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Effects of Gully Erosion on the Vegetation Distribution in Idemili North Local Government Area of Anambra State

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Abstract

This work examined the effect of gully erosion on vegetation distribution in Idemili North L.G.A. of Anambra State, Nigeria. The research work adopted a survey design and included the use of both primary and secondary data. Plant species diversity survey, inventory and enumeration were undertaken in order to obtain baseline data for further analysis of this study. Primary data were collected from field. Five soil samples each from both gully site and non-gully site were collected and analyzed at Soil Science Laboratory of the University of Nigeria, Nsukka. Secondary data were elicited from published and non-published materials. Shannon Wiener diversity index was used to determine the diversity indices of the plant species in the area. Effects of gully erosion on vegetation were analyzed using Principal Component Analysis. The component matrix of the soil proprieties as well as plant diversity indices from the PCA isolated five components that together explained 91.825% variation in the effect of gully erosion on vegetation distribution. Based on the results, recommendations on strategies to curb the effects of the gully erosion in the study area especially on the vegetation distribution include maintenance of remnant vegetation along drainage lines, eliminating grazing, vegetation management, and engagement of both individuals and government in afforestation process amongst others.

Keywords: Vegetation distribution, PCA, Specie diversity

Introduction

According to Ofomata (2009), soil erosion, is simply a systematic removal of soil, including plant nutrients, from the land surface by the various agents of denudation. Erosion is an ecological challenge that reduces the availability, accessibility and utilization of land for human activities and thereby limits his options for development. Ajaero and Mozie (2011) found that gully erosion menace has over the years been responsible for increasing losses of houses and land of the people, thereby displacing affected inhabitants. Also, it has led to the loss of life of the people and livestock, as well as the destruction of farms on which the majority of the population depends for survival thereby directly reducing the amount of vegetation. There is the urgent need to solve problems of gully erosion in Anambra state or at least reduce its impacts on the environment before more valuable lands are lost to gully erosion.

Gullying is a threshold-dependent process controlled by a wide range of factors, including rainfall and flowing water, soil properties, and drainage area. Gabriel and Jibrin (2012) defined gully erosion as the erosion of the soil by flowing water through a defined channel and it is readily observable in the field because of the striking morphological expression on the landscape. It is directly associated with what is called sub-surface or bottom erosion and it reveals itself as a continuous washing out of the bottom of the gully and normally result in permanent loss of land or soil. Koci, *et al* (2021) undertook a study in a savanna rangeland in northeast Australia on the Rehabilitation effects on gully sediment yields and vegetation and asserts that Invariables climates, long-term gully rehabilitation will progress during wetter periods, and regress during droughts, hence understanding linkages between rehabilitation measures, their hydrologic, hydraulic and vegetation effects and gully sediment yields is important to defining the conditions for their success. Jibo, *et al*., (2020) assessed the effects of gully erosion on physical and socio-economic activities in Akko Local Government Area of Gombe State, Nigeria. Data were obtained through physical observation, interview, google earth, Global Positioning System (GPS), and observation and questionnaire administered to household heads of targeted residents within the study area. Result of the impact of gullies on the physical infrastructure rests on residential houses, while result on the impact of gully erosion on socio-economic activities revealed that, farming is the most identified mean of livelihood affected by gully. The research therefore recommended channeling of runoff water to less risk areas, planting of trees and other vegetation cover as measures to controlling gully erosion.

Bernini, et al (2021) in their research on the Evaluation of Gully Erosion Susceptibility Using Maximum Entropy Model in the Upper Mkhomazi River basin in South Africa, compiled a gully inventory map and applied remote sensing techniques as well as field surveys to validate the gully inventory and the gullies were subdivided into slope gullies and fluvial gullies , noted that susceptibility maps were derived based on the spatial distribution of gully types to assess the most important driving factors.

Asuoha, *et al.,* (2019) examined the impact of soil erosion on the conservation of biodiversity in Isiala Ngwa North LGA. Data were obtained through focus group discussions and plant species enumeration. Diversity indices of plant species were derived from quadrat analysis using Shannon Wiener's diversity index. Eighteen soil samples were collected from agricultural erosion sites in the study area and analysed in the laboratory. The results obtained were analysed using principal component analysis (PCA). The rotated component matrix of the soil properties, as well as plant and animal diversity indices from the PCA isolated three components that together explained 93.821% of the observed variation. The results show that bush clearing in the form of slash and burn, uncoordinated bush burning and harvesting of plant species are the activities that cause soil erosion in the study area. Agro-forestry, bush fallowing, reforestation and legislation on indiscriminate harvesting of plant species were recommended.

According to Ajaero and Mozie, (2011) on gully menace in Agulu-Nanka, they reviewed the causes of gully erosion and came out with the following percentages: deforestation-48.6%, geology 33.3%, high rainfall-66.7%, infrastructural development and poor drainage- 54.2% and topography- 61.1%. Therefore, they concluded that the surface flood incidence was the genesis of erosion problem, hence the initiation and enlargement of gully over the years and this is as a result of the exceptional heavy rainfall (66.7%) as the slides occur mainly between June and early October. They further asserted that the land use changes also increased the rate of runoffs and create the bad land topography which continuously advances the gully head.

Amare, et al., (2019) showed what caused valley bottoms gullies and presented deficiencies in existing rehabilitation measures. They report that watershed characteristics determine location of valley bottom gullies; an increase in water transported from the watershed initiates the formation of gullies; the rate of change of the valley bottom gullies, once initiated, depends on the amount of rainfall and the soil and bedrock properties. Valley bottom gully reclamation measures are generally effective in arid and semi-arid areas with the limited subsurface flow and deep groundwater tables, whereas, for (sub) humid regions, similar remedial actions are not successful as they do not address the effects of subsurface flows. To ensure effective implementation of rehabilitation measures, especially for humid regions, an integrated landscape approach that addresses both the combined subsurface and surface drainage is needed.

Hassen and Bantider (2020) assessed the drivers, dynamics and impacts of gully erosion in case of Tabota Koromo and Koromo Danshe watersheds, South-Central Ethiopia. The result of the study indicated that gully erosion was initiated in the steep slope following the 1970s and 1980s land cover change and other anthropogenic factors which contributed in exacerbating the problems of loss of soil and loss of biodiversity as the major physical impacts of gully erosion.

Rehman, et al., (2015) in their research in Paskistan on slope gradient and vegetation cover effect on runoff and sediment yield in hill slope, noted that increase in vegetation cover results in a significant reduction in discharge of sediment.

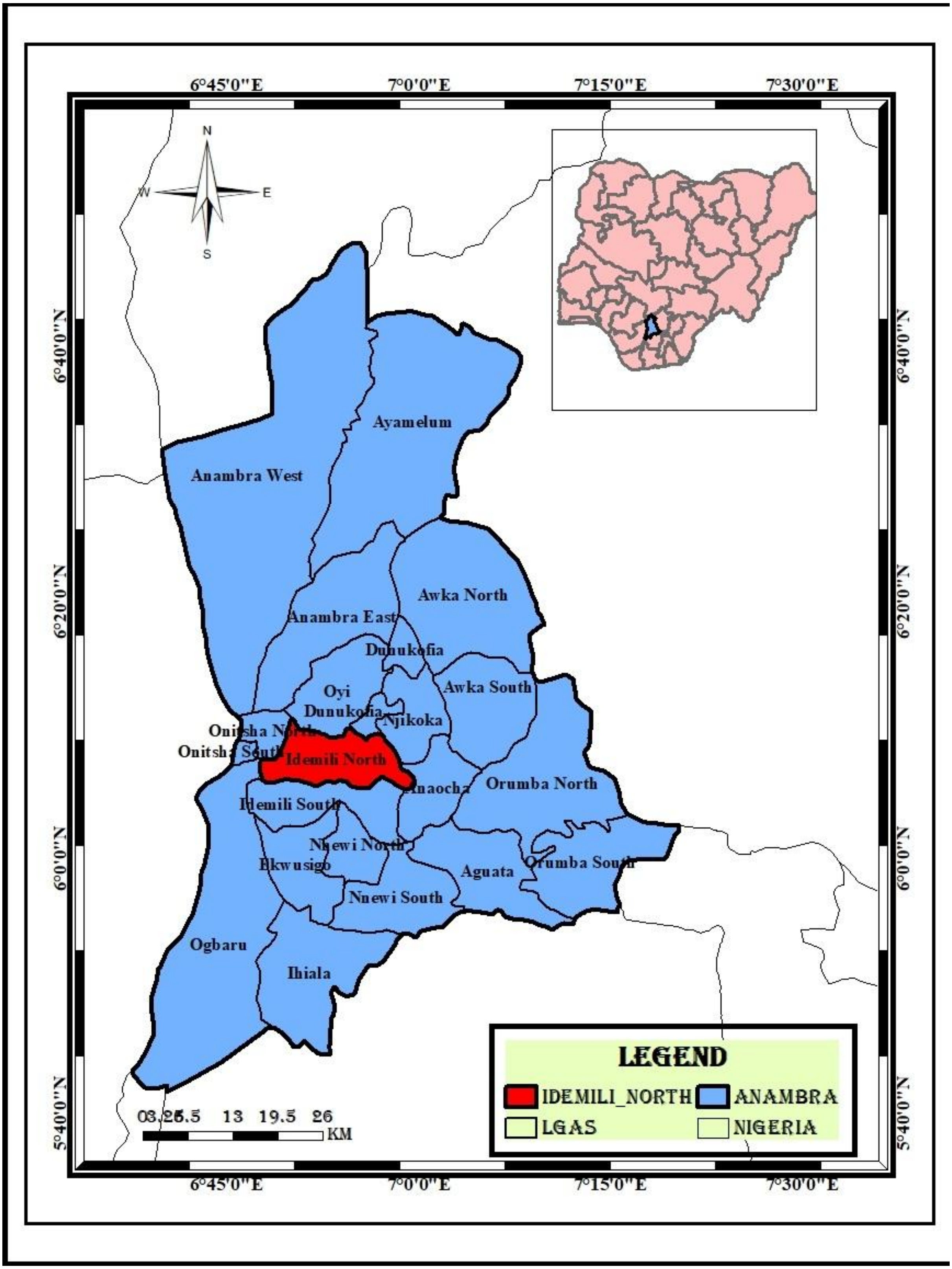
Zhou, *et al* (2023) in their research in Xiangjiang River Basin, China on the effects of Land Use Changes on Ecosystem Service Value, noted that the loss of cultivated and forested land flows mainly to built-up land, Ecosystem Service Value (ESV) increases first and then decreases mainly in the middle and high grades and changes faster in the east, the cross-sensitivity coefficient reflected that the net conversion of cultivated land to forest land and water area had a promoting effect on ESV.

Min, *et al* (2024) studied Spatio-Temporal Variations in Soil Erosion and its Driving Forces in the Loess Plateau from 2000 to 2050 based on the RUSLE Model and asserted that soil erosion prevention and management efforts should focus on the ecological restoration of upland areas in the future. Furthermore, Han, *et al* (2022) studied the Gully erosion susceptibility considering spatiotemporal environmental variables in the Midwest U.S. region, remote sensed environmental data were used. The study developed a data-driven modelling framework which indicates that fifteen factors were the most relevant for developing the gully erosion susceptibility map. It further identified the importance of high temporal resolution in varying seasonal factors to improve model predictability compared to annual temporal discretization.

Methodology

Study Area

The study area is Idemili North LGA of Anambra State of Nigeria which lies between latitudes 06 00.7'N and 06 04. 12'N and longitudes 06 49.22'E and 07 00.10'E. It is bounded in the North by Oyi Local Government; in the south by Idemili South Local Government Area, in the East by Njikoka Local Government Area, and in the west by Onitsha North, Onitsha South and Ogbaru Local Government Area. The local government area is made up of ten communities, namely: Abacha, Abatete, Eziowelle, Ideani, Nkpor, Obosi, Ogidi, Oraukwu, Uke, and Umuoji (Google Earth, 2021). Idemili North Local Government was created out of the extinct Idemili local government area that consisted of the present Idemili North and Idemili South on October 1, 1996 by Late Sani Abacha (GCFR). This local government area derived its name from the famous Idemili River which has its source from Agulu Lake in Anaocha local government area, but flowing through most communities in Idemili North and South, before joining with River Niger at Iyi-owa in Onitsha Idemili North local government has its headquarters and seat of government situated in Ogidi, the ancestral home of the late famous scholar, Chinua Achebe (Obioji & Eze, 2019). The position of the area in relation to Anambra state is shown in Fig. 1.


6°45'0"E
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7°30'0"E
6°40'0"N
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N
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Ayamelum
Anambra West
Awka North
Anambra East
Dunukofia
Oyi
Njikoka
Awka South
Onitsha North
Onitsha South
Idemili North
Anaocha
Orumba North
Idemili South
Nnewi North
Ekwusigo
Aguata
Orumba South
Nnewi South
Ogbaru
Ihiala
LEGEND
IDEMILI_NORTH
ANAMBRA
LGAS
NIGERIA
13
19.5
26
KM

Figure 1: Anambra State showing Idemili North L.G.A. ***Source: (Google Earth, 2021).***

Research Design

This research work adopted a survey design and included the use of both primary and secondary data. A field work was conducted in the study area in which plant species diversity survey, inventory and enumeration were undertaken. This was done in order to obtain baseline data for further analysis of effects of gully erosion on the vegetation distribution in the study area. Soil samples were also collected in areas affected by gully erosion and areas not affected.

Data Collection Methods

The source of primary data employed for this study was field observation, also known as reconnaissance survey. The work carried out a reconnaissance survey of the study area. This enabled preliminary observation of the area in terms of vegetation distribution and the nature of soil. This was followed by the actual field work in which plant species were enumerated in terms of species richness and diversity.

For the secondary data, there was consultation of relevant documents, like textbooks, published and unpublished research works etc. ArcGIS software was used to generate a map of the study area.

Instruments for Data Collection

Soil auger was used to collect ten (10) soil samples each at a depth of 10-20cm from each zone using purposively sampling technique. All plants species in each quadrat were identified and enumerated in the five (5) communities using quadrats size of 10 X 10 m each placed in the different vegetation zones of the study area. A hand held GPS was used to collect the coordinates of the quadrats and locations where soil samples were collected.

A very tiny long stick was used in place of a ranging pole to mark out the quadrat sizes either in grid form or along the a transect. Cellophane bags were used for bagging soil samples. Measuring tape was used for taking measurement of the depth of soil.

Data Analysis

The soil sample analysis was conducted at the Soil Science Laboratory of the University of Nigeria, Nsukka to determine the following chemical properties which include soil total carbon (C), soil total nitrogen (N), soil organic matter content (O.M), Available phosphorous (P), cation exchange capacity (CEC), Effective Cation Exchangeable Capacity (ECEC), available potassium (K) and a host of others like H^+, Kcl, Na^+, $Ca^{2+,}$ $Mg^{2+,}$ Al^{3+}, H^+. See Appendix A for the meaning of the chemical properties.

Soil organic carbon was determined by the walkey and black (1934) method as modified by Allison 1965. Soil organic matter content was also determined by multiplying the value of soil organic carbon by Bamnelen factor of 1.724. Cation Exchange Capacity (CEC) was determined by the Ammonium Acetate displacement method of Rhoades (1982). Effective Cation Exchangeable Capacity (ECEC) was determined based on summation method of Morgan extraction (1941).

Exchangeable potassium was measured by atomic absorption spectrophotometer; available phosphorus was determined using Bray and Kurtz (1945), sodium and potassium content were determined using Flame photometer to take reading while nitrogen content was determined using Kjedahl's method as described by Bremner (1965). All these analyses were carried out using standard procedures to ensure accuracy of the results.

The data analyses methods that were employed for this study were both quantitative and qualitative. This study also adopted descriptive statistics for some analysis. Effects of Gully erosion on vegetation distribution were analyzed using Principal Component Analysis (PCA). For the vegetation, Shannon Wiener diversity index was used to determine the diversity indices of the plant species in the area. This index takes both species abundance and species richness into account.

The calculation of the species diversity indices in the area was done using the formula for Shannon Wiener diversity index as follows:

$$H^1 = \frac{NLnN-\sum(ni\ In\ ni)}{N}$$

Where N is the total number of individual species, ni is the number of individuals of species i, In is natural logarithm.

The result of the soil analysis were further subjected to ANOVA to ascertain whether a statistically significant difference exists between the two sites and vegetation distribution in Idemili North Local Government Area.

Result and Discussion

The Result of the laboratory analysis of soil properties of both the gully and non-gully sites in Idemili North L.G.A is presented in table one below which shows the different soil composite of each soil sample.

Testing of Hypothesis

We tested the hypothesis of the study, using Analysis of Variance (ANOVA**)** to ascertain whether a statistically significant difference exists between the two sites and vegetation distribution in Idemili North LGA. From the analysis, there is statistically significant difference between soil properties and vegetation distribution. Hence, variables with significant difference between the two sites are Cation Exchangeable Capacity, Dominance, %Nitrogen and %Organic matter. Others had no significant difference. See Table 2.

Table 1: Analysis of variance on the effects of gully erosion on vegetation distribution in the study area.

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
ECEC	Between	.013	1	.013	.014	.909

	Groups					
	Within Groups	7.396	8	.925		
	Total	7.409	9			
CEC me/mg)	Between Groups	12.544	1	12.544	6.198	.038
	Within Groups	16.192	8	2.024		
	Total	28.736	9			
%Base salt	Between Groups	263.066	1	263.066	1.451	.263
	Within Groups	1450.377	8	181.297		
	Total	1713.443	9			
Al3+ (me/100g)	Between Groups	.036	1	.036	.514	.494
	Within Groups	.560	8	.070		
	Total	.596	9			
H+ (me/100g)	Between Groups	.004	1	.004	.010	.922
	Within Groups	3.120	8	.390		
	Total	3.124	9			
Dominance	Between Groups	.003	1	.003	5.329	.050
	Within Groups	.004	8	.001		
	Total	.007	9			
P Mg/kg	Between Groups	12.522	1	12.522	.583	.467
	Within Groups	171.936	8	21.492		

	Total	184.458	9			
%N	Between Groups	.044	1	.044	6.988	.030
	Within Groups	.050	8	.006		
	Total	.093	9			
%OC	Between Groups	.013	1	.013	.030	.866
	Within Groups	3.293	8	.412		
	Total	3.306	9			
%OM	Between Groups	38.494	1	38.494	8.820	.018
	Within Groups	34.916	8	4.364		
	Total	73.410	9			
%Ca	Between Groups	.400	1	.400	1.980	.197
	Within Groups	1.616	8	.202		
	Total	2.016	9			
%Mg	Between Groups	.169	1	.169	.786	.401
	Within Groups	1.720	8	.215		
	Total	1.889	9			
%K	Between Groups	.000	1	.000	.112	.747
	Within Groups	.014	8	.002		
	Total	.014	9			
%Na	Between Groups	.004	1	.004	1.124	.320

	Within Groups	.025	8	.003		
	Total	.029	9			
HI	Between Groups	.240	1	.240	2.744	.136
	Within Groups	.700	8	.088		
	Total	.941	9			

Evaluation of Diversity and Dominance Indices of the Plant Species in the Study Area

We also determined the diversity and dominance indices of the plant species in the study area with reference to gully and non-gully sites. Surprisingly, the highest H^1 of 4.06 was obtained from a quadrat in gully erosion affected area. The same applies to Dominance. The four highest Dominance indices (0.98, 0.961, 0.95 &0.94) were obtained from gully erosion affected part of the study area. This is presented in Table 4 while Plate 4 shows sections of gully erosion site in the study area. Appendix B presents the determination of the diversity and dominance indices of the plant species in the study area. The reason for these unexpected results could be as a result of gully erosion management strategies adopted in the area.

Table 2: Diversity and Dominance Indices of the plant species in the two Sites

Area	**HI**	**Dominance**
Gully	4.06	0.985015
Gully	3.49	0.969388
Gully	3.72	0.95352
Gully	3.63	0.94825
Gully	3.06	0.910714
Non gully	3.4	0.924934
Non gully	3.34	0.913043
Non gully	3.26	0.916393
Non gully	3.47	0.944474
Non gully	2.94	0.903805

Table 3: The Inventory of the Plant Species Found in the Study Area according to the Zones.

Zone A (GULLY SITE)

S/N	Family	Common Name	Scientific Name
1.	Poaceae	Bamboo Maize Goose grass Spear grass Vertiver grass Paspalum grass	*Bambusa vulgaris* *Zea mays* *Elusine indica* *Imperata cylinderica* *Chrysopogon zizanioides* *Paspalum notatum*
2.	Euphorbiaceae	Castor oil tree Asthma weed African lily Asthma weed Dog mercury	*Ricinus communis* *Euphorbia hyssopifolia* *Thevetia euphorbia* *Euphorbia hyssopifolia* *Mercurialis perennis*
3.	Moraceae	Iroko	*Milicia excels*
4.	Fabaceae	Sensitive plant Sickle senna Flame thorn Butterfly pea African Indigo	*Mimosa pudica* *Cassia tora* *Acacia ataxacantha* *Centrosoma spp* *Lonchocarpus cyanescense*
5.	Myrtaceae	Cider gum	*Eucalyptusa gunni hook*
6.	Bignonaceae	Indian bean Boundary tree	*Catalpa bignoniodes walter* *Newbouldia loevis*

7.	Celastraceae	Spike thorn	*Maytenus senegallensis*
8.	Malvaceae	Caesar weed	*Urenalobata*
9.	Gnetaceae	Okazi(Afang)	*Gnetum Africanum*
10.	Zingiberaceae	Ginger	*Zingiber officinale*
11.	Irvingiaceae	Ogbono(bush mango)	*Irvingia gabonensis*

ZONE B (NON-GULLY) SITE

S/N	**Family**	**Common Name**	**Scientific Name**
1.	Apocynaceae	Stool wood False rubber tree	*Alstonia congensis* *Holarrhena floribunda* *Landolphia dulcis*
2.	Fabaceae	Sensitive plant Sickle senna Flame thorn Butterfly pea African sandlewood Sweet acacia Silk plant Bay bean African locust bean Apple leaf	*Mimosa pudica* *Cassia tora* *Acacia ataxacantha* *Centrosoma spp* *Baphia nitida* Acacia farnesi*ana* *Albizia zygia* *Canavalia rosea* *Parkia biglobosa* *Philenoptera violacea*
3.	Sterculiaceae	African tragacanth Giant cola	*Sterculia tragacarntha* *Cola gigantean*

4.	Moraceae	African breadfruit African corkwood Cape fig	Treculia Africana Musanga cecropoides Ficus carpensis
5.	Bombacaceae	White silk-cotton	Ceiba pentadra
6.	Hyperiaceae	Orange milk tree	Arungana madagascariansis
7.	Lecythidaceae	Christmas bush	Alchornia cordifolia
8.	Loganiaceae	Cabbage	Anthocleista djalonensis
9.	Euphorbiaceae	Castor oil tree Asthma weed Cassava Taro Christmas bush Bridelia	*Ricinus communis* *Euphorbia hyssopifolia* *Manihot esculenta* *Malanga barteri* *Alchornia cordifolia* *Bridelia ferruginea*

From Zone A, Poaceae family tends to be more dominant than other families. The Poaceae family, formerly called Gramineae, is a grass family of monocotyledonous flowering plants, a division of the order Poales. The Poaceae are the world's single most important source of food. They rank among the top five families of flowering plants in terms of the number of species, but they are clearly the most abundant and important family of the earth's flora. This zone also has a reasonable number of the Fabaceae family and a handful of the Euphorbiaceae family. It is also one of the world's most important sources of food. They are mostly used to feed man (wheat), livestocks (pennisetum purpureum) and poultry and also used by man for roof making and other boundary purposes (Bamboo).(See Table 4). Zone B had more of the Fabaceae family, pea family of flowering plants (angiosperms) which are now included in the Leguminosae family, than any other. These plants are leguminous in nature. They are normally called food plants and are one of the most important ecological and economic plants. Legumes help to increase soil nitrogen and provide rich sources of vegetable proteins for humans, livestock, and wild animals. Fabaceae is the third largest family among the angiosperms after orchidaceae (orchid family) and Asteraceae (aster family).

Table 4: Unrotated Principal Component Analysis

Component Matrix[a]					
	Component				
	1	2	3	4	5
HI	*.796	-.247	.167	.349	-.269
Dominance	*.842	-.425	-.093	.248	-.121
P (ppm)	.488	.420	.403	*.587	.233
%N	*.694	-.211	.267	-.488	.237
%OC	.314	*.637	.404	-.048	*-.555
%OM	-.313	*.694	-.030	.315	-.416
%Ca	*.686	.240	-.126	.460	.438
%Mg	-.142	*.717	.005	*-.609	.150
%K	.462	*.643	.455	-.196	-.255
%Na	*.677	.165	-.427	-.367	.038
ECEC	*.548	*.686	-.340	-.099	.261
CEC me/100g)	.499	-.183	*.669	-.314	.161
%Base salt	-.259	*.610	*-.562	.224	.275
Al3+ (me/100g)	-.411	.332	*.693	.155	.371
H+ (me/100g)	*.536	.096	*-.776	-.097	-.198
Eigen Value	4.496	3.358	2.800	1.816	1.305
% variance	29.971	22.386	18.666	12.104	8.698
Cummulative % variance	29.971	52.357	71.023	83.126	91.825
Extraction Method: Principal Component Analysis.					
a. 5 components extracted.					

Note: *Only significant correlation coefficients (at least 0.5) are taken into account.

Table 4 shows that five components were extracted from fifteen variables which together explain 91.825% variation in the effect of gully erosion on vegetation distribution. The first principal **Component I** has significant loadings on seven variables. The variables with significant loadings are (HI), (Dominance), (% of nitrogen), (%Calcium), (%Sodium), (ECEC) and (Hydrogen me/100g) meaning that the more highly positively loaded variables, the more the variables with negative loading disappear. This impacts negatively on the vegetation distribution. For the remaining six variables under component 1 including (% Calcium), (% Carbon), (% sodium), (% ECEC), and (Hydrogen me/100g), the positive loading implies increase in soil properties and increase in diversity index which also has influence on the vegetation distribution. This component exemplified soil properties and accounted for Eigen value of 4.496 and explains 29.971% of the variation in vegetation distribution. It implies that soil properties has little impact on vegetation distribution. The soil properties isolated by this component are very important in vegetation distribution. So if they diminish due to gully erosion, vegetation is adversely affected.

Component 1I has significant loadings on loading on six variables viz (% of carbon), (% of organic matter), (% of Magnesium), (% of potassium), (ECEC), (% of Magnesium) and (% of Base salt).The heavy loadings on these variables denotes the impact of these minerals on diversity of plant species. The component has a Eigen value of 3.358, 22.386 % variance and explains 32.29% of the cumulative variance. This component reflects soil richness in terms of its fertility as influenced by vegetation cover (distribution).

Component III has a significant loading on four variables (CEC me/mg), (% of Base salt), Al^{3+} (me/100g) and (H^+ me/100g). The positive loadings on this components is indicative of the effects of these soil nutrient on diversity of plant species. The component has a Eigen value of 2.800, accounts for 18.666% of the total variance and a cumulative percentage value of 71.023.

On the other hand, **Components IV**, only two of the variables were significantly loaded. They include phosphorus (ppm) and % of magnesium. Their higher loadings imply that the more these properties in the soil, the more the diversity index. This in turn implies that the soil would support more plant species diversity. The component has an Eigen value of 1.816 which explains 12% of the total variation.

Component V has negative significant loading on just one variables which is organic carbon. It implies that decrease in soil organic carbon decreases diversity index. The component has an Eigen value of 1.305, and accounts for 8.698% of the total variance.

Discussion

From the study, the effect of gully erosion on vegetation distribution in the area was reciprocal. Gully had effect on the plant diversity in the zones, also, the vegetation had effect on the soil across zones. It was discovered during the research that soil properties were responsible for the vegetation distribution in the study area, as it was responsible for the different species noticed in the various zones. Secondly, it was noticed that Zone B (non-gully site) has more of the Fabaceae family than any other. These plants are leguminous in nature. They are normally called food plants, and are one of the most important ecological and economic resources. We tested the hypothesis of the study, using Analysis of Variance (ANOVA**)** to ascertain whether a statistically significant difference exists between the two sites and vegetation distribution in Idemili North LGA. From the analysis, there is statistically significant difference between gully and vegetation distribution. Hence, four variables (CEC, Dominance, %N and %OM)) had significant difference between the two sites.

Recommendations

The research investigated the effects of gully on vegetation distribution in Idemili L.G.A. From the findings of the study, we recommend the following:

1. Maintenance of remnant vegetation along drainage lines and eliminating grazing from the study area will go a long way in preventing the development of gully.
2. There is need for vegetation management. This involves the practices of managing vegetation (such as crops, forage, or timber) to improve its quality and diversity.
3. It is also recommended that both individuals and government should engage in tree planting to replace the lost one (afforestation). There was a tree planting campaign across the country in the past decades. Such approach is strongly encouraged to ensure the sustainability of plant species diversity in the study area. From the study, we were able to identify common species from the various zones, and even found out common families that existed between zones. There should be sustainable conservation and management of the plant species in the study area.
4. Finally, we recommend that more research be carried out on other factors that could affect vegetation distribution such as rainfall trends, sand mining, land use change and so forth. The two zones shared almost similar plant species, so it would therefore be necessary to undertake further studies to see whether any other environmental factors could be the source of variation in the vegetation distribution in the study area. This will help in sustainable vegetation management in the study area.

Conclusion

Vegetation is a key component of an ecosystem and, as such, is involved in the regulation of various biogeochemical cycles, e.g. water, carbon, nitrogen. It affects soil development over time, generally contributing to a more productive soil. Vegetation can be easily described and mapped, and therefore can be used to monitor changes in cover, composition, and structure due to natural or human-influenced events.

Gully erosion reduces the ability of soil to store water and support vegetation distribution, thereby reducing its ability to support biodiversity. Erosion promotes critical losses of water, nutrients, soil organic matter and soil biota, harming forests, rangeland and natural ecosystems.

The study examined the effects of gully erosion on vegetation distribution in Idemili North L.G.A. of Anambra State. It also recommended measures that could be adopted in order to curb the menace of gully erosion and its attendant impact on vegetation distribution in the study area.

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