

Residents / Community Perception of the Application of Hard and Soft Landscape Elements for Environmental Quality in Ngwo Enugu State, Nigeria

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Abstract

Erosion is environmental occurrences that are widespread in the desert and coastal regions of Nigeria, Ngwo in Enugu not exemption. This study centered on Residents/Community Perception of the Application of Hard and Soft Landscape Elements for Environmental Quality in the study area. The study adopted survey research; structured questionnaires and in-situ-observations/weekly measurement from the 3 gully areas at the study area. Random sampling was adopted to arrive at the sample size of 400 households. One-Way Analysis of Variance (ANOVA) was used to test the hypothesis. The result showed that the Chi-square (χ^2_{cal}) value = 22.97 while the chi-square (χ^2_{tab}) at 5 percent level of significance = 9.49. Since the $\chi^2_{cal} > \chi^2_{tab}$ at 5 percent level of significance, H_0 is rejected and H_1 accepted. Therefore, the application of both soft and hardscape elements is efficient in controlling soil erosion in the study area. However, this go a long way to improve the environmental qualities of the study area. The hardscape elements were measured by the use of retaining walls, interlocking tiles, kerbing, stones etc in the study area while the soft scape elements were measured by the use of shrubs, grass lawns, refuse dumping, land filling etc. in controlling soil erosion. This also signified that the introduction/implementation of these soft and hard landscape elements will be of good beneficial in soil erosion mitigation in the study area.

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Background to the Study

Our environment is not an abstract concern rather, the sum of all external conditions, which strongly influence our mental health development and survival (Adam, 1990). It becomes sustainable when the responsible interaction is been carried out in the environment in a way that it will avoid depletion or degradation of natural resources and allow for long-term environmental quality. The practice of environmental sustainability helps to ensure that the needs of today's population are met without jeopardizing the ability of future generations to meet their needs.

Allen (1995), opined that natural environment has a rather remarkable ability to rejuvenate itself and sustain its viability. For example, when a tree falls, it decomposes, adding nutrients to the soil. These nutrients help sustain suitable conditions for plants to grow. Meanwhile, when nature is left alone, it has a tremendous ability to care for itself. However, when man enters the picture and uses many of the natural resources provided by the environment, things change. Human action can deplete natural resources and without the application of environmental sustainability methods, long-term viability can be compromised (Onokerhoraye, 1994).

Potter (1999) affirms that environmental degradation causes a variety of direct effects on mankind. Some of these effects are difficult, if not impossible to measure accurately, but they are however real. They include reactions to environmental deterioration by sensory perceptions, example, tastes, odours and irritation of the eyes, throat and nose. An awareness of a need to measure environmental quality and to prevent further degradation is widely recognized. According to Lambert (2000) the landscape elements such as vegetation, land form, water and other landmarks introduced by man, the combinations of intrinsic qualities of these elements determine contribution of landscape to environment. Landscape elements are broadly categorized as hard and soft landscape. The landscape that form by hard surface are hard elements examples; lines of building, walls, pavements, interlocking tiles, kerbing stone etc. While soft landscapes are: trees, shrubs, grasses among other soft element. These landscape elements (hard and soft) assisted in erosion control through the following ways: They checkmate the flow of rain water; used to construct drainages, used to build retaining wells, used to asphalt the road, used to demarcate boundaries/build embankments, soft landscape elements (vegetation) assist to prevent excess flow of run-off water; prevent washing away of earth surface and reclamation of site where erosion have devastated.

According to potter (2001), following constant warnings from ecologists, an environmental awareness has been created among all the professionals involved in planning, design and development of built environment, an awareness that the built environment should be in symbiotic relationship with nature, if man should survive on the planet. Soil erosion has devastated many coastal areas of Nigeria resulting to loss of lives, loss of arable land, water pollution, threat to aquatic lives, destruction of available infrastructural facilities. However, concerted efforts were made by the government and communities affected to prevent their land for further devastation using the traditional and modern mitigating measures for erosion. Therefore, this study centres on the “Residents/Community Perception of

Application of Hard and Soft Landscape Elements for Environmental Quality in Ngwo, Enugu State”.

Problem Statements

Soil (gully, sheet or rill) are wide spread in Nigeria and Ngwo in Enugu State not exclusive. The study area is affected through degradation of farmland, population displacement, houses engulfed with untold hardship, environmental degradation, loss of farmland, ecological damages, loss of farm crops/economic trees, destruction of available infrastructural facilities etc. For further details, see Plate 1, 2 and 3 below:



Plate 1: The effect of gully erosion as it dissected the land opposite the Enugu State Broadcasting Transmitting station, which was originally the site of the army, quarters in Ngwo.



Plate 2: The effect of deep gullies that have damage major portions of the road at Ngwo



Plate 3: The effect of gully erosion recently developed behind the three breweries viz-a viz the Nigerian breweries, Nigerian Bottling Company and Rex Onoh Bottling Company.

Aim and Objectives of the Study

The aim of this study: is to determine Residents/Community Perception of the Application of Hard and Soft Landscape Elements for Environmental Quality in Ngwo, Enugu State. The specific objectives are:

1. To determine the resident's perception of the application of hard and soft landscape elements for soil erosion mitigation.
2. To evaluate the resident's/community perception of the application of hard and soft landscape elements for controlling soil erosion in the study area.
3. To ascertain the components of modern landscape elements to improve the environmental quality.
4. To ascertain the efforts made by the study area in improving their environmental quality through landscaping exercises.

Research Questions

The following research questions were raised.

- a. What are the residents/perceptions of the application of hard and soft landscape elements for improving their environmental quality?
- b. What are the resident's/community perceptions on the application of traditional over modern landscape elements in improving their environmental quality?
- c. What are the components of modern landscape elements in the study area?
- d. What are the efforts made by the residents/community in improving the environmental quality of the study area?

The Hypothesis

Ho: The application of both soft and hardscape elements are not efficient in controlling soil erosion in different locations of the study area.

Hi: The application of both soft and hardscape elements are efficient in controlling soil erosion in different locations of the study area.

The Study Area

Ngwo is located in Udi Local Government Area of Enugu State and lies geographically between Latitudes 6°25'N – 6°29'N and longitudes 7°23'30 "E" – 7°25'30 "E" and with total land mass of 25km² and accessible through Nsukka and Obollo-Afor, through Enugu/Okigwe, Awka and Onitsha. The major towns include: 9th Mile and Nsude. Ngwo soil is made up of shallow and stony lithosols found at the steep slope of the Cuesta and often left uncultivated. Ngwo is situated in a valley-border surface or hill slope. Ngwo Town is threatened by the problem of flood which has been devastating the communities for a long time e.g. Milikin Hill-Ngwo, Ugwu Onyema, 9th Mile Road, Colliery Comprehensive Secondary School, Silas Memorial Primary School premises, Army Quarter Site Ngwo etc. All were devastated by gully erosion. For further details of the study area see Plate 1, 2 and 3 respectively.

The main surface water in Ngwo is the Ajali River usually used by the Ajali Water Works. Ngwo Town is predominantly for farming, trading and industrial activities. The annual rainfall ranges from 2,000 to 3,000mm while the temperature maxima ranges from 29.4°C to 35°C and the minimum ranges from 20.8°C to 22.8°C (Jungerius, 1999).

Ngwo has hilly areas and other rolling lands at 223 meters above the mean sea level, usually endowed with Udi, Agwu and Nsukka highlands and well-drained soil during the raining season. The Hills are flanked by rolling Low Land to the Oji River Basin. See the geological and topographical maps of the study area in figure 4 and 5 respectively. However, gully erosion is predominate in Ngwo Town and constituted threat to human and economic activities see Plate 1, 2 and 3 for the damages done by erosion in the study area.

Fig. 1: Enugu State showing Udi LGA. (Source: GPS, 20th, May 2019)

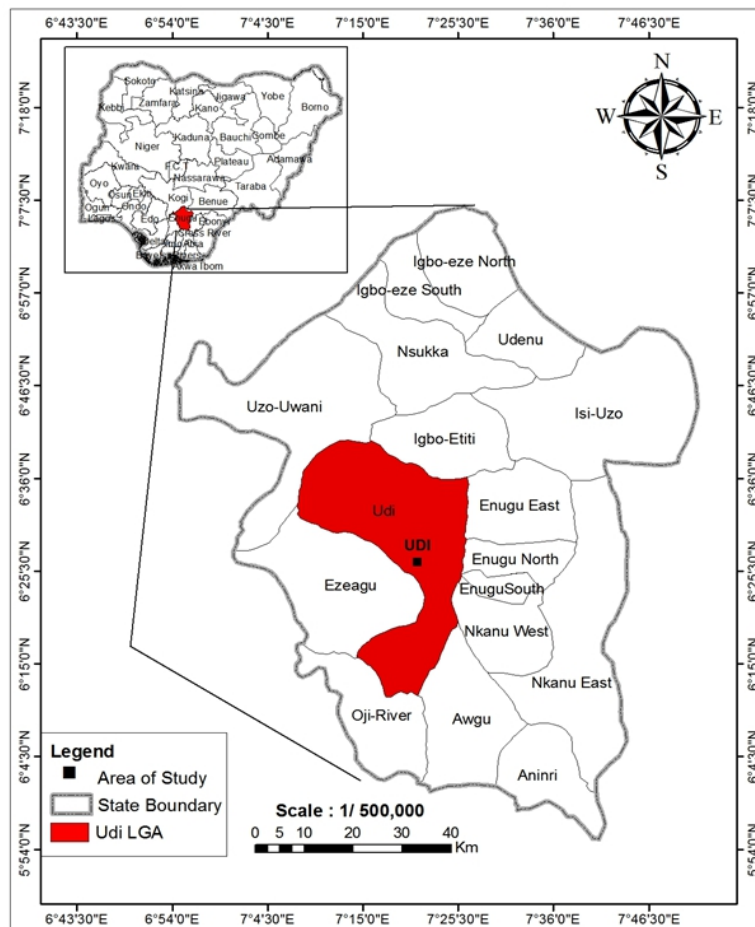


Fig. 2: Detail map of Udi L.G.A showing the study area. (Source: GIS Map, 20TH May 2019).

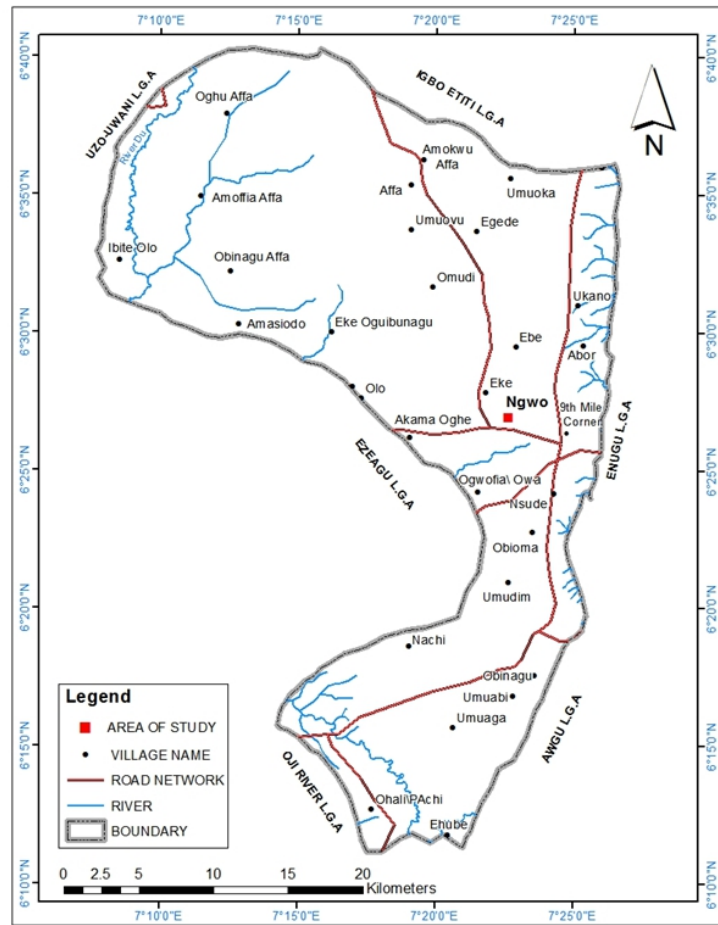


Fig. 3: The study area showing the three locations (**Source:** GPS, 20th May 2019)



Literature Review

Lambert (2000) carried out a research on the elements of landscape, its types and nature. He discovered that lawns, lakes, pools, fountains, shrubs, grasses, trees, paved areas, footpaths among others are types of landscape elements and it also enrich the foreground. He further found out that the landscape elements in the built environment were broadly categorized as soft and hard landscape. On his result, he revealed that soft surfaces like lawns and ground covers planted around the erosion prone areas are not only checkmating the erosion but also make the area tidy and cool the fresh air entering the surrounding buildings. On the issues of hard surface like paved areas, reinforce walls, kerbing stones asphaltting among others are not only use to mitigate erosion but also serves as aesthetic, which give beauty to the environment.

Landscape Elements for the Mitigation of Soil Erosion

Nyssen et al. (2006) discloses that erosion involves series of action by natural agents that result in washing away soil and rock fragment from the earth surfaces while gully is a steep side, ditch or valley created by channel of running water. David (2006) observes that there are several elements which could be seen on landscape while some are practically barren, dominated by sand and stony outcrops, some also are hilly or mountainous. According to Ume (2001), There are several elements that will be found on the landscape, some could be

dominated with elements while others may be scanty yet they give character to the landscape and also practically instruct the landscape planner and designer on the natural and cultural resources that are available in that environment for the controlling of erosion. These elements include landforms, water, vegetation, structures (building), and roads among others. Lyons (1997) affirms that each of these techniques has one or more specific type of technology or measures that can be used to meet its objective.

Methodology

Both secondary and primary data were sorted while the data collected were collated, analyzed and presented in charts, tables and percentages for clarity. The sample size was determined using Yaro Yamane formula to arrive at the sample size of 400, the formula stated as:

$$n = \frac{N}{1 + N(e^2)}$$

Where

- n = Sample size
- N = Sample population
- e = Margin error
- 1 = Constant

Given that N = 62,374, e = 0.05 therefore the sample size will be

$$= \frac{66,374}{1 + 62,374(0.05)^2} = 400$$

$$= \frac{66,374}{1 + 62,374 \times 0.0025} = 397.45 = 400 \text{ households}$$

However, random sampling method was employed to select three localities in the study area namely: Amankwo, Enugu Ngwo and Amaeke Community.

One-Way-ANOVA (Chi-Square) was employed to test the formulated hypothesis. The hardscape elements were measured by the application of retaining walls, interlocking tiles, kerbing, stones etc in controlling the erosion in the study area while the soft scape elements include the use of shrubs, grass lawns, refuse dumping, bamboo, land filling methods in controlling soil erosion.

Data Analysis and Presentation

The three communities: Amankwo, Enugu Ngwo and Amaeke were surveyed. The gender of the respondents from the administered questionnaires comprised of (Amankwo Community) 133 questionnaires (33.25 percent), 33 questionnaires (33.25 percent) and 134 questionnaires (33.5 percent).

Age of Respondents

Respondents within the age bracket of 40 – 49 ranked highest a total frequency of 100, while

age bracket of 60 and above has the frequency of 60. This shows that population that responded more to the questionnaire survey is a very active and independent population. Therefore, they are eager and more interested in finding the lasting solution to the erosion problems that ravaged their farm land.

Gender Distribution of Respondents

The Table 1 shows that 201 of the respondents are female representing 50.25 percent of the total number of respondents, while the male respondents have a frequency of 199 representing 49.75 percent. This shows that more female was interviewed than male during the research work reason been that majority of men in the various study location are civil servant and this could translate to high vulnerability to erosion risk in the area since women are less resilient to natural disasters such as soil erosion, land slid, land degradations among others.

Table 1: Gender Distribution of Respondents

Gender	Amankwo	Enugu Ngwo	Amaeke	Total	Percentage
Male	54	70	75	199	49.75
Female	79	64	58	201	50.25
Total	133	134	133	400	100

Education Qualification

Table 2 shows that 63 out of 400 respondents did not attend any formal education (uneducated) and this represents 15.75 percent of the total respondents. A greater percentage of the respondents are formally educated with a total of 337 representing 84.25 percent of the total number of respondents. This shows that a more than proportionate percentage of the populations are consciously aware of the dangers associated with soil and gully erosion. Meanwhile, Gully erosion awareness does not depend on education.

Table 2: Education Qualification of Respondents

Variable	Amankwo Comm.		Enugu Ngwo Comm.		Amaeke Comm.		Total No
	Male	Female	Male	Female	Male	Female	
Uneducated	9	14	12	9	10	9	63
Vocational	19	19	15	14	16	5	88
Primary	2	4	7	9	9	2	33
Secondary	5	12	12	8	13	6	56
Tertiary	19	30	24	24	27	36	160
Total	54	79	70	64	75	58	400
%	13.5	19.75	17.5	16	18.75	14.5	100

Occupation

Table 3 shows that 24.25 percents of farmers and 24.25 percents of civil servants were the highest respondents. This signified that the farmers and civil servants were interviewed more in the study area. It also shows that the high literacy level in the communities is expected to also facilitate developmental process in the area.

Table 3: Occupation of Respondents

Variable	Amankwo Comm.		Enugu Ngwo Comm.		Amaeke Comm.		Total No
	Male	Female	Male	Female	Male	Female	
Artisan	15	15	13	11	12	3	69
Trader	13	14	12	10	12	6	67
Farmer	12	20	14	13	23	15	97
Retired	4	8	16	15	13	14	70
Civil /S	10	22	15	15	15	20	97
Total	54	79	70	64	75	58	400
%	13.5	19.75	17.5	16	18.75	14.5	100

Table 4: Whether the respondents are from this community

Variable	Amankwo comm.		Enugu Ngwo comm.		Amaeke comm.		Total
	Male	Female	Male	Female	Male	Female	
Yes	39	48	41	31	50	41	No
No	15	31	29	33	25	17	250
Total	54	79	70	64	75	58	150
%	13.5	19.75	17.5	16	18.75	14.5	400 100

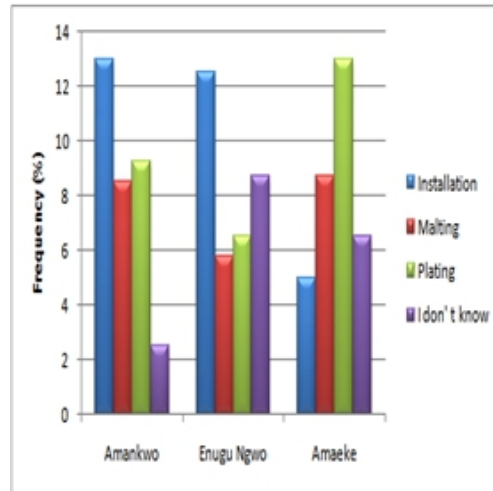
Table 4 shows that 62.5 percents of the respondents were indigenes from the study area while 37.5% were residents but not indigenes. This shows that the communities in focus have a greater number of residents at home.

Method of Application of Landscape Element

Histogram (figure 4) shows that 30.5% of the respondents are of the opinion that this can be achieved through installation, 23% through malting, 28.75% through planting and 17.75% don't know. This signified that this landscape element can be applied through installation. The histogram also shows that the high number of respondents in Amankwo and Enugu Ngwo agreed to the method of installation while most of respondent from Amaeke agree on the planting practice of a landscape element for soil erosion mitigation. The histogram below also revealed that Amankwo and Enugu-Ngwo respondents were of the highest opinion that landscape element practice should be carried out with the method of installation while most

of the respondents from Amaeke are of the opinion that planting method was the best way for the soil erosion mitigation.

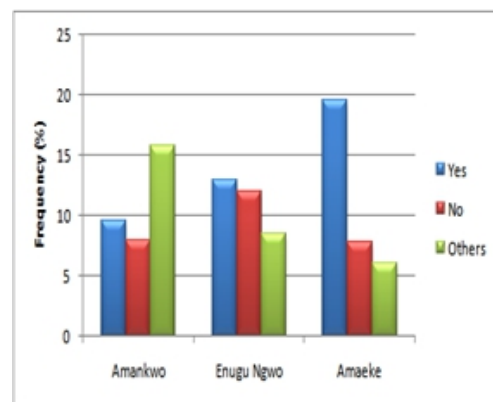
Fig.4: The landscape element method for the mitigation of soil erosion.



View of respondents on if the landscape elements meet its objective and people's expectation

Histogram (figure 5) shows that 42% of the respondents are of the opinion that the landscape elements meet its objective and expectation of the people in the study area, 27.75% of the respondents are not in support while 30.25% don't know. This signified that the landscape elements partially meet up its objective and people's expectation because more than 50% of the respondents are not aware and in support that landscape element can meet its objective and people's expectation in the study area. The histogram also shows that most respondents in Amaeke agreed that the landscape elements meet the objectives and expectations while most of respondents in Amankwo and Enugu Ngwo disagreed.

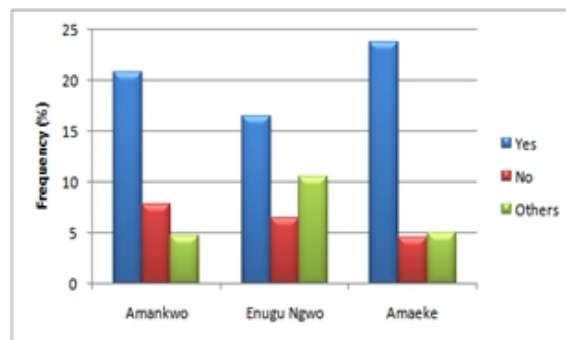
Fig. 5: Whether Landscape Element meets its objective and people's expectation?



List of Major Environmental Land Degradation by Soil Erosions

The histogram (figure 6) shows that 61% of the respondents are of the opinion that the clearing of bush, burning, flooding, Continuous farming among others are the major environmental factor aiding land degradation by soil erosion, 18.75% are not in support while 20.25% don't know. This signified that taking measures to stop these malpractices will help in controlling environmental land degradation by soil erosion. The histogram also shows that most of respondent in all communities agreed that they are aware that forest clearing bush burning, flooding, and Continuous farming among others are the major environmental land degradation by soil erosions.

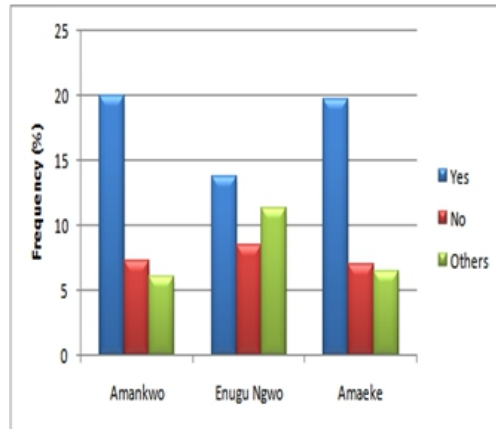
Fig. 6: The respondents are aware that the major environmental practices/factors aiding land degradation by soil erosions are forest clearing bush burning, flooding, and Continuous farming among others



View of Respondents on Factor that Causes Soil Erosion

Figure 7 shows that 53.5% of the respondents are of the opinion that rain drop on open land, run off from homes, blocking drainage, excavation/sand collection among others can cause soil erosion, 22.75% are not in support while 23.75 don't know. This signified that the prepare mitigation of these factors can help in controlling soil erosion in the study area. The histogram also shows that most of respondent in all communities agreed that the rain drop on open land, run off from homes, blocking drainage and excavation/sand collection among others are factors that cause soil erosion in the study area.

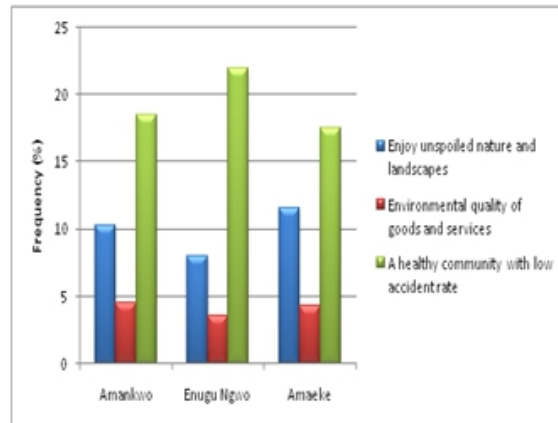
Fig. 7: The view of respondent on the factors that cause Erosion



The benefit of Landscape Elements on Soil Erosion Mitigation

Fig. 8 shows that 29.75% of the respondents are of the opinion that the landscape elements can be beneficial in soil erosion mitigation through enjoy unspoiled nature and landscapes (i.e. remaining naturally as God created it), 12.25% through environmental quality of goods and services while 58% through a healthy community with low accident rate. This signified that the implementation of these landscape elements will be of good beneficial in soil erosion mitigation. The histogram also shows that a healthy community with low accident rate has highest respondents against other options.

Fig. 8: The benefit of Landscape Elements on Soil Erosion Mitigation

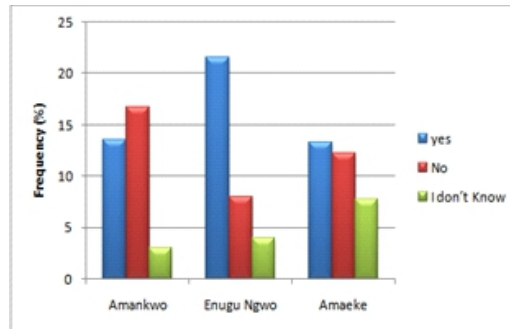


Level of Effectiveness of Landscape Element Practices in Soil Erosion Mitigation

From the Fig. 9, 48.25% of the respondents are of the opinion that the landscape element practice is effective in soil erosion mitigation, 37% of the respondents disagreed while 14.75% of the respondent affirmed that they don't know of any level of effectiveness of landscape element. Therefore, the histogram also shows that highest number that that agreed to the level

of effectiveness of landscape element is from Enugu- Ngwo while the high frequency of respondent in Amankwo disagreed.

Fig. 9: The level of Effectiveness of landscape element practices in soil erosion mitigation



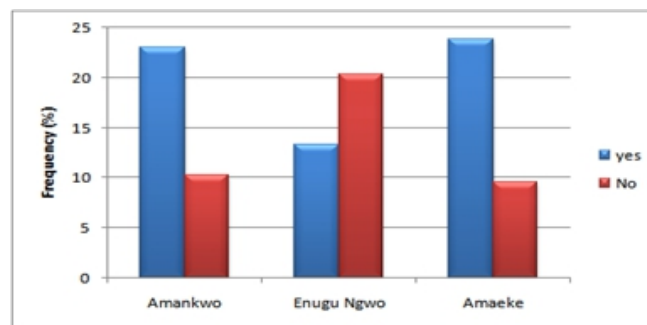
Residents Perception on the difference in the level of effectiveness between Hard and Soft Landscape Elements in Soil Erosion Mitigation in the study area

This section seeks to know the ideals of the people living at the study area concerning the use of landscape elements as mitigation tool for erosion control if it will be partially sustainable or totally sustainable when it applies at the erosion prone areas. Like when using the following: retaining walls, interlocking tiles, kerbing stones, asphaltting, trees, flowerbeds, vegetable garden, grasses, shrub among others.

Examples of Hard Landscape Elements (retaining walls, interlocking tiles, kerbing stones among others)

From the Fig.10, 60% of the respondents representing those that are of the opinion that the stones, rocks, tiles, fountains among others are the examples of hard landscape elements while 40% of the respondents are saying they are not. This indicates that good examples of landscape elements used in the study area include stones, rocks, tiles, etc. The histogram also shows that most respondent in Amankwo and Amaeke aware that stones, rocks, tiles, fountains among others are examples of hard landscape elements while most of respondent in Enugu Ngwo are not aware.

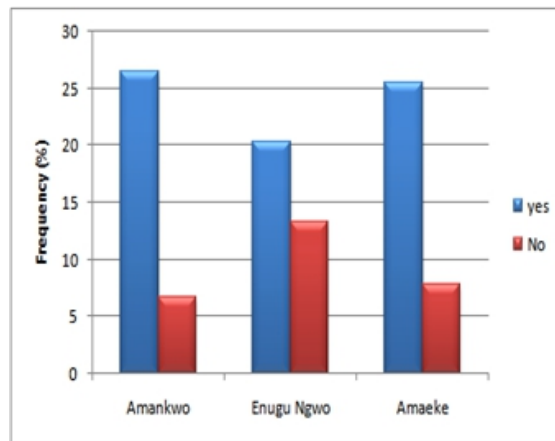
Fig.10: The view of respondent on examples of hard landscape elements?



Examples of Soft Landscape Elements (Trees, flowerbeds, vegetable garden, grasses, shrub among others).

Fig. 11 shows that 72.25% of the respondents are of the opinion that the plants, flowers, grasses are the soft landscape elements while 27.75% of the respondents are saying they are not. This signified that those mentioned elements are the examples of soft landscape elements. The histogram also shows that most of the respondents are aware that plants, flowers, grasses are examples of soft landscape elements

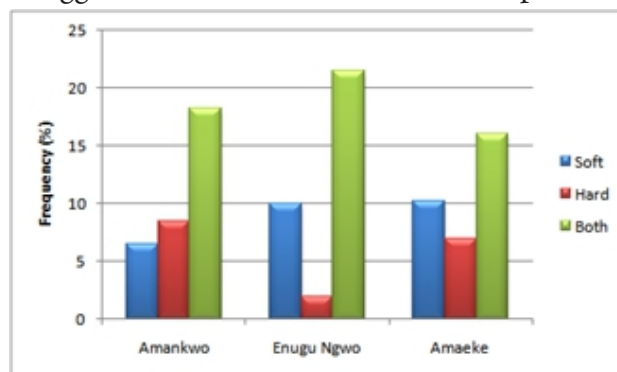
Fig. 11: The view of respondents on examples of soft landscape elements



Methods Suggested Between Hard and Soft Landscape Element

In this case, after explaining to the respondents the different between hard and soft landscape elements and its uses and applications, the respondents were then asked to suggest on their own the better ways these elements (hard and soft) can be apply in order to mitigate erosion at their areas. Fig 12 shows that 26.75% of the respondents suggested the soft element for mitigation of soil erosion while 17.5% of the respondents suggested the hard element. The 55.75% of the respondents suggested the practice of both soft and hard elements for mitigation. It also shows that most of respondent suggested combining both hard and soft landscape element.

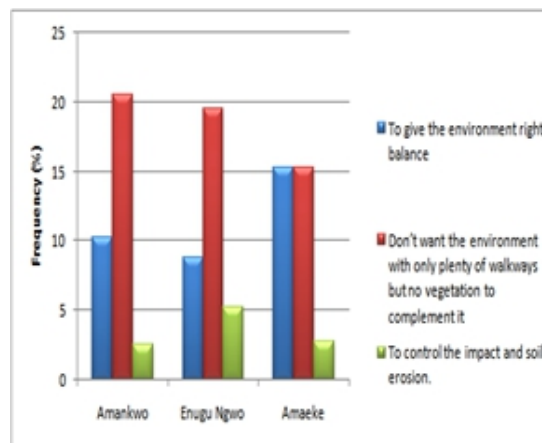
Fig. 12: The methods suggested between hard and soft landscape element



Objectives of Combining both Hard and Soft Landscape Elements

From the Fig. 13, 34.25% of the respondents are of the opinion that paved roads are the features of hard and soft landscape found in urban planning in order to mitigate soil erosion, 55.25% of the respondents are for Ground cover while 10.5% of the respondents are not in support of the both. This shows that the ground cover and paved roads is the feature of hard and soft landscape found in urban planning in order to mitigate soil erosion. The histogram also shows that most of respondents view the objective of combining both hard and soft to give the environment right balance and to not have the environment with only plenty of walkways but no vegetation to complement it.

Fig. 13: The view of respondent on the objectives of combining both hard and soft landscape elements



Test of Hypothesis

The result of the hypothesis (analysis) showed that $\chi^2_{cal} = 22.97$ and χ^2_{tab} at 5 percent level of significance = 9.49. Since $\chi^2_{cal} > \chi^2_{tab}$ at 5 percent level of significance, H_0 is rejected and H_1 is accepted. Therefore, the application of both soft and hardscape elements in controlling soil erosion in the study area are more efficient. They also helped in the improvement of the environmental quality in the study area.

Conclusion

The study revealed that both soft and hardscape methods were adopted in the control of soil erosion and they appeared efficient. The soft scape includes the use of grass lawns, shrubs, trees, heaping of refuse etc while the hardscape methods include the application of kerbs, interlocking, stones, Asphalts etc. The best and affordable way to adopt these proposed soft and hardscape elements are through the practice of planting and landscape soil erosion prone areas. Most of the respondents are of the opinion that rain drop on open land, run off from homes, blocking drainage; excavation/sand collection among others can cause soil erosion. The study also revealed that the respondents are of the opinion that the landscape elements can be beneficial in soil erosion mitigation through enjoying unspoiled nature and landscapes, through environmental quality of goods and services and through a healthy

community with low accident rate. The respondents also are aware of hard landscape element for mitigation which comprise stones, rocks, tiles, fountains among others are examples while soft landscape element are flowers, grasses, trees among others. The respondent agreed that the combine of both hard and soft is the most efficient for mitigation of soil erosion at the study.

Recommendations

1. Legislation on hard and soft landscape element for control should be enforced, to avoid indiscriminate excavation of sharp sand and mining of soil from the access road that courses gully erosion.
2. Due to increased population, pressure on available land spaces has increased. This calls for continuous monitoring of landscape element practice to enable adequate planning and distribution of resources.
3. This study should be extended to all the local government areas of the State (Enugu) and other South Eastern States of Nigeria, to enable continuous data gathering for gully erosion monitoring and assessment.
4. Construction of concrete drains to accommodate run off during rainfall should be encouraged to avoid run off diversions thereby speeding up of gully formations.

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