of environmental Decision making. In: *Environment and Planning A*. vol. 35, pp. 1095-1110.
- Agrawal, A. (2008): *The Role of Local Institutions in Adaptation to Climate Change*. International Forestry Resources and Institutions Program Working Paper 081-3.
- Ajaero, C.K.(2008): *Spatial impacts of rural-urban migration on rural livelihoods in southeastern geo-political zone of Nigeria*. Unpublished doctoral seminar, Department of Geography, University of Nigeria, Nsukka.

- Ashekoya, T. (2009): *Summary of the report on the assessment of gully erosion in affected areas in Southern States of Nigeria*. Available at www.frcn.radionigeria.net Abuja.
- Bates, D. (2002): Environmental refugees? Classifying human migration caused by environmental change. In; *Population and Environment*, 23(5), Springer, The Netherlands.
- Bell, G. (2000): *Geological Hazards*. McGraw- Hill Publishers, New York,
- Berkes, F. (2007): Understanding Uncertainty and Reducing Vulnerability: Lessons from Resilience Thinking. In: *Natural Hazards*. vol. 41, pp. 283-295.
- Biermann, M (2009): *The Role of Local NGOs in Anticipating and Responding to Climate Change*. Prepared for Munich Re Foundation and United Nations University Institute for Environment and Human Security co-organized "2009 Summer Academy on Social Vulnerability: Tipping Points in Humanitarian Crises" 26 July-1 August, Munich, Germany.
- Bilsborrow, R.E.(2009): "Issues of uncertainty and data requirements" In: Laczko, F. and Aghazarm, C.(Eds.) *Migration, environment and climate change: Assessing the evidence*. IOM, Geneva . pp77-107.
- Department for International Development (DFID), (1999): *Sustainable livelihoods guidance sheets*. Department for International Development, London.
- Egboka, B. C. E.; Nwankwor, G. I. (1985): The hydrogeological and geotechnical parameters as agents for gully type erosion in the Rain-Forest Belt of Nigeria .In: *Journal of African Earth Sciences*, vol. 3, No. 4, 47-425.
- Egboka, B.C.E.; Okpoko, E.I.(1984): Gully erosion in the Agulu-Nanka region of Anambra State, Nigeria. *Proceedings of the Harare Symposium, Publication number 144, July, 1984*.
- Eze Uzoamaka et al. (1979): *Niger – Techno (1978) Soil Erosion control in Imo and Anambra State* Summary reports.
- Fabricius, C.; Folke, C.; Cundill, G.; Schultz, L. (2007): Powerless Spectators, Coping Actors, and Adaptive Co-managers: A Synthesis of the Role of Communities in Ecosystem Management. In: *Ecology and Society*. vol. 12, no.1, pp. 29-44.
- Füssel, H.-M.; Klein, R.J.T. (2006): Climate change vulnerability assessments: An evolution of conceptual thinking. In: *Climatic Change*. vol. 75, pp. 301-329.
- Hugo, G.(2009): Migration, development and environment. *International Organization for Migration(IOM), Geneva*
- Hunter, L.(2005): Migration and environmental hazards. In: *Population and Environment*, 26(4):273-302

- Huq, S.; Reid, H. (2007): *Community-based adaptation: a vital approach to the threat climate change poses to the poor*. International Institute for Environment and Development, London, UK.
- Igbokwe, et al. (2008): Mapping and Monitoring the Impact of Gully Erosion in Southeastern Nigeria with Satellite Remote Sensing and Spatial Information Science. In: *Intl. Archives of Photog. Remote Sensing and Spatial Information Sciences*.vol. 37, Part B, pp. 865-71, Beijing. China.
- Isiwa, S.(2008): Disasters affect Nigeria's Growth. *Leadership Newspapers*. October 30, p.17.
- Keane, D.(2004): Environmental causes and consequences of migration: A search for the meaning of environmental refugees.In:*Georgetown International Environmental Law Review*.Available at http://findarticles.com/p/articles/mi_qa3970/is_200401/ai_n9353848/pg_1.
- Leary, N.; Adejuwon, J.; Barros, V.; Batimaa, P.; Biagini, B.; Burton, I.; Chinvano, S.; Cruz,R.; Dabi, D.; de Comarmond, D.; Dougherty, B.; Dube, P.; Githeko, A.; Hadid, A.A.;Hellmuth, M.; Kangalawe, R.; Kulkarni, J.; Kumar, M.; Lasco, R.; Mataki, M.; Medany, M.; Mohsen, M.; Nagy, G.; Njie, M.; Nkomo, J.; Nyong, A.; Osman, B.; Sanjak, E.; Seiler, R.; Taylor, M.; Travasso, M.; von Maltitz, G., Wandiga, S.; Wehbe, M. (2007): *A Stitch in Time: Lessons for Climate Change Adaptation from the AIACC Project*. AIACC Working Paper No. 48.
- Mozie, A.T. (2010): Some Observation on the Causative Factors and Slide Processes in the Ududonka Gully Head, Isiama Igbo, Agulu, Anaocha L.G.A, Anambra State. *Paper presented at the International Conference on Slides and National Hazards organized by the Geology Department, UNN, and the Landslide Institute, Kyoto Japan, March 21-26-2010 University of Nigeria, Nsukka*
- Mozie, A.T.(On-going): *A discourse on the environmental laws of Nigeria*.
- Naik, A.(2009): Migration and natural disasters. In: Laczko, F. and Aghazarm, C.(Eds.) *Migration, environment and climate change: Assessing the evidence*. IOM, Geneva . pp 247-317.
- Nir, D. (1984): *Man, a geomorphological agent: an introduction to anthropic geomorphology*. Kluwer Publications, London.
- Norwegian Refugee Council (NRC)(2009): *Climate changed: people displaced*. Report No.3
- Nwajide, S.C. and Hoque, M. (1979): Gullying processes in south-eastern Nigeria. In:*The Nigerian Field Journal*. 44(2), 64-74
- Nwajide, I. N.(1996): *Process and forms of soil erosion in Alor, Idemili local government area of Anambra State*. Unpublished B.Sc. project, Department of Geography, University of Nigeria, Nsukka.

- Ofomata, G.E.K. (1985): *Soil erosion in Nigeria: the views of a geomorphologist*. University of Nigeria Inaugural Lecture Series No.7.
- Ofomata, G.E.K.(2002): Soils and soil erosion. In: Ofomata, G.E.K(Ed): *A survey of the Igbo nation*. Africana First Publishers Ltd, Onitsha. pp 99-116.
- Okoye, J. (2009): *Oral Communication*. October 18, 2009, Isiama Igbo village, Agulu Anaocha LGA, Anambra State
- Okoye, N (2008): Federal Radio Co-operation of Nigeria (FRCN)Radio programme. *Ka Oha Malu*, FRCN, Enugu
- Reid, P.; Vogel, C. (2006): Living and responding to multiple stressors in South Africa-- Glimpses from KwaZulu-Natal. In: *Global Environmental Change*. vol. 16, pp. 196-206.
- Thomalla, F.; Cannon, T.; Huq, S.; Klein, R.J.T.; Shaerer, C. (2005): Mainstreaming Adaptation to Climate Change in Coastal Bangladesh by Building Civil Society Alliances. In: *Solutions to Coastal Disasters*. Charleston, SC. pp. 668-684.
- Udo, R. K. (1971): *Geographic Regions of Nigeria*. Heinemann Publishers, Ibadan.
- United States Geological Survey (USGS)(2010): *Landslides-facts*
- Ziervogel, G.; Bharwani, S.; Downing, T. (2006): Adapting to Climate Variability: Pumpkins, people and policy. In: *Natural Resources Forum*. vol. 30, pp. 294-305.