IOSR Journal Of Pharmacy And Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 17, Issue 2 Ser. II (Mar. –Apr. 2022), PP 59-65
www.Iosrjournals.Org

Survey of Vegetative Abundance of Plant Species in Some Selected Erosion Sites in Imo State, Nigeria.

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Abstract
Vegetative abundance has been globally accepted as the method of determining plant species abundance in a particular environment or location. Different plant species are found in different locations; thus, proving that an environment that supports a particular species of plants may not be able to support the other. Plants species possesses some attributes that enable them to thrive in the environment in which they are found. Man's influence to majority of these environments has made it inhabitable to some of these plant species; thus, they needed extraordinary characteristics to enable them to survive in this harsh and human dilapidated environment. Environments that are prone to erosion and the most and sustainable way of minimizing it remains a task to be surmounted. Vast hectares of agricultural land are lost globally annually due to erosion. Different plant species are seen thriving on these erosion sites, hence forms the basis of this study. The purpose was to Identify vegetation species that have adapted to the soil condition of these erosion sites and recommend them for possible reclamation programs. Three gully sites were selected, representing the urban, semi-urban and rural ecosystems in Imo State, Nigeria. The result showed that Panicum maximum was the most dominant plant species with the importance value, an index of species abundance of 58.01, 47.88, 41.19 respectively, followed by Aspillia africana as against Tridax procumbens with 3.60, 18.45, and 8.095, as the least dominant species. Plant species diversity (H_{max}) was higher in rural location (2.56) than in the semi-urban and urban locations with (2.08.), and when aspects are taken into consideration, it is higher towards the east aspect of the gully than the west. Grass species are majorly found to be also, the species adapted to these gully sites and could be used in reclamation of these sites in the region.
Background: *Plant species remain the bedrock of animal life, due to their ability to manufacture their own food through the process of photosynthesis on which animals and other micro-organisms depends. Green plants therefore are essential for the existence of all kinds of life (Dutta, 2009). It is evident therefore, that for these plant species on which animal life depends to thrive, soil must provide the necessary anchorage, nutrient and support. Food crops grow best in fertile soil, which is a mixture of humus, sand, clay and rock particles. When these soils are affected by erosion, the resultant effect will affect the flora and the fauna aspect of life of the land area. Hence, this study was carried out to survey the vegetative abundance of plant species of erosion sites in Imo State Nigeria. This was to determine the type of plant species that thrive in these areas which can be used in reclaiming such areas and beyond, using these plants species and others with the same characteristics.*
MATERIALS AND METHODS: *This study was carried out around selected gully erosion sites in Imo state, south eastern Nigeria. The experiment was carried out in three different locations namely, the urban, semi-urban and rural areas. Species abundance was calculated by placing 60cm×60cm quadrat thrown at the center of the coordinate points, selected randomly from a pack of numbers. Plant species found inside the quadrat were counted, recorded and Identified. The data collected was determined using Shannon Wiener's index of species diversity.*
RESULTS*: Results of the sampling showed that species abundance status of the gully erosion site in the rural location is the highest, followed by that of the semi-urban and urban respectively. Panicum maximum with the important value index of 58.01, 47.88 and 41.19 dominated the gully sites in the urban, semi-urban and rural areas respectively. Species diversity by locations showed 0.19, 0.89 and 0.83 for rural, semi-urban and urban gully erosion sites respectively. Species diversity of the gully sites by location and aspect showed that the East aspect of the gully sites has higher species diversity than the West aspect.*
CONCLUSION: *Species diversity of the gully is highest at the rural location and lowest at the urban location. Panicum maximum was found to be the most dominant of all the plant species found at the gully erosion.*
Key word: *Gully, Dominant species, Species abundance, Species diversity, location, Aspect*.

Date of Submission: 20-03-2022 Date of Acceptance: 03-04-2022

I. Introduction

Green plants are essential for the existence of all kinds of life (Dutta, 2009). They function both in purification of the atmosphere and manufacturing of food. It is evident, therefore that animals including human beings are indebted to plants for their basic needs. These plants in turn need the soil for anchorage and nutrient intake. Soil provides a vital habitat-primarily for microbes including bacteria and fungi; also, for micro-fauna, meso-fauna and macro-fauna (Barget, 2005). Human intervention such as deforestation and practices associated with over farming remove the components of the soil that help to bind soil together and the structures that protect it from the forces of the elements. When this happens, erosion and other factors of degradation can act to draw the nutrient-rich topsoil off the farmland, often depositing it in water courses. This destroys the productivity of the land and damages the rivers and lakes where the top soil ends up (Stephen, 2004). The countries of sub-Saharan Africa are besieged by serious environmental degradation resulting in desert encroachment, draught and soil erosion due to either wind impact or very highly intensive rainfall. (Daniel, 2012). The ecological and social settings of these zones are often distorted sometimes leading to losses in human and material capitals. The greatest threat to the environmental settings of southern Nigeria is the gradual but constant dissection of the landscape by soil erosion by water (Daniel, 2012). It is realistic to accept, that meeting the challenges of food scarcity and feeding to an ever-growing population does not rest on expensive and light technology or stretch the limits of food production in better endowed areas, but on restoring the production capacity of the existence wastelands (Bernard, 1998)

Food crops grow best in fertile soil, which is a mixture of humus, sand, clay and rock particles. Most of the humus that sustains the activities of the micro-organisms and plants is found in the uppermost layer of the soil, called the topsoil. Such soil is produced by long term interaction between the soil and plants growing in it (Miller, 2002).

The binding effect of the roots of various vegetations cannot be underestimated and their ameliorating role in degraded soil reclamation has been paramount. The binding properties of their root systems and the formation of humus from leaf fall contribute to soil development. According to Kraayenoord and Hathaway (1986), vegetation, especially the root system possessed by particular dominant specie growing on a particular land area, plays a major role in stabilization and rehabilitation of eroded lands. Naturally, vegetation will ensure lasting reclamation as the roots of the plants hold the soil together and prevent it from being eroded. (Stephanie, 2014).

Visual observation on some selected gully erosion sites showed that areas with less species of some particular plants show greater damages by gullies than areas with these plants. Identification of these plant species and their development can be of paramount help in reclaiming these lands biologically.

This study aims at studying the vegetative abundance of these species and the attributes that had adapted them to grow in these erosion prone areas. This will be necessary in development of erosion control measures in developing countries such as Nigeria.

II. Materials and Methods

The study was carried out in three ecosystems located within the highly weathered soil (utisols) of Eastern Nigeria (Imo state). The areas have been subjected to intensive flood coming from rainfall. The soils of these areas due to this intensive flood were carried away by erosion. These areas are in the devastating conditions, in that gully erosion, has set in from the study, the soil in these sites had low nutrient reserve and high acidity (Enwezor, 1976).

The location of the gully sites studied is in Owerri Municipal, the capital territory of Imo state (urban); also, in a semi-urban area of Awo-Omamma in Oru-East and in a rural Area of Orlu all in Imo State, Nigeria.The pedology of the area shows that the soils are all of sedimentary origin with sandstones and shale as the two dominant parent materials. The soil is a deposit of the territory age characterised by red and brown soils rich in iron. It belongs to the utilised order (Akamigbo, 1992).

The climate of the area is dominantly the tropical types and has a uniformly high temperature with mean monthly minimum of 26oc. The rainfall is intensive with an annual range of 1500mm-2000mm and the area is now in a derived savanna ecological zone due to mass deforestation (Areola, 1982; Oguntoyinbo, 1987). The rainfall occurs in a single season from March to November with the peaks in the months of July and November. Imo State is bordered by Abia State on the East, River Niger and Delta State to the West, Anambra State on the North and Rivers State to the South. The State lies within latitudes 4o45IN and 7o15IN and longitude 6o50IE and 7o25IE with an area of around 5,100 sqkm. Within the vicinity of these gully sites are found other shrubs mainly Oxytenanthera abyssinica (bamboo), and other vegetative species like Panicum maximum and some fruit plants like banana and plantain (Musa species) in the urban area of the erosion site.

EXPERIMENTALDESIGNANDLAYOUT:

The experiment was performed/carried out in three different locations. Before samples were collected, a preliminary survey of the gully site area was carried out to ensure proper sectioning of the sites to be located in an urban, semi urban, and rural areas. This was aimed at establishing the gully effects of water runoff in three locations in order to arrive at a reasonable conclusion in solving the related problems in this type of areas, in other parts of the country and West Africa under the same type of geographical climate taking into consideration the effects of (some plants that thrive in these areas prone to erosion. These sites having been ascertained to be prone to erosion were marked out with pegs and tapes, and the area to be studied mapped out. With the aid of compass, the east and west side of each erosion sites will be determined. Vegetative abundance of species on both sides of erosion sites were calculated.

PLANTS SPECIES IDENTIFICATIONS AND POPULATIONS COUNTS.

A 60cm x 60cm quadrat was placed at random between a distance of 30 meters each from the two sides of the gullies to determine the plants species at the erosion site. The plants species were counted and specimen collected for identification. The method used in the plant species sampling is the random sampling to ensure that every part of the sampling area has an equal chance of being sampled. Two straight lines at right angles to each other from the margin of the 30m × 30m area mapped out and around its gully sites will be established. This area mapped out was sampled ten times with a 60cm x 60cm quadrat using a pair of random numbers that were picked from the pair of number coordinates making sure no pair will fall outside the area mapped out. The random points were determined by tracing the random numbers at one of the coordinate points and the quadrat placed at the point of interception of the coordinates.

From the result of the ecological sampling, abundance measures calculated include specie density, frequency, relative density, relative frequency, and importance value.

PLANT PARAMETERS

The formular used for obtaining the Above abundance measure is

$$\text{DENSITY} = \frac{number\ of\ each\ specie}{Total\ area\ sampled}$$

$$\text{FREQUENCY} = \frac{number\ of\ times\ a\ specie\ ocuured}{total\ number\ of\ times\ seacrched\ for\ it} \times \frac{100}{1}$$

$$\text{RELATIVE DENSITY} = \frac{Density\ of\ each\ specie}{Total\ densities} \times \frac{100}{1}$$

$$\text{RELATIVE FREQUENCY} = \frac{Frequency\ of\ each\ specie}{Total\ frequency\ of\ all\ specie} \times \frac{100}{1}$$

IMPORTANCE VALUE = Relative frequency + Relative density

- Species diversity will also be calculated using Shannon Wiener index of species diversity

H^1_{max} = Lns where S = Total number of species

Equitability, E = $\underline{H^I}$

$H_{max}H_{max}{}^1$ = max equitability

E= Summation sign

PI = Proportion of species in the community

Ln = Natural log

S = Number of species

DATA ANALYSIS: The data of plant species present were determined and the data collected were subjected to statistical analysis using analysis of variance.

III. Results

Species Abundance Status and Diversity of the Gully Sites

In Tables 1, 2 and 3 show the species abundance status of gully site in the urban, semi-urban and rural location. The tables indicate, that the gully sites in urban, semi-urban and rural areas are dominated by *Panicum maximum* with importance value index of 58.01, 47.88 and 41.19 respectively.

Table no 1: Species Abundance Status of the Gully Site in Urban Location

Species	Species No	Count in Quadrat	Freq.	Rel Freq.	Species Dens	Rel Dens	IVI
Pancium maximum	30	9	90	21.4	3	36.59	58.01394
Aspillia Africana	18	8	80	19	1.8	21.95	40.99884
Mimosa pudica	10	6	60	14.3	1	12.21	26.48084
Sidaacuta	9	6	60	14.3	0.9	10.98	25.26132
Chromolaenaodorata	7	5	50	11.9	0.7	8.537	20.44135
Euphorbia Heterophylla	4	4	40	9.52	0.4	4.878	14.40186
Magniferaindica	3	3	30	7.14	0.3	3.659	10.80139
Tridaxprocumbens	1	1	10	2.38	0.1	1.22	3.600465
Total			420	100	8.2	100	200

Table no2: Species Abundance Status of the Gully Site in Semi-urban Location

Species	Species No.	Count In No.Quandrat		Rel. Freq	Species Freq	Rel. Density	Density.	IVI
Panicum maximum	25	8	80	17.391	2.5	30.488		47.88
Aspillia Africana	18	8	80	17.391	1.8	21.951		39.34
Sidaacuta	11	11	110	23.913	1.1	13.415		37.33
Chromolaena odorata	7	5	50	10.87	0.7	8.5366		19.41
Tridaxprocumbens	8	4	40	8.6957	0.8	9.7561		18.45
Ageratum conyzoide	6	4	40	8.6957	0.6	7.3171		16.01
Mucunapuriens	5	4	40	8.6957	0.5	6.0976		14.79
Bambusa vulgaris	2	2	20	4.3478	0.2	2.439		6.787
Total			460	100	8.2	100		200

IVI = Importance value index

Table no3: Species Abundance Status of the Gully Site in Rural Location

Species	Species No	Count in Quadrat	Freq.	Rel. Freq.	Species Dens	Rel. Dens	IVI
Panicum maximum	33	9	90	15	3.3	26.19	41.19
Aspillia Africana	15	6	60	10	1.5	11.905	21.9
Pennisetum Purpereum	9	7	70	11.7	0.9	7.1429	18.81
Chromolaena Odorata	10	5	50	8.33	1	7.9365	16.27
Mucunaperuriens	10	5	50	8.33	1	7.9365	16.27
Cyperusretundus	10	5	50	8.33	1	7.9365	16.27
Euphorbia Heterophylla	8	5	50	8.33	0.8	6.3492	14.68
Crotolaria retusa	7	5	50	8.33	0.7	5.5556	13.89
Kyllinga bulbosa	8	2	20	3.33	0.8	6.3492	9.683
Bambusa vulgaris	4	3	30	5	0.4	3.1746	8.175
Tridax procumbens	6	2	20	3.33	0.6	4.7619	8.095
Eurphorbia hirta	3	3	30	5	0.3	2.381	7.381
Magnifera indica	3	3	30	5	0.3	2.381	7.381
Total			600	100	12.6	100	200

Table no 4: Shows the species abundance status of the gully site by location and aspect. The table indicates that the gully site by location and aspect is dominated by *Panicum maximum(51.11 East, 66.7 West in the urban location, 66.86 West in the Semi-urban and 37.01 East, 46.00 West in the rural location),* with the exception of the East aspect of the semi-urban location which was dominated by *Aspillia Africana with 46.67 species abundance.*

Table no4: Species dominance Status of the Gully Site by Location and Aspect

Abundant Plant Species	IVI	Aspect	Location
Panicum maximum	51.11	East	urban
Panicum maximum	66.7	West	urban
Aspillia Africana	46.67	East	semi-urban
Panicum maximum	66.86	West	semi-urban
Panicum maximum	37.01	East	Rural
Panicum maximum	46.00	West	Rural

Table no 5: Table 5 shows the species diversity status of the gully site by location. The table indicates that species diversity of the gully site is highest in rural location with diversity as (2.34). There was a higher even distribution of the species in rural gully site than in the other gullies.

Table no5: Species diversity Status of the Gully Sites by Location

No of Location	Species	H^1	H_{max}	Equitability
Urban	8	1.73	2.08	0.83
Semi-Urban	8	1.85	2.08	0.89
Rural	13	2.34	2.56	0.91

Table no 6: Shows the species diversity status of the gully site by location and aspect. The table indicates that the species diversity is higher towards the east aspect of the gully than the west aspect in all the gully sites.
It shows that there was also more even distribution of species in the east than in the west aspect of all the gully sites.

Table 6: Species diversity Status of the Gully Sites by Location and Aspect

Location		Aspect		Species	H^1	H_{max}	Equitability
Urban		East	8		1.82	2.08	0.877
West	6		1.47	1.79	0.82		
Semi-Urban		East	8		1.89	2.08	0.911
		West	6		1.19	1.79	0.66
Rural		East	13		2.36	2.56	0.92
		West	13		2.27	2.56	0.866

H^1= Shannon – wiener's diversity index,
H_{max}= Maximum diversity possible/equitability

IV. Discussion

The finding of the study with respect to vegetative development at the gully site indicated that *Panicum maximum* is the most dominant plant species across location and aspect of the gully. Sharma (2009) reported that the fibrous root system of grasses *like Panicum maximum* enable them to be efficient users of resources and also in withstanding against being carried away easily by erosion. This probably would explain the reason for the dominance of *Panicum maximum* at the gully site. As result Sharma (2009) suggested that grasses like the *Panicum maximum* may serve as important plant resources for the reclamation of erosion sites. Furthermore, the study as expected revealed that the species diversity of the rural area was higher than that of the urban and semi-urban. Similarly, the west aspect of the gully recorded higher species diversity. Kohli et al. (2012) studies confirms the findings of this study, showing that urbanization and other destructive man activities reduce the species diversity of many plant communities.

Following the findings of the study, the effect of aspect of the gully may be better appreciated when the different activities of human at gully sites are considered

V. Conclusion

This study observed that human activities through urbanization can alter ecological characteristics and vegetative development of gully sites. The vegetative development at the gully sites was particularly different across locations and between gully horizons. However, the vegetations of the selected gully sites were found to be related. Of all the plant species found at the gully sites, *Panicum maximum* was found to be the most dominant. The study finally showed that the species diversity of the gully is highest at the rural location, followed by that of the semi-urban and lowest at the urban location.

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