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ASSESSMENT OF RURAL COMMUNITY EFFORTS IN GULLY EROSION CONTROL IN IMO STATE, NIGERIA

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Abstract
The study examined rural community efforts in gully erosion control in Imo state, Nigeria. The study identified the erosion control activities, ascertained the level of participation in gully erosion control activities, examined the perceived effects of gully erosion on rural community development and identified factors militating against the efforts of rural communities in gully erosion control. Multistage random sampling procedure was used in sampling 180 respondents. Data for the study were collected with the use of a well structured questionnaire. Data collected were analyzed with descriptive statistics (frequency, percentage, mean and standard deviation). Findings showed that long ridges across slope or the ground (55.0%) was the major gully erosion control activity. Respondents participated poorly in erosion control activities (1.7) and strongly perceived the effect of gully erosion on community development (3.26). Factors militating against rural community efforts on gully erosion control were soil properties (81.1%), topography (80.0%), and shape and size of watershed (72.8%). The study also showed that the rural communities participated poorly in efforts to control gully erosion menace as only long ridges across the slope was their major effort in controlling gully erosion. The study therefore recommends that water should be properly channeled by constructing drainages especially within the residential areas.

Keywords: Community efforts, Gully Erosion, and Control

Introduction

In its evolution, the earth has suffered and continues to suffer major changes due to the action and interaction between endogenous and exogenous factors. Crust movements, caused by endogenous factors, lead to the activation of exogenous factors such as gully erosion (Okoye *et al.,* 2014). As a result of the direct and indirect transfer of technology and modern living standards from the industrialized world to developing countries such as Nigeria, and the living population explosion with its attendant effects, problems of many environmental execution of gigantic or small-scale projects of industrial or engineering nature, the possible changes in the structure of soil or rock is rarely thought about or even considered (Abdulfatai *et al.,* 2014). More so, human activities such as irrigation schemes, major road networks, small and large scale dams, rural development and urbanization programs, engineering constructions across flood-ways etc. are executed day-in-day-out without proper studies of the nature of the environment with their concomitant effect on gully development (Okoye *et al.,* 2014).

Furthermore, gully erosion is generally most highly developed where there is contributing effects of land use, climate and slope interaction. The western slopes of North South Wind (NSW) feature many hot spots of erosion on susceptible soils. High rainfall also contributes to the development of many serious gullies on the eastern slopes. Obaje *et al.,* (2013) in his detailed study and the factors which govern the development of gully erosion and landslides in southeastern Nigeria, suggested that gully erosion is controlled by physiography, geology, hydrogeology, and engineering properties of the soil materials. Gully erosion occurs primarily as a result of rain drop impact, washing away by running water which creates rills that later develop into gullies. The different activities of man without regards to the conservational laws are manifested by the degrading of the soil through the process of weathering and erosion.

Erosion (gully) occurs in various patches in the South-Eastern states of Nigeria. Erosion problems arise mainly from natural causes but their extent and severity are increasingly being attributed to man's ignorance and unintentional action (Belayneh, 2010). In spite of technological advancement, erosion menace still

remains a major problem in Nigeria (especially in South East Nigeria). The yearly heavy rainfall has very adverse impacts altering existing landscape and forms. Such landforms create deep gullies that cut into the soil (Ajibade *et al.,* 1987). The gullies spread and grow until the soil is removed from the sloping ground. Gullies when formed expand rapidly coupled with exceptional storm or torrential rain down the stream by head ward erosion gulping up arable lands, economic trees, homes, lives, dis-location of families and valuable properties that are worth millions of naira.

Nowhere does the strategy "prevention is the best cure" apply better than in gully control. Gullies usually develop because of an imbalance in run-off conditions, and are almost always due to man's activities. Gully control is therefore often an effort to restore a balance which need not have been destroyed in the first place. In most cases, gullies can be prevented through good land husbandry - by maintaining infiltration capacity, vegetative cover, soil structure, etc. - and by simple measures to avoid concentration of excess run-off (Valentine *et al.*, 2015). These are also measures which ensure good crop yields, growth of forest vegetation and fodder production. The prevention of gully formation is not a burden on the land user but a natural consequence of good land management. Early interventions are far more economical than late ones. A small gully or rill can easily be repaired (Asimba, 2019). But if the situation is allowed to deteriorate, the same gully may develop beyond economic recovery. In most cases, gully control is aimed at preventing further damage and loss of productive land rather than at reclaiming gullied land for agricultural use.

This soil degradation process have negative effects on site (both in the gully and the inter-gully area) several soil functions (e.g. biomass, food and fiber production, water filtering function, bearing function, ecological function, archive function) and hence soil quality (Valentin *et al.*, 2015). In addition, gully erosion represents a major sediment-producing process, generating between 10% and 95% of total sediment mass at catchment scale, whereas gully channels often occupy less than 5% of the total catchment area (Poesen *et al.,* 2013). Furthermore, gully channel development increases run-off and sediment connectivity in the landscape, hence increasing the risk for flooding and reservoir sedimentation significantly.

Available Statistics in Nigeria show that over 300 gullies exist in Abia State, 270 in Anambra State, 200 in Enugu State, and 250 in Imo State (UNEP, 2012 cited in Osadebe and Enuvie, 2018). The environment that is destroyed by gully erosion is a supporting system for human existence and survival, and provides physical milieu and raw materials required for socio-economic progress. Any influence which diminishes the rich and variety of our environment is therefore likely to impact negatively on the fullness and span of our lives (UNEP 2012), and should not be neglected.

Consequently, lives and properties are regularly lost; houses with the entire families living in them have often been swallowed by landslides in various parts of Imo State. Sometimes major landslides carry along many houses, trees, roads, all standing as they were, into loose flood plains or wide deep gully bottoms. Poorly constructed roads that become major flood channels later were wantonly contracted out and built. Ancient and recent natural flood/stream/river channels are often blocked with buildings without leaving enough safety flood flow measures. Sensitive drainage areas, wetlands and flood channels are encroached upon by hungry land developers. Unapproved and unplanned buildings spring up in Imo State within and across these environmentally sensitive areas and later block them. Excavations of red earth, laterite and sands are carried out indiscriminately, often without proper planning, or permission from the relevant government authorities (Obaje *et al.,* 2013).

The harmful deforestation activities have led to continued loss of the rainforest belt in parts of Imo State. These devastating events have kept the citizens of the State in a state of continuous concern and fear and dismay all the year-round. Land, lives, infrastructure, and properties are regularly lost yearly. The citizens are now so threatened and desperate for their life existence and sustenance. However, one would ask, what are the people of Imo State doing to salvage the menace of gully erosion? This study therefore fills the research gap by empirically assessing the effort of rural communities in gully erosion control in the study area with the following objectives; identify the gully erosion control activities in the study area, ascertain the level of participation in gully erosion control activities; examine the effect of gully erosion on rural communities and identify the factors militating against the efforts of rural communities in gully erosion control in the study area.

Methodology

The study was conducted in Imo State, Nigeria. Imo State lies between latitudes 5^0 12 and 5^0 56 North of the equator and longitude 60^0 38 and 70^0 25 East of the Greenwich meridian (Imo State Annual Gazette, 2012). Imo state falls within the rainforest zone of Nigeria with the various characteristics of tropical rainforest zone. The State has an average population density of about 590persons per square kilometer and its total population 3,927,563 (NPC, 2006) . The State is bounded in the East by Abia State, in the West by Anambra and Delta States, in the North by Enugu State and in the South by Rivers State.

Multistage random sampling procedure was used in selecting 180 respondents in this study. In the first stage, 9 autonomous communities were selected by purposive sampling technique. This was because the study focused specifically on areas with the highest prevalence of gully erosion in the study area. In the second stage, 2 villages were selected from each autonomous community using simple random sampling technique, making a total of 18 villages. In the third stage, 10 respondents were

randomly selected from each village, giving a total of 180 respondents for the study. Primary data were collected using structured questionnaires. Data were collected on all the specific objectives of the study. Data collected were analyzed with descriptive statistics such as frequency, percentages, mean count and standard deviation. The level of participation in gully erosion control activities in the study area was analyzed using mean count collected on 4-pont rating scale of Very often (4), Often (3), Rarely (2) and Never (1). The mid-point of 2.5 was used to make decision. A mean score of above 2.5 was adjudged high level of participation while mean score of less than 2.5 were adjudged low level of participation. The perceived effect of gully erosion in the study area was analyzed with mean count of data measured on a 5 point Likert scale of strongly agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1), with a mid-point of 3.0. Mean score of above 3.0 was adjudged to have effect while mean score of less than 3.0 was adjudged no effect and finally factors militating against the efforts of rural communities in gully erosion control in the study area were identified using frequency and percentage.

Results and Discussion

Gully erosion control activities

Table 1 shows the distribution of the respondents based on gully erosion control activities. The Table reveals that many (55.0%) respondents used long ridges across slopes or the ground in gully erosion control activities followed by 41.1% and 40.6% that use catch pits and tree and grass planting respectively. The result implies that the respondents mostly used long ridges across the slope in the effort to control erosion in the study area. The purpose is to slow down the velocity of the run-off water. If the run-off is fast moving, its damage causing capacity is high. However, if its velocity is reduced by creating obstacles along its path by building ridges, it will move more slowly and cause less damage. However, their use of other gully erosion control activities was minimal. This result agrees with the findings of Osadebe and Enuvie (2018), that the amount of run-off water will be reduced, since part of it would infiltrate into the ground between the ridges.

Table 1: Gully erosion control activities

Gully erosion activities	Percentage *
Tree and grass planting	40.6
Catch Pits	41.1
Short and thick walls around compounds, farms, and open places (bunds)	13.3
Long ridges across slopes or the ground	55.0*
Use of sand bags and brush bundles	38.9
Contour Farming	10.6
Strip cropping	5.6
Terracing	5.6
Restoration of gullied land	11.7
Reclamation measures	17.8
Educating the people on causes and effects of erosion	3.3

Multiple Responses Recorded
Source: Field Survey, 2018

Level of participation in gully erosion control activities

The result on Table 2 shows the distribution of respondents based on their level of participation in the control of gully erosion activities in the study area. The result reveals a grand mean of 1.70 (less than the bench mark mean of 2.50, which indicate that the respondents had low participation in gully erosion control activities in the study area. Given the evidence of the gully erosion menace in the study area, it was surprising to observe that the residents rarely participate in erosion control activities in the study area. This result is plausible in that participation in rural community development activities can only be often if there are incentive packages. This result is in tandem with Okoye *et al.,*(2014), who indicated low participation in erosion control activities in Anambra State, Nigeria.

Table 2: Level of participation in gully erosion control activities

Gully erosion	SD	Mean
Tree and grass planting	0. 90923	1.99
Catch Pits	0. 86441	1.92
Short and thick walls around compounds, farms, and open places (bunds)	0. 73538	1.53
Long ridges across slopes or the ground	1.0030	1.93
Use of sand bags and brush bundles	0. 96358	1.90
Contour Farming	0.93453	1.66
Strip cropping	0. 77794	1.56
Terracing	0. 77698	1.57
Restoration of gullied land	0.83251	1.57
Reclamation measures	0. .8083	1.52
Education of the people on causes and effects of erosion	0.82171	1.52
Grand mean		**1.7**

Source: Field Survey, 2018

Key: Very often (4), Often (3), Rarely (2) and Never (1)

Decision: $\bar{x}$ > 2.50 high and 2.50 $\bar{x}$ < low

Perceived effect of gully erosion

Distribution of the respondents based on their perceived effect of gully erosion is presented in Table 3. The result shows a grand mean of 3.26 (which is greater than the bench mark mean of 3.0), implying a general strong perception of the effect of gully erosion in the study area. The result reveals that the respondents perceived loss of productive land ($\bar{X}$ = 3.49), dissection and fragmentation of plots causing access and management difficulties (X = 3.42), reduced amenity and property values including destruction of farm facilities such as fences or roads ($\bar{X}$ = 3.35), damage to infrastructure such as roads, bridges, culverts, buildings, altering transportation corridors and irrigation or water supply schemes ($\bar{X}$ = 3.34), gully erosion dramatically affects sediment budgets and flux rates, and influences stream dynamics ($\bar{X}$ = 3.26), silting up of storage dams, ponds, waterways and irrigation canals, and even fertile agricultural fields ($\bar{X}$ = 3.17). In the worst scenarios, gully erosion is directly linked to changing climatic conditions ($\bar{X}$ = 3.00). The result implies that gully erosion remain a major problem of the people in the area, especially as their lives and means of survival depend greatly on the land. The gully erosion activities results in loss of farm land (threat to vegetation), destroy lives, properties and dislocation of villages and towns from others. The findings of this result affirm the opinion of Ajibade *et al.,* (1987), that yearly heavy rainfall has very adverse impacts, altering existing landscape and forms. Such land forms create deep gullies that cut into the soil. Gullies when formed expand rapidly coupled with exceptional storms or torrential rains gulping up arable lands, economic trees, home, lives, and dislocation of families (Umudu, 2008).

Table 3: Perceived effect of gully erosion

Perceived effect of Gully erosion	SD	Mean
Loss of productive land (gullies often occur in the most productive area of a watershed)	0.6809	3.49
Dissection and fragmentation of plots causing access and management difficulties	0.7087	3.42
Reduced amenity and property values including destruction of farm facilities such as fences or roads	0.7283	3.35
Silting up of storage dams, ponds, waterways and irrigation canals, and even fertile agricultural fields.	0.8423	3.17
Local lowering of the water table	0.9023	3.00
Damage to infrastructure such as; roads, bridges, culverts, buildings, altering transportation corridors and irrigation or water supply schemes	0.7412	3.34
Gully erosion dramatically affects sediment budgets and flux rates, and influences stream dynamics	0.7197	3.26
In the worst case scenarios, gully erosion is directly linked to changing climatic conditions	0.7444	3.07
Total mean		**26.1**
Grand mean		**3.26**

Note: Strongly agree (5), Agree (4), undecided (3), disagree (2), strongly disagree (1)

Decision: $\bar{x}$ > 3.0 there is effect 3.0 $\bar{x}$ < no effect

Source: Field Survey, 2018

Factors militating efforts of rural communities in gully erosion control

The distribution of respondents based on the factors militating against the efforts of rural communities in gully erosion control is shown in Table 4. The result shows that rainfall and soil properties (81.1% each), topography (80.0%), shape and size of watershed (72.8%) and trail and foot paths (55.0%) are important constraints militating against efforts of rural communities in gully erosion control in the study area. This result agrees with the findings of Okoye (2015), who stated that the process of water erosion starts with rainfall. Raindrops which do not touch plants will have the splash effect, defined as the impact of raindrops on the soil surface. Soil aggregates are smashed and their particles thrown in all directions. From the surface, water can infiltrate the soil through pores, as long as they are not saturated. Excess water moves as overland flow (run-off) down slope and detaches additional soil particles. This result implies that the traffic of livestock, vehicles and men compact the soil and reduce the water holding capacity and becomes the focus of concentrated

Table 4 Factors militating against efforts of rural communities in gully erosion control

Factors	Percentage*
Improper land use	44.4
Forest and grass fires	8.9
Overgrazing/Free grazing	16.1
Trails and foot paths	55.0
Rainfall	81.1
Topography	80.0
Shape and size of watershed	72.8
Soil properties	81.1
Vegetative cover	35.0

Multiple Responses Recorded
Source: Field Survey, 2018

Conclusion

It could be inferred from the study that the major community effort for gully erosion control in the study area was the use of long ridges across slopes or the ground. It was strongly perceived that gully erosion posed a serious danger for rural communities and there is need for other serious self-help efforts in order to control the menace. Therefore the study recommended community leaders and stakeholders should be encouraged to come up with better ways of making rural community participate more on gully erosion control activities since there was low participation in gully erosion control activities. Since rainfall is a serious factor in gully erosion, concerted efforts should be made by rural people to properly channel the erosion by construction of drainages especially in the residential areas. Trails and footpaths that encourage gully erosion menace should be closed by the community leaders.

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