

## **Solid Waste Disposal: A Way of Controlling Soil Erosion in Usen Community, Ovia South West Local Government Area, Edo State, Nigeria**

<sup>1</sup>Isemede Ose Ahiante Patricia, <sup>2</sup>Iyoha Efosa O, & <sup>3</sup>Idehen Arthur

<sup>1,2,&3</sup>School of Environmental Studies, Edo State Polytechnic, Usen, Edo State

### **Abstract**

*This paper examined solid waste disposal: A way of controlling soil erosion in Usen community, Ovia South West Local Government Area, Edo state, Nigeria. The purpose for this study was to investigate the influence of soil erosion as result of solid waste disposal in Usen community four research question were raised and two hypotheses were formulated to guide the study. Correlational survey design was utilized, 1000 respondents were sampled out through simple random sampling technique from five streets. Questionnaire was used to collect data for the study multiple and linear regression were used to analyzed the instrument. The study revealed that flooding significantly influences soil erosion in Usen community. Among the recommendations was that all stakeholders, the government, the community should play that roles to pave way for proper planning and control of soil erosion in Usen.*

### **Introduction**

Solid Waste Management is the collecting, treating and disposal of solid materials that are discarded because they have served their purpose or are no longer useful. Waste Management is actually the collection, transport, processing, recycling or disposal and monitoring of waste materials, (Magutu, 2011). Besides the waste generated at home, schools, markets and other public places, there are those from industries, garbage, refuse sludge, trash and rubbish such as paper products, plastic, glass, metal and organic waste. Solid waste if not properly disposed can result to indiscriminate flooding which on the long run can cause soil erosion.

Soil erosion is the washing away of the top soil by running water as a result of rainfall. When the flood is much, the top layer which contains the organic materials that is fertile is washed away. Some of the causes of soil erosion include: contraction, logging and mining, grazing, farming, wind and rainfall. When rain drops directly on the topsoil and depending on the area, if the runoff water is not properly channeled, the water and the soil materials are pulled down the slope thus resulting in soil erosion. Soil erosion could be any of these types: sheet erosion, rill erosion, gully erosion or bank erosion. (Al-Kaisi, 2011).

According to Pereira and Munoz-Rojas (2017), Soil erosion is one of the major causes, evidence of, and key variables used to assess and understand land degradation.

Although soil erosion is a natural process, human activities have greatly accelerated it like agriculture, grazing of animals, mining, construction, recreational activities, etc.

Flooding is a major cause of soil erosion. It is as a result of heavy rainfall, a dam break, overflowing river, snowmelt, storm surge, lack of vegetation, etc. Flooding can cause damages to buildings and other structures, blockage of sewage systems, roadways and canals. Blockage of gutters and drainages is a major cause of flood, so drainage systems need to be cleared at all times. Landscaping and vegetation can be used to help reduce flooding. Urban development is important to the growth of any society which planning is concerned with.

According to Akinbo (2006), the urban society characterized by a huge economic disparity between a population of small wealthy families and a large number of poor families is a factor that makes the living conditions within cities so bad. The causes of urbanization in Nigeria includes: Population growth, economic growth, legislative designation of new urban centres and increases in densities of rural trading centres. Kubiati (2018).

### **Statement of the Problem**

Urban development all over the world is as a result of migration of rural dwellers to urban areas. This in the long run results in rapid growth in population, when population increases, flooding from sewers can occur where there are combined storm and foul sewers and their capacity is exceeded due to large amounts of surface water run-off which causes soil erosion. Poor waste disposal can lead to blockage of sewers and local flooding. The focus of this study is to investigate the factors that influence soil erosion as a result of solid waste disposal in Usen Community.

### **Purpose of the Study**

The main objective of this study are:

1. To find out whether waste disposal pattern influence soil erosion in Usen community'
2. To determine whether flooding significantly influence soil erosion in Usen community.

### **Research Questions**

1. Does waste disposal pattern influence soil erosion in Usen community?
2. Does flooding significantly influence soil erosion in Usen community?

### **Hypotheses**

3. Waste disposal pattern does not have influence on soil erosion in Usen community'
4. Flooding does not significantly influence soil erosion in Usen community.

## **Literature Review**

### **Soil Erosion and Urban Development**

The way and manner refuse are dumped in the community matters a lot. The challenges of flooding and control of soil erosion is occasioned by improper management of solid wastes.

Syeda and Azra (2013) carried out a study on open dumping of municipal solid waste and its hazardous impacts on soil and vegetation diversity at waste dumping sites of Islamabad City. The focus of the study was to assess the contribution of open waste dumping in soil contamination and its effects on plants diversity in one of the renowned green cities of Pakistan. Cluster Analysis (CA) method was used to determine groups of sampling sites to correlate with vegetation. It was found that environmental problems associated with the disposal sites is the risk posed to the soil. Since the waste was disposed directly unto the surface of the soil, a number of contaminants including heavy metals rapidly penetrate and eventually they contaminate the soil and affect the vegetation abundance of the area.

### **Soil Erosion and Population Increment**

The more people we have in a community, the more waste that is generated. The major problem that is occasioned by increment in population is that measures are not put in place to manage waste generated. Egede (2013) stated that the devastating effect of soil erosion is strongly related to the population of the affected localities.

Ijeoma, Ache and Choji (2015) carried out a study on sustainability of urban solid waste management in Nigeria. Content analysis was employed to examine case studies in previous research using deductive approach with qualitative data from relevant documents on urban solid waste in Nigeria. The results revealed that uncontrolled waste disposal sites cause nuisance and constitute health hazards to the populace and the environment.

### **Soil Erosion and Public Awareness**

Aliyu and Adamu (2014) focused on current management of municipal solid waste in Kano Metropolis and highlights the problems that impede efficient management. Focus group discussion method was used to ascertain people's perception. Kano metropolis was stratified into three zones (Old walled City – Yan Awaka Quarters, G.R.A – Sokoto Road and Surburban – Kwana).

The results showed that although public awareness and participations has been shown to be critical in the success of municipal solid waste management endeavor all over the world, it has been absent in Kano Metropolis. The paper recommended door to door campaign.

### **Effect of Flooding on Soil Erosion**

Chima and Okoro (2015) carried out a study on the effects of flooding on soil properties in Abakaliki South – Eastern Nigeria. The surveyed areas were along Ebonyi

River. Core Soil Samples were collected and weighed and dried at  $110^{\circ}\text{C}$  for 24 hours. The soil contents of Iron (Fe), Zinc (Zn) and Copper (Cu) were determined using the formula,  $T_p = 100 \left( 1 - \frac{D_b}{D_p} \right)$ . The results showed that in total porosity and moisture content were among the benefits and they concluded that flooding can bring benefits to soils by making soils more fertile and provides nutrients required.

## Methodology

### Research Design

The research work utilized Correlational Survey design since it is basically an inquiry into the relationship between solid waste disposal and soil erosion control in Usen community. According to Omorogiuwa (2006), a correlational survey design is applied to a study that seeks to establish if linear relationship exists between two or more variables. This design is essential in this research because the research primarily intends to establish the relationship that exists between solid waste disposal and soil erosion control in Usen Community.

### Population

The population for the research work consisted of 1000 adults selected from 10 streets in areas that are prone to flood in the community and from the polytechnic zone.

### Sample and Sampling Technique

The sample size for this research was 500 respondents and they were selected through simple random sampling technique from 5 streets prone to flood and the polytechnic community.

**Table 1: Distribution of Sample Size**

Name of Street	No of Respondents
Polytechnic Community	200
Palace Road	60
Akure Street	60
Elawure Street	60
Omole Street	60
Akede Street	60

### Method of Data Collection and Analysis

The researchers administered questionnaires to Community Leaders and Usen Residents. Questionnaire on Influence of Solid Waste Disposal on Soil Erosion (CLURQISWDSE) to the respondents and also went round the locality to observe and discuss with the inhabitants of the flood prone areas. Global positioning System (GPS)

was used to collect the geographic coordinates of the various points which was entered in Microsoft Excel environment. ArcGIS was used to determine the rate of exposure of the sampled areas to risk of soil erosion.

**Research Question 1**

*How does increment in population influence soil erosion in Usen Community?*

**Table 1:**  
**Means & Standard Deviations of Respondents’ Responses on the Influence of Population Increment on Soil Erosion in Usen Community**

S/N	Statements on Influence Population Increment	SA(4)	A(3)	SD(2)	D(1)	UN(0)	N	$\bar{X}$	SD	Remarks
1	Increase in Population does not influence soil erosion	542	217	193	121	113	1186	2.80	1.36	Accept
2	I am not aware of increase in population in Usen community	204	233	453	166	130	1186	2.18	1.20	Accept
3	Population has not no relationship with soil erosion	154	192	414	383	43	1186	2.03	1.07	Accept
4	There is no Soil Erosion in Usen Community	92	199	561	139	195	1186	1.88	1.11	Reject
5	There is no solid waste disposal system in place in Usen community	144	454	369	162	57	1186	2.39	1.02	Accept

The results in Table 1 show that the respondents accept that increase in population does influences soil erosion, they are not aware of the increment of population in Usen; accept that there is no waste disposal system in Usen but reject that there is no soil erosion in Usen Community

**Research Question 2**

*What is the level of awareness of flooding due to improper development in Usen Community?*

**Table 2:**  
**Means and Standard Deviations of the Level of Awareness on Flooding Due to Urban Development**

S/N	Statements on level of Awareness	SA(4)	A(3)	SD(2)	D(1)	UN(0)	N	$\bar{X}$	SD	Remarks
1	I am not aware of any flooding problem in Usen	190	391	326	173	106	1186	2.33	1.17	Accept
2	Flooding is a normal thing everywhere; it is not a problem	111	225	591	209	50	1186	2.12	0.95	Accept
3	It is a normal thing for soil erosion to occur at any time not necessarily because of urban development	413	395	114	185	79	1186	2.74	1.27	Accept
4	I am not aware that population growth can cause flooding	66	347	436	210	127	1186	2.01	1.06	Accept
5	I am not aware that blockage can cause soil erosion	206	212	336	319	113	1186	2.07	1.23	Accept

The results in Table 2 indicate that the respondents agree that they are not aware of any flooding problem in Usen, they also think that is a normal occurrence and can happen at any time and not necessarily because of urban development. They accept that they are not aware that population growth can cause flooding and that blockages of sewers can result in soil erosion.

### Research Question 3

*Does Flooding Influence Solid Waste Disposal design system?*

**Table 3:**  
**Means and Standard Deviations on the Influence of Flooding on Solid Waste Disposal Design System**

S/N	Statements	SA(4)	A(3)	SD(2)	D(1)	UN(0)	N	$\bar{X}$	SD	Remarks
1	There are no solid waste management in place here in Usen	238	825	57	48	18	1186	3.03	0.74	Accept
2	Soil erosion is caused by rainfall and not indiscriminate waste disposal	221	583	181	155	46	1186	2.66	1.05	Accept
3	If waste disposal design system is not well planned, it results in soil erosion	290	671	102	79	44	1186	2.91	0.96	Accept
4	Waste disposal design system is the best way to check soil erosion	451	469	126	110	30	1186	3.01	1.04	Accept
5	Flooding can occur where there is no disposal system in place	543	456	83	26	78	1186	3.15	1.09	Accept

Table 3 reveals that the respondents accept that there are no solid waste management in place in Usen. They believe soil erosion is caused by rainfall and not indiscriminate waste disposal. They accept that if waste disposal system is not well planned, it can result in soil erosion. They accept that waste disposal is the best way to check soil erosion and that flooding can occur where there is no waste disposal system in place.

**Research Question 4**

*To what extent does soil erosion influence urban development?*

**Table 4:**  
**Means and Standard Deviations of responses on the Influence of Soil Erosion on Urban Development**

S/N	Statements on influence of erosion	SA(4)	A(3)	SD(2)	D(1)	UN(0)	N	$\bar{X}$	SD	Remarks
1	Soil erosion can negatively influence urban development	415	415	119	118	119	1186	2.75	1.30	Accept
2	Soil erosion makes urban development difficult	291	557	83	107	148	1186	2.62	1.29	Accept
3	Soil erosion and flooding does not have any relationship with urban development	63	71	474	503	75	1186	1.62	0.90	Reject
4	Areas with high topography experience severe soil erosion	364	249	36	320	217	1186	2.19	1.55	Accept
5	Soil erosion influences development pattern of residential buildings in Usen Community	437	413	202	87	47	1186	2.93	1.09	Accept

Table 4 shows the respondents accept the fact that soil erosion can negatively influence urban development, and make urban development difficult. Areas with high topography experience severe soil erosion and soil erosion influences development pattern but they disagree that soil erosion and flooding does not have any relationship with urban development.

**Hypothesis 1:**

*Solid Waste Disposal Pattern does not have influence on Soil Erosion in Usen Community*

**Table 5:**  
**Multiple Regression Model of the Relationship between Solid Waste Disposal**

Model	R	R Square	Df	F	P Value	Decision
1	.494	.244	1183	3.972	.112	Accept $H_0$

**Pattern and Soil Erosion**

Table 5 above shows an F – value of 3.993 and a p – value of .112 testing an at alpha level of .05. The p – value is greater than the alpha level so, the null hypothesis which states that solid waste disposal pattern does not have influence on soil erosion in Usen community is accepted which means the Solid waste disposal pattern in Usen does not have a direct relationship with the soil erosion in the community.

**Hypothesis 2:**

*Flooding does not significantly influence soil erosion in Usen Community*

**Table 6**  
**Linear Regression Model of Relationship between Flooding and Soil Erosion**

Model	R	R Square	Df	F	P Value	Decision
1	.763	.582	1183	1.601	.0000	Reject $H_0$

Table 6 reveals an F – value of 1.601 and a p – value of .000 testing at an alpha level of .05. The p -value is less than the alpha level and this is evidence to reject the null hypothesis which states that flooding does not significantly influence soil erosion in Usen community. This means that, flooding significantly influences soil erosion in Usen community.

Solid Waste Disposal does not influence soil erosion in Usen Community. This study is in contradiction with the study carried out by Ijeoma, Ache and Choji (2015) which revealed that uncontrolled waste disposal sites causes nuisance and health hazard to the populace and the environment.

**Summary of Findings**

- i. Solid waste disposal pattern does not have influence on soil erosion in Usen community
- ii. Flooding significantly influences soil erosion in Usen community

## **Discussion of Results**

The findings of this study were based on the hypotheses that were raised at the beginning of the study and analyzed in the tables. The findings of these factors are discussed as follows:

### **a) Influence of Solid Waste Disposal Pattern on Soil Erosion in Usen Community.**

The result from the analysis showed that there was no significant relationship between solid waste disposal pattern and soil erosion. The implication of this is that the pattern, this study is in contradiction with the study carried out by Ijeoma, Ache and Choji (2015) which revealed that uncontrolled waste disposal sites causes nuisance and health hazard to the populace and the environment.

### **b) Influence of Flooding on Soil Erosion in Usen Community**

The result from the analysis showed that flooding significantly influences soil erosion in Usen community. It therefore implies that flooding has greater influence on soil as a result of soil erosion this is in corroboration with the study of Chima and Okoro (2015) where the authors concluded that flooding can bring benefits to the soil by making it more fertile and provides the nutrients required

## **Phase 2.**

The use of Global Positioning System (GPS) in the collection of coordinates GPS enables someone to record the location of natural and man-made features on the earth. It is a space -based navigation system that uses a constellation of satellites to determine the location of the receiving unit on earth. To be able to determine the flow and direction of flood on ground in Usen Community the use of GPS is needed to get the highest and lowest points in different location within the Community.

The highest point in Usen is located close to the Elawure Grammar and Edo State Polytechnic Guest House, at that point the height is 129m, moving down into the town towards Akure road which is adjacent to Hospital road the height is 120m from the mean sea level. Moving down towards the Edo State Polytechnic school gate the height falls and completely reduce to 95m from the mean sea level. At the Hospital end, immediately after the hospital there is a deep fall in height from 120m to 100m, moving down in that direction there is a complete fall in height till it's completely falls to 85m at the lowest point from the mean sea level to the river.

Water they say must find its level, erosion in Usen Community flow from the highest point to the lowest areas, the findings revealed that the lowest point in Usen is 85m from the mean sea level while the highest point is 129mm. It can therefore be concluded that drainages can be constructed at the level of 85m at the lowest points in the different locations in Usen Community to control soil erosion.



**Fig. I.** Water flow in Usen Community

### Conclusion

Based on the findings of this study, it is interesting to note that flooding has great influence on soil erosion in Usen community and that there is no pattern of solid waste disposal system put in place in Usen community as at now.

### Recommendations

Based on the findings, the researchers made the following recommendations:

1. To ensure development in the community, the Local Government should collaborate with the community to work out modern patterns of Solid Waste Disposal systems in Usen.
2. To curb the menace of flooding in some parts in Usen Community, the Government should make necessary plans as soon as possible as regards control of soil erosion.
3. As a requirement to review urban and environmental flooding in the locality, all stakeholders have roles to play; the government should provide infrastructure that are needed to pave way for proper planning and checking of soil erosion.

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