

A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of Nigeria.

Amatobi, D. A.¹, Adenaike, O. A.²

^{1,2} Department of Civil Engineering, Akanu Ibiam Federal Polytechnic Unwana, Afikpo, Ebonyi State, Nigeria

¹Corresponding Author: Amatobi, D. A

Received 20 December 2019; Accepted 03 January 2020

Abstract: Gully erosion has remained an intractable problem in the South East Region of Nigeria despite the huge sums of money being spent to curb the menace by the Federal and State government. This study explores the causes and consequences of gully erosion in South Eastern States of Nigeria. It identifies some natural causes (precipitation, topography and soil properties) as well as human causes (vegetation clearance, uncontrolled urbanization, road construction, and poor farming practices) of gully erosion. It also enumerates the consequences of gully erosion in the South Eastern Nigeria. The study highlights the current efforts undertaken to address gully erosion in the South East Region of Nigeria. It concludes that the current approach of addressing gully erosion in South Eastern States is driven by the federal government down to the states, while the local government and affected communities are passive participants. Facts gathered from this study suggest that the current approach has neither been effective nor will it be sustainable for the control and prevention of gully erosion. Despite allocating billions of Naira annually to address gully erosion in the South East Region, the number of active gullies is on the increase. Therefore, this study proposes a bottom-up approach which can make the affected communities and local governments the most active participants in the control and prevention of gully erosion in Nigeria. The study recommends the implementation of the proposed bottom-up approach for effective and sustainable reduction of gully erosion in South East Region of Nigeria.

Keywords: Active, Approach, Bottom-up, Effective, erosion gully

I. INTRODUCTION

Gully erosion is a major ecological problem in Southern Nigeria, but more so in the South Eastern States of the country. In 1997 the Nigerian government estimated the existence of 2000 active gully erosion sites in the country (Olawumi, 2009) but in 2018, according to an assertion credited to World Igbo Environmental Foundation [WIFE] (Premium Times Agency Report, 2018) more than 2,800 active erosion sites exist in the South-East of Nigeria. The breakdown of the sites among the five south Eastern States is Anambra - over 1000 active, Imo - about 300, Abia - about 500, Enugu - about 500 and Ebonyi - about 500. The direct effect of active gully erosion is the gradual but continuous washing off of top soil - snowballing into creation of ditches, surface valleys or gullies. Of course gully erosion has some devastating spillover effects of economic and social dimensions. It leads to soil degradation, destruction of access roads, destruction of properties, food shortages, humanitarian disasters, and loss of human lives. Hence gully erosion has been rightly described as "the silent killer in the South Eastern Nigeria" (Ezezika, 2010 p1).

The Federal, State and Local Governments had in the past, or even at the moment, adopted or adopt many measures in an attempt to tackle gully erosion. In 2013 the Federal government of Nigeria requested support from the World Bank to tackle gully erosion in seven pilot states: Abia, Anambra, Cross River, Ebonyi, Edo, Enugu and Imo. The World Bank in response established the Nigerian Erosion and Watershed Management Project (NEWMAP). The Project was mobilized on September, 2013 with about \$8.6 million (The World bank, 2013). Yet in 2017 members of the Federal House of Representatives, recognizing the seriousness of soil erosion in the country requested for the establishment of Erosion Control and Prevention Commission, and suggested a budget estimate of N989.8 billion to finance the commission on the first years of operations (Nwannekanma, 2017). Erosion Control and Prevention bill which establishes and empowers Erosion Control and Prevention Commission was passed by the National Assembly in 2018, and its impact is obviously yet to be felt. Meanwhile, most of the budgetary allocations for implementing rural and environmental development policies in the South Eastern States of Nigeria (for example, River Basin Development Authority [REDA]) are being channelled into solving erosion and flood control problems. Some of these allocations can be extracted from the 2018 Federal budget allocations to the South East (Table 1 below, for instance).

The effort of NEWMAP, especially in terms of financial commitment and technical expertise, is commendable. Yet gully erosion persists in South Eastern States of Nigeria, gulping huge sums of money, bringing untold socio-economic hardships to people of the region. The existence of many serious new and ongoing gully erosion sites in the region is an indication that the current strategy used to address erosion and

A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of ..

flooding related challenges is not providing desired or satisfactory results. The current gully erosion control strategy in the South Eastern States is a top-down approach which has not only proved to be ineffective, but also unsustainable. The top-down approach looks upon the Federal and State government as the most active participants in the control of gully erosion while the local government and the affected communities remain passive, or at best ceremonial participants. The approach tends to focus on active gully site control and tends to pay less attention to gully prevention and monitoring. The result is that the number of active gullies is increasing while funding for control and prevention projects remain insufficient. It is therefore time to explore other approaches for combating the ecological problem in the South East Region. The 2018 Nigerian Federal Budget allocated over 3 billion NGN for erosion and flood related challenges in south eastern states.

Table 1: Federal allocations in Nigeria’s 2018 Federal budget to South Eastern States dedicated to control of gully erosion and flooding.

S/No	State	Activity	Place of Work	Appropriated Cost (Naira)	Status	Allocation Head
1	Abia	Irrigation, Erosion and Flood Control	Umunwanwa	10000000	Ongoing	Anambra Imo REDA
2	Abia	Erosion Control Works	Sacred Heart College Izukwu Aba	20000000	Ongoing	Anambra Imo REDA
3	Abia	Erosion Control Works	Nkwoagu-Suochi, Umunneochi LGA	167000000	Ongoing	Anambra Imo REDA
4	Abia	Erosion Control Works	Amaigbo in Umuahia	82000000	Ongoing	Anambra Imo REDA
5	Abia	Erosion Control	Itungwa-Akanu, Obigwa LGA	140000000	Ongoing	Anambra Imo REDA
6	Abia	Erosion Control	Amogudu, Ohafia LGA	34000000	New	Anambra Imo REDA
7	Abia	Erosion Control	Umuecheokwu, Umuovo, Old Umuahia	105000000	New	Anambra Imo REDA
8	Abia	Gully Erosion Control	Museum Road Ebite, Amafor Isingwu, Umuahia North LGA	40000000	New	Fed Min of Environ.
9	Abia	Erosion And Flood Control Project	Okwoko Nkporo, Ohafia LGA	30623008	Ongoing	Fed Min of Environ.
10	Abia State Total			628623008		
12	Anambra	Erosion Control Project	Obiuno Igboekwu	15000000	Ongoing	Anambra Imo REDA
13	Anambra	Erosion Control Works And Construction Of Rural Roads	Enugwu Agidi Hrough Ifitedunu	50000000	Ongoing	Anambra Imo REDA
14	Anambra	Flood And Erosion Control Works	Irunnebo Community	100000000	Ongoing	Anambra Imo REDA
15	Anambra	Erosion Control Works And Road Onstruction With Drainage	Asutech Mbanagu Otolo Nnewi Road	20000000	Ongoing	Fed Min of Environ. HQ
16	Anambra	Flood And Erosion Control	Akwa Ifitedunu, Dunukofia Lga	200000000	Ongoing	Anambra Imo REDA

A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of ..

17	Anambra	Flood and Errosion Control	Umuano Ifitedunu, Dunukofia LGA	100,000,000.00	Ongoing	Anambra Imo REDA
18	Anambra	Flood and Erosion Control	Umueze Umuano Ifitedunu, Dunukofia LGA	100,000,000.00	Ongoing	Anambra Imo REDA
19	Anambra	Flood and Erosion Control	Nkwelle Umunachi, Idemili North LGA	100,000,000.00	Ongoing	Anambra Imo REDA
20	Anambra	Erosion Control Works and Road Onstruction With Drainage	Enugwu Agidi	100,000,000.00	Ongoing	Anambra Imo REDA
21	Anambra	Erosion Control Works and Road Onstruction With Drainage	Isuaniocha Road Njikoka Lga	150,000,000.00	Ongoing	Anambra Imo REDA
22	Anambra	Erosion Control Works	Ogidiga Avenue Mpiti Iruobieli Village, Njikoka LGA	50,000,000.00	Ongoing	Anambra Imo REDA
23	Anambra	Flood And Erosion Control	Girl's Secondary School Iruobeli Village	15,000,000.00	Ongoing	Anambra Imo REDA
24	Anambra	Flood and Erosion	Boys' Technical Econdary School Obunagu Achalla	20,000,000.00	Ongoing	Anambra Imo REDA
25	Anambra	Erosion Control and Channelization Works	Nri Agukwu Anaocha South Lga	25,001,001.00	Ongoing	Fed Min of Environ. HQ
26	Anambra	Erosion Control	Enuagu Village In Enugwu-Ukwu	40,098,345.00	Ongoing	Fed Min of Environ. HQ
27	Anambra	Erosion Control	Uhu Community Umudim	15,098,876.00	Ongoing	Fed Min of Environ. HQ
28	Anambra	Erosion Control	Iruobieli-Ifite-Amaobia Road Gully	91,658,662.00	New	Fed Min of Environ. HQ
29	Anambaa	Erosion Control Works	Etitinabo, Nnewi, AnaochaLGA	25,300,000.00	Ongoing	Fed Min of Environ. HQ
30	Anambaa	Erosion Control Project	Oba Idemili South	20,678,000.00	Ongoing	Fed Min of Environ. HQ
31	Anambra	Erosion Control	Mbanagu Otolo Nnewi North	20,000,000.00	Ongoing	Fed Min of Environ. HQ
32	Anambra	Erosion Control	Ifite Ani Village Agulu	25,000,000.00	Ongoing	Fed Min of Environ. HQ
33	Anambra State Total			1,282,834,884.00		
35	Ebonyi	Erosion Control Works	Amaenu Ugwulangwu	30,340,980.00	Ongoing	Fed Min of Environ. HQ
36	Ebonyi	Gully Erosion Site	Amuda Amachi Afikpo North LGA	10,222,423.00	Ongoing	Fed Min of Environ. HQ
37	Ebonyi State Total			40,563,403.00		

A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of ..

38	Enugu	Flood and Erosion Control	Umuabi Udi	15,000,000.00	Ongoing	Anambra Imo REDA
39	Enugu	Erosion Control	Obodo Upa Amede Road & Eha-Amufu Isiuzo LGA	20,000,000.00	Ongoing	Anambra Imo REDA
40	Enugu	Erosion Control Works and Road Construction With Drainage	Agidi/Isuaniocha Ward, Njikoka	30,000,000.00	Ongoing	Anambra Imo REDA
41	Enugu	Odobo / Akpanya Erosion Control Project	Itchi Igboeze South LGA	15,000,000.00	Ongoing	Anambra Imo REDA
42	Enugu	Completion of Erosion Control Project	At Ujiri Market Square - Mbogu - Ndibe Ekwelle Achi, Oji River LGA	125,000,000.00		Anambra Imo REDA
43	Enugu	Completion Of Erosion Control Project	At Ezicheze - Iheachi – Ekwelle Enugu Agu Achi Oji River LGA	60,000,000.00	Ongoing	Anambra Imo REDA
44	Enugu	Completion of Erosion Control Project	Ndibe Orji - Lakwa – Ndibe Ekwelle Achi, Oji River LGA,	125,000,000.00	Ongoing	Anambra Imo REDA
45	Enugu	Completion of Offia Aguenyi - Ohafia - Oduma Erosion Control Project	Aninri LGA	150,000,000.00	Ongoing	Anambra Imo REDA
46	Enugu	Completion of Asphalt Obeagu - Ezza - Mpu Erosion Control Project	Aniniri LGA	150,000,000.00	Ongoing	Anambra Imo REDA
47	Enugu	Completion Of Ihuejuro - Aguenyi Erosion Control Project	Aninri LGA	200,000,000.00	Ongoing	Anambra Imo REDA
48	Enugu	Completion of Ndeabor Azunkwo Asphalt Erosion Project	Aninri LGA	150,000,000.00	Ongoing	Anambra Imo REDA
49	Enugu	Completion of Nzerem/Ogboekpur u Anekeorji Mpu Erosion Control Project	Aniniri LGA	80,000,000.00	Ongoing	Anambra Imo REDA
50	Enugu	Erosion Control Works Ohomu Village Orba Town	Udenu LGA,	100,000,000.00	Ongoing	Anambra Imo REDA
51	Enugu	Erosion and Flood Control	Enugu Anadima	15,000,000.00	Ongoing	Anambra Imo REDA
52	Enugu State Total			1,235,000,000.00		

A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of ..

53	Imo	Flood and Erosion Control	Uzomiri Ariamgu Village Ihiagwa	15,000,000.00	Ongoing	Anambra Imo REDA
54	Imo	Erosion and Flood Control Works	Community Secondary School Umuchima Ihiagwa Owerri West LGA	15,000,000.00	Ongoing	Anambra Imo REDA
55	Imo	Erosion Control Works and Road Construction with Drainage	Assah Market Junction To Adapalm Head Office In Ohaji Egbema LGA	10,000,000.00	Ongoing	Anambra Imo REDA
56	Imo	Ergp12113605 Erosion Control Works and Road Construction with Drainage	Obile Market To Abanweke River In Ohaji Egbema LGA	10,000,000.00	Ongoing	Anambra Imo REDA
57	Imo	Erosion Control	Nkwoduru-Ukwu-Ogbor Road, Ahiazu-Mbaise LGA	52,500,000.00	New	Fed Min Niger Delta HQ
58	Imo	Erosion/Flood Control Works	Okwu/Amakohia	50,500,000.00	New	Fed Min Niger Delta HQ
59	Imo	Erosion And Flood Control	Amudara,Ehime-Mbano Lga	21,189,793.00	Ongoing	Fed Min of Environ. HQ
60	Imo	Erosion/Flood Control Works	Ihitte Ubi Oparanadim	50,000,000.00	New	Fed Min Niger Delta HQ
61	Imo	Ubaha-Akpulu Erosion Control	Ideato North LGA	81,000,000.00	New	Fed Min Niger Delta HQ
62	Imo State Total			305,189,793.00		
63	Regional Total			3,492,211,088.00		

Source: Budget Office of the Federation. (2018)

This paper therefore seeks to propose a bottom-up approach as an effective and sustainable strategy for combating the challenges of gully erosion in South Eastern Nigeria The paper is organized in five chapters

1. Chapter two explores the initiation, causes and consequences of gully erosion with emphasis in South Eastern states of Nigeria: Abia, Anambra, Ebonyi, Enugu and Imo States.
2. Chapter three highlights the current efforts for addressing gully erosion in the South East Region of Nigeria
3. Chapter four proposes the bottom-up approach for controlling and preventing gully erosion in South East Region
4. Chapter five presents the conclusion and recommendations.

II. INITIATION, CAUSES AND CONSEQUENCES OF EROSION

Active gully erosion sites are common in all states of South Eastern Nigeria. Dip gullies caused by erosion are visible by sides of, or even on major highways, on farmlands, impassable rural roads and on threatened or abandoned homelands. Figure 2.1 is an example of a gully erosion site at a major highway in the South East of Nigeria.



Figure 2. 1: The Ugwuonyeama gully erosion site on Enugu end of the Enugu-Onitsha highway (Njoku, 2018)

Nevertheless, in order to recognize the challenges of gully erosion, it may be necessary to understand its initiation, causes and consequences.

A. INITIATION OF GULLY EROSION

Gully erosion is initiated by rain water run-off; when run-off flows, accumulates and develops sufficient velocity and energy as to detach and transport soil particles. By some extraordinary supporting events severe erosion starts to develop on the weakest part of the soil, then stretches and forms visible indentation along the flow path. The indentation results on sharp change of gradient along the overland flow path forming a gully bed. Figures 2.1 and 2.2, show typical stages in the formation of a gully.

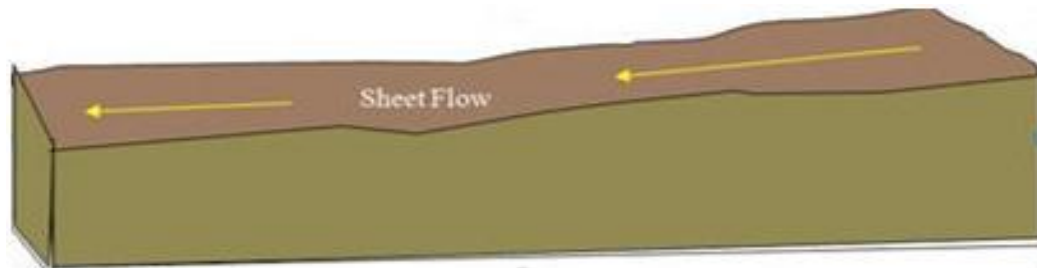


Figure 2.2: Land profile before the commencement of gully erosion

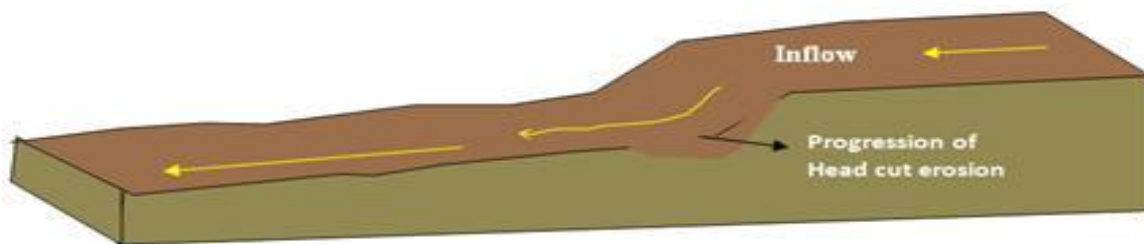


Figure 2.2 Land profile at the commencement of gully erosion

Figure 2.1 shows an ordinary situation where run-off flows normally, with no significant erosion, along the natural gradient of overland flow path. In figure 2.2, an extraordinary event takes place and visible soil erosion is initiated. Then a gully bed develops. The initial nick point typically occurs at a significant change in gradient in the downstream end of overland flow path. Ongoing rainfall and storm-water runoff expands the gully in both length and width. A hydraulic jump may develop along the path and aid run-off to gather momentum as to plunge over the gully head. Freefall of sand may occur at the base of the gully head, undercutting the subsoil, and the gully develops and eats its way up the slope.

Gully erosion may, however, develop in watercourses or other places where run-off concentrates. Gully erosion is initiated when a bell-shaped scour hole, deeper than the immediate downstream gully bed, develops (figure 2.3).



Figure 2.3 Head of gully erosion at a road in Umuaku Uli, Ihiala LGA, Anambra State

Source: Eribake (2014)

Gully erosion can also start as a 'rill', when a shallow cut in the landscape occurs and expands by soil erosion to form a gully. The newly formed gully bed will typically have flatter slope than the original slope of the overland flow path (figure 2.4).

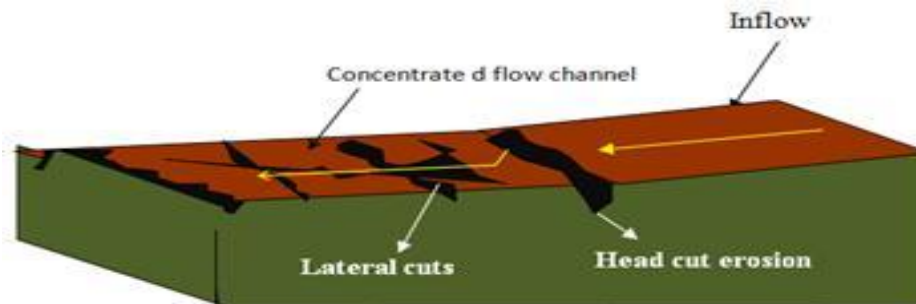


Figure 2.4: The gully banks experience ongoing erosion caused by surface runoff spilling laterally into the gully (a process known as lateral bank erosion)

As the gully develops it migrates up-stream of the valley and the further the gully migrates, the higher and less stable the gully banks become. This can result in various forms of bank erosion including undercutting, slumping, dry-cracking and lateral bank erosion.

B. CAUSES OF GULLY EROSION

In the previous section it was stated that gully erosion is aided by some extraordinary events. These are not spiritual or mysterious events. They are actually physical conditions, including anthropogenic activities, which tend to distort the overland natural ecological balance. This may be a major reason many researchers categorize the causes of gully erosion into two broad categories, namely the natural and man-made (anthropogenic) causes. Though it may be argued that many of the so-called natural causes of gully erosion are a result of accumulated impudent human interventions on the natural environment; for instance actions contributing to climate change. Natural causes include precipitation, topography, soil properties, and climate change. Man-made causes of gully erosion include vegetation clearance, urbanization, road construction, and poor farming practices.

i. Precipitation

During the peak of rainy season, the soil can be completely saturated. When it rains intensively for two or more consecutive days, runoff accumulation increases causing floods, landslides and gullies. The South Eastern states of Nigeria are among the zone that receives the highest rainfall in the country.

ii. Topography

Topography can influence the degree to which precipitation infiltrates the soil. The topography of a landscape can cause runoff to collect and concentrate before flowing out. The concentration of run-off weakens the soil and gully erosion bed begins to form when soil particles are detached and transported from the concentrated flow path. Gully formation can increase when concentrated runoff flow from steep ground into drainage depressions. Some parts of South Eastern Nigeria have steep topography which encourages gully erosion.

iii. Soil Properties

The texture of soil can influence its capacity to resist erosion, because the rate of infiltration depends on texture. Based on texture, a soil can be categorized into seven classes, namely: sand, loamy sand, sandy loam, loam, silt, loam, clay loam and clay. The rate increases of infiltration from clay to sand. Thus clay soil has the least ability to absorb run-off, followed by clay loam soil and so on. The prevalent soil in South Eastern Nigeria is the red clay soil which is weak to resist gully formation.

iv. Climate Change

The effects of climate change which can increase gully erosion include abnormally heavy or prolonged rainfall, flooding and deforestation.

v. Vegetation Clearance

Vegetation clearance includes all the human activities which remove grasses, shrubs and trees over a relatively large area or a significant portion of land such that the land's resistance to erosion is compromised. Thus vegetation clearance includes deliberate clearing of land for farming, access roads, industrial, civic and residential buildings. It also includes destructive logging, cutting of trees for fuel wood, over grazing, and all forms of deforestation. Vegetation clearance can reduce rainfall retention by plant leaves, increase run-off concentration in the soil, reduce rainwater infiltration, and weaken soil's resistance to erosion. Vegetation

clearance also includes replacement of forest trees/shrubs with grass. Over grazing does not only contribute to vegetation clearance; cattle paths in the bush can initiate gully erosion (figure 2. 5).



Figure 2.5: Over grazing and cattle paths may gradually create gullies

vi. Urbanization

Urbanization can have a similar influence to that of vegetation clearance. Significant changes can occur to the size of waterways following the growth of poorly managed or uncontrolled urbanization (E.g. figure 2.6). Soil compaction caused by heavy machinery which reduces the infiltration capacity of the soil and thus promoting excessive water runoff and soil erosion. Improper disposal of solid waste generated mostly in urban areas often lead to blocking of waterways and cause flooding which may initiate or propagate gully erosion.



Figure 2.6: The Federal High Court, Awka , Anambra State, Nigeria is under serious gully erosion threat and at the verge of imminent collapse (EnviroNews Nigeria , 2018)

vii. Road Construction

Poorly designed road drainage systems, including poor termination of drains, can initiate and propagate gully erosion. When the road drainage system does not cope with increased run-off during intense rainfall, gully erosion can start from the drainage system or from the sides of the road. Also prolonged less intense, or trickling flows across poorly designed drains can saturate the soil in the immediate drainage area thereby weakening it structurally to resist erosion. Weak pavement in new constructed roads can initiate gully erosion. Also cleared and compacted sides of the road when not re-vegetated quickly can induce gully erosion on the road sides. Figures 2.7 and 2.8 are examples of gully erosion initiated by road construction in Nigeria.



Figure 2.7: Erosion severs Nkpor-Nnobi Road, Onitsha (NAN, 2018)



Figure 2.8: Damaged drain channels forming gully erosion at a Nigerian road (Obiadi. et al.2011)

According to NEWMAP, as reported by Warami (2019), “over 90% of gully erosion in Nigeria is caused by road construction.”

viii. Poor Farming Practices

Poor farming techniques such as bush burning, lack of crop rotation and large scale replacement of deep rooted plants with shallow rooted crops can cause soil to lose its stability, and its ability to resist erosion. Deep sloughing of land can also initiate gully erosion.

C. CONSEQUENCES OF GULLY EROSION

Much literal and graphic information have been documented on the consequences of gully erosion in Eastern Nigeria. The consequences can be summarized as follows:

- a) Loss of lives of rural population.
- b) Displacement of Large Population of People and renders some of the rural communities homeless.
- c) Loss of hectares of valuable land and ancestral properties/edifices including collapsing of building.
- d) Destruction and removal of trees and natural vegetation
- e) Reduced access to roads, land and properties
- f) Reduction and fragmentation of limited arable and other agricultural land thereby increasing farming cost.
- g) Destruction of roads bridges, rails and other infrastructure such as electric poles, transformers communication derricks, etc.
- h) Generate sediment and increase flooding and reducing soil fertility.

III. CURRENT EFFORTS FOR ADDRESSING GULLY EROSION IN THE SOUTH EAST REGION OF NIGERIA

Many active gully erosion sites in South East of Nigeria have grown into monster valleys, eating up farmlands, residential buildings and access roads. Resources required for combating the menace has gone beyond what the State or even the Federal Government can readily afford. Though the Federal Government of Nigeria has established an Ecological Fund to finance ecological projects, including erosion control and prevention efforts, the Fund has not been able to meet the requirement soil erosion challenges on ground. According to (Lawal.2018: Nnodim, 2018) whereas requests by various communities, groups and politicians for control of soil erosion and flooding exceed N1.1tn, Ecological Fund Office receives between N12bn and N15bn quarterly.

The severity of environmental degradation prompted the Nigerian government to seek urgent support, in 2013, from the World Bank to tackle the ecological challenge in seven states on a pilot basis: Abia, Anambra, Cross River, Ebonyi, Edo, Enugu and Imo. In response, the World Bank established the Nigeria Erosion and Watershed Management Project (NEWMAP) to address soil erosion. The project is financed through a US\$500 million IDA Fund. According to the World bank, “ State and Local Governments and their constituencies are overwhelmed by the scale and complexity of the gully erosion problem,” and “attempts at all tiers of government to prevent or rehabilitate gullies have been generally unsuccessful” (The World Bank, NEWMAP ,2017, p6). The World Bank, NEWMAP identifies some gaps which it aims to close in order to combat soil erosion in Nigeria. These include:

1. Poor transparency of the ecological fund.
2. Unclear and overlapping mandates of federal and state institution.
3. Poor institutional performance.
4. Insufficient technical capacity in the institutions.
5. Poor governance and multi-sector coordination.
6. Lack of information access.

7. Poor, incomplete or inadequate scale of response (such as an over-emphasis on inflexible civil engineering interventions without addressing water flows in the sub-watershed or building upon a strong evidence base.
8. Weak community involvement in prevention and restoration activities.
9. Insufficient attention to alternative livelihood issues, and
10. Insufficient attention to transparent governance, corruption, and local participation.

The above issues are common in the management of most Nigerian natural resources-related challenges. The same gaps exist (in different connotations) the national challenges of water resources, solid mineral resources and forest resources for instance. So NEWMAP is apt in the identification of these gaps and its attempt to close them is a step in the right direction. For same reason NEWMAP has been active in South Eastern Region of Nigeria since 2013; and has been engaged in technical works to control some ferocious active erosion sites. However, the above identified gaps have not been effectively closed. The numbers of active erosion sites in the region keep on increasing, and the demand for funding of erosion control measures by communities, Local and State Government keep on rising.

The fight against gully erosion in Nigeria both by Nigerian governments and the international agency, so far, has largely focused on technical/engineering solutions, and has been a top-bottom approach. As already explained the current strategy has not yielded the positive result. Hence a new strategy is desired for effective and comprehensive control and preventive of gully erosion in South Eastern Region of Nigeria. The next chapter highlights a bottom-up approach for controlling and preventing gully erosion in south eastern Nigeria; an approach that combines possible technical/engineering and non-engineering solutions.

IV. PROPOSED BOTTOM-UP APPROACH FOR COMBATING GULLY EROSION CHALLENGES IN SOUTH EASTERN NIGERIA

Many studies have been documented on the control and prevention of gully erosion in the South East Region of Nigeria. These studies have given useful insights about the gully erosion and made meaningful recommendations on how to address the menace. However many of the recommendations are only emphasis on what the government is already doing or what it should be doing, along a top-bottom and often a reactive/selective approach. This paper highlights a bottom-up approach which integrates the useful recommendations (available in literature) into a proactive/ comprehensive framework for addressing gully erosion challenges in South Eastern Region of Nigeria.

The bottom-Up approach is an emphasis for the gully erosion affected communities to be the starting point and the key drivers of erosion prevention and control efforts. The idea is that the host communities are the ones closest to the erosion sites; the ones who can tell the history of gullies, the one who most bear the brunt of devastating consequences of the ecological problem. Therefore, the gully erosion affected communities should be active participants in gully prevention, control and monitoring. Funding is required from all levels of government and other stakeholders in gully erosion control and prevention efforts but the host communities should be active participants from the beginning to the end. Figure 4.1 is framework for the proposed bottom-up approach for combating gully erosion in South Eastern Nigeria.

The framework consists of four levels of measures for control and prevention of gully erosion: Community measures, Local Government measures, State Government measures and Feral Government measures. Communication processes and intervention measures are closest to the affected communities.

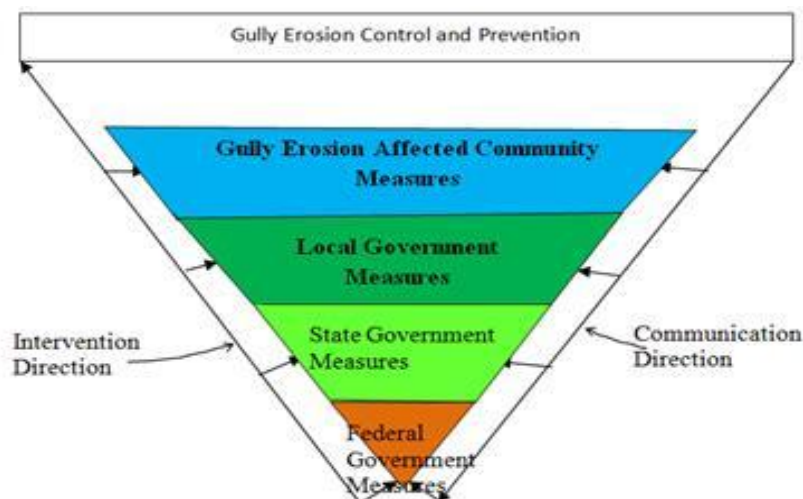


Figure 4.1: Framework for the Bottom-up Approach

A. COMMUNITY MEASURES FOR GULLY EROSION CONTROL AND PREVENTION MEASURES

For erosion control and prevention to be proactive and sustainable, it may be necessary for the control and prevention measures to start at community level. The gully sites are nearest to affected communities. It is only the communities who can give a good account of gullies in their farmland, their access roads and their neighborhoods. Only they can appreciate preventive and monitoring activities about gullies. The village heads, traditional rulers, and town unions can be the foremost initiators of gully erosion control and prevention programmes in South Eastern States of Nigeria. The community based programmes can include the following:

1. Compiling the inventory of active and dormant gullies within the community and reporting to the Local Government on a yearly basis.
2. Carrying out basic preventive measures such as clearing of drains, closing potholes created by run-off by side of roads streets or bush paths.
3. Ensuring no part of community land is given out for excavation without involvement of Local or State for inspection (a sort of erosion impact assessment) and approval. Often what is obtainable in most communities in the South East Region is that owners of land negotiate and sell some piece of land to construction companies who excavate and carry sand for constructions purposes. There are some instances where the pits left behind became the head of active gully erosion.
4. Monitoring the active, controlled and dormant gullies and reporting changes formally to Local Government authorities.
5. Prevention of bush burning and illegal tree cutting in plantations and forests, reserves.
6. Involvement of Local and State authorities on gully erosion impact assessment before selecting and clearing large area of bushes for community infrastructural use or for large scale farming
7. Being prudent in the use of land to avoid unnecessary clearing of vegetation. Minimizing the instances whereby a large expanse of land is being cleared for sighting a small community project such as hall or a civil centre.
8. Practicing of community-based shifting cultivation where possible.
9. Avoiding the creation of new access roads or paths in bushes without involvement of professionals at Local and State Government levels.
10. Cooperating with the Local, State, Federal and international agencies in the control and prevention of erosion.

B. LOCAL GOVERNMENT- BASED GULLY EROSION CONTROL AND PREVENTION MEASURES

1. Producing and updating local government gully erosion map on yearly basis.
2. Liaising with the State Government and communities within the Local Government for capacity building on gully erosion control and prevention.
3. Supporting communities on basic gully erosion prevention measures.
4. Sourcing ecological fund to control erosion for or on behalf of communities.
5. Monitoring erosion control and prevention sites within the Local Government and formally reporting to the State, Federal and international agencies as the need arises.
6. Support the communities on gully erosion impact assessment as it concerns large scale clearing of bushes, excavation of land and community based opening of new access roads.

C. STATE GOVERNMENT- BASED GULLY EROSION CONTROL AND PREVENTION MEASURES

1. Production of up-to-date yearly gully map for the State, specifying active, controlled and dormant gullies.
2. Enacting relevant laws for control and prevention of gully erosion within the State.
3. Make and execute gully erosion control and prevention projects.
4. Sourcing fund from the ecological fund for the control and prevention of gully erosion within the state.
5. Engage engineers and other relevant professionals in the control of active gully erosion sites.
6. Ensuring that qualified and tested construction companies undertake construction and maintenance of state roads and take responsibility for dealing with any gully which develops from road construction.
7. Generate and follow master plans in development of cities.
8. Assist the Local Government and communities in training and establishment of gully erosion control and prevention units.
9. Involving host communities on all gully erosion projects, by providing relevant information and ensuring participation of qualified locals in the project workforce.
10. Liaising with Federal and international agencies in prioritizing and executing gully erosion control and prevention efforts.

D. FEDERAL GOVERNMENT - BASED GULLY EROSION CONTROL AND PREVENTION MEASURES

1. Providing relevant legislation for control and prevention of gully erosion.
2. Providing adequate funding for Ecological Fund.
3. Corroborating with international agencies for funding and executing projects for control and prevention of gully erosion; such as what is being done with the World Bank through NEWMAP.
4. Corroborating with and giving timely necessary information about on-going gully erosion prevention and control efforts to States, Local Governments and host communities.
5. Use machinery of government to sustain fight against corruption and ensuring that project contractors work with the approved specification, schedule and budget.
6. Ensuring that qualified and tested construction companies undertake construction and maintenance of federal roads and take responsibility for dealing with any gully which develops from road construction.

V. CONCLUSION AND RECOMMENDATIONS

The paper concludes that the current approach to address gully erosion in South Eastern States, has neither been effective nor will it be sustainable for the control and prevention of gully erosion. The approach is largely based on top-down approach, where the Federal Government of Nigeria is the most active participant whereas the affected communities are the least involved, Despite efforts put by all levels of government, the number of active gullies continues to increase while the resources to address the menace remain insufficient.

The following are the study recommendations:

1. Using the proposed bottom-up approach, gully erosion affected communities should be made the most active participants in the control and prevention of gully erosion; that is to follow a bottom-up approach as proposed by this paper.
2. Federal, State and Local Government and international agencies should continue to provide funding and technical support for fixing active gully sites. However, the host communities should be equipped to take central roles in the prevention, monitoring and control of gully erosion.
3. Road construction project contract terms should make it compulsory for road contractors to take responsibility of any gully which develops on newly constructed road over a reasonable time period of at least half of the agreed lifespan of the project.
4. Every unplanned removal of vegetation above an acre of land area should be sanctioned by appropriate authorities through proper regulation and enforcement.
5. Maintenance of drainages and natural/artificial water ways should be legally enforceable duties by all levels of government and affected communities.

REFERENCES

- [1]. Budget Office of the Federation. (2018). 2018 FGN Budget Proposal. Ministry of Budget and National Planning, Abuja.
- [2]. Ahmed, M. S., Mohammed, A. S., & Agusiobo, O. B. (2006). Development of a Single Phase Automatic Change Over Switch. *AU Journal of Technical Report*, 10(1), 68–74.
- [3]. EnviroNews Nigeria .(2018). Awka Federal High Court resumes amid gully erosion threat. EnviroNews Nigeria. September 17.
- [4]. Eribake,A.(2014). Abandoned road project: Fears as erosion threatens Anambra community. *Vanguard*, December, 31. Retrieved from: <https://www.vanguardngr.com/2014/12/abandoned-road-project-fears-erosion-threatens-anambra-community/>
- [5]. Ezezika. O .(2010). Gully Erosions: the silent killer in Southeastern Nigeria. *Nigerians Talk*. March, 22. Retrieved from: <https://nigerianstalk.org/2010/03/22/gully-erosions-the-silent-killer-in-southeastern-nigeria/>
- [6]. NAN,(2018). Gully erosion severs Nkpor-Nnobi road in Anambra. *The Guardian*, August,20. Retrieved from: <https://guardian.ng/news/gully-erosion-severs-nkpor-nnobi-road-in-anambra/>.
- [7]. Njoku, L.(2018) Motorists groan as gully erosion tears Enugu apart, *The Guardian*, August 13. Retrieved from: <https://guardian.ng/news/nigeria/metro/motorists-groan-as-gully-erosion-tears-enugu-apart/>
- [8]. Nnodim,O.(2018). Ecological Fund Office receives N1.1tn requests for erosion, flooding, *Punch*,March,26. Retrieved from: <https://punchng.com/ecological-fund-office-receives-n1-1tn-requests-for-erosion-flooding/>
- [9]. Nwannekanma, B.(2017). Reps seek N989.8b for takeoff of erosion control commission. *The Guardian*, June, 06. Retrieved from: <https://guardian.ng/news/reps-seek-n989-8b-for-takeoff-of-erosion-control-commission/>
- [10]. Obiadi. I.I, Nwosu.C.M., Ajaegwu.N.E, Anakwuba.E.K, Onuigbo.N.E, Akpunonu.E.O, & Ezim.O.E. (2011). *International Journal of Environmental Sciences* , 2(2): 795-804.

A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of ..

- [11]. Olawumi, A. (2009). *Environmental considerations in Nigerian agricultural policies, strategies, and programs*. International Food Policy Research Institute. Nigeria Strategy Support Program (NSSP) Report No. NSSP 004. Abuja, Nigeria: Federal Ministry of Environment
- [12]. Premium Times Agency Report (2018). Over 2,800 active erosion sites in South-east Nigeria — Group. *Premium Times*, July 14.
- [13]. The World bank.(2013). *Combating erosion in Nigeria: New project spells hope in seven states*. Retrieved from: <https://www.worldbank.org/en/news/feature/2013/11/26/combating-erosion-in-nigeria-new-project-spells-hope-in-seven-states>
- [14]. The World Bank, NEWMAP (2017). Combined Project Information Documents / Integrated Safeguards Datasheet (PID/ISDS). documents.worldbank.org › curated › text › Project-Information-Docume...
- [15]. Warami, U. (2019). 90% of gully erosion in Nigeria caused by road construction – NEWMAP. *Vanguard*, September 12. Vanguard Media Limited, Nigeria.

Amatobi, D. A. " A Bottom-up Approach for Combating the Challenges of Gully Erosion in South East Region of Nigeria." *IOSR Journal of Engineering (IOSRJEN)*, vol. 09, no. 12, 2019, pp. 56-68.